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Consensus Statement | Infectious Diseases

Guidelines for the Prevention, Diagnosis, and Management of Urinary Tract Infections in Pediatrics and Adults

A WikiGuidelines Group Consensus Statement

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Abstract

IMPORTANCE Traditional approaches to practice guidelines frequently result in dissociation between strength of recommendation and quality of evidence.

OBJECTIVE To create a clinical guideline for the diagnosis and management of urinary tract infections that addresses the gap between the evidence and recommendation strength.

EVIDENCE REVIEW This consensus statement and systematic review applied an approach previously established by the WikiGuidelines Group to construct collaborative clinical guidelines. In May 2023, new and existing members were solicited for questions on urinary tract infection prevention, diagnosis, and management. For each topic, literature searches were conducted up until early 2024 in any language. Evidence was reported according to the WikiGuidelines charter: clear recommendations were established only when reproducible, prospective, controlled studies provided hypothesis-confirming evidence. In the absence of such data, clinical reviews were developed discussing the available literature and associated risks and benefits of various approaches.

FINDINGS A total of 54 members representing 12 countries reviewed 914 articles and submitted information relevant to 5 sections: prophylaxis and prevention (7 questions), diagnosis and diagnostic stewardship (7 questions), empirical treatment (3 questions), definitive treatment and antimicrobial stewardship (10 questions), and special populations and genitourinary syndromes (10 questions). Of 37 unique questions, a clear recommendation could be provided for 6 questions. In 3 of the remaining questions, a clear recommendation could only be provided for certain aspects of the question. Clinical reviews were generated for the remaining questions and aspects of questions not meeting criteria for a clear recommendation.

CONCLUSIONS AND RELEVANCE In this consensus statement that applied the WikiGuidelines method for clinical guideline development, the majority of topics relating to prevention, diagnosis, and treatment of urinary tract infections lack high-quality prospective data and clear recommendations could not be made. Randomized clinical trials are underway to address some of these gaps; however further research is of utmost importance to inform true evidence-based, rather than eminence-based practice.

+ Supplemental content

Author affiliations and article information are listed at the end of this article.

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Introduction

Urinary tract infections (UTIs) are among the most common infections globally, notably impacting patient quality of life and posing substantial clinical and economic challenges. UTIs exhibit diverse etiologies and clinical severities, from simple cystitis to pyelonephritis and life-threatening sepsis. Diagnosis can be a challenge, due to the lack of validated, highly accurate testing. Management is further complicated by evolving multidrug resistance. Despite advancements in diagnosis and treatment, UTIs can cause high morbidity and mortality, with profound implications in both community and health care settings.

In this third WikiGuidelines consensus statement, we provide an evidence-based approach to UTI management developed by a global network of experts for practical use across diverse clinical settings. This guideline fills a critical gap by providing pragmatic, broadly applicable recommendations tailored for generalist care and systems-based practice. Our guidance is rooted in the best available evidence and is designed for clinicians from various backgrounds and health care environments. It emphasizes a patient-centered approach to the diagnosis, prevention and treatment of UTIs and related genitourinary infections.

Methods

Our multinational team includes 54 experts from 12 countries, including 31 physicians and 23 pharmacists or PhDs with expertise in internal medicine, pediatrics, infectious diseases, and/or microbiology (eTable 1 and 2 in the Supplement). This study followed the Standards for Quality Improvement Reporting Excellence (SQUIRE) reporting guideline and followed the WikiGuidelines charter, which requires issuing clear recommendations only when supported by sufficient hypothesis–confirming evidence, including 2 well-conducted concordant randomized clinical trials (RCTs) or 1 well-conducted RCT and a well-conducted concordant prospective observational study. When evidence does not meet these criteria, a review of the literature and discussion is presented in lieu of a recommendation with the goal of proposing reasonable management strategies that maximize benefits, minimize harms, and avoid definitive recommendations for unsubstantiated practices.

On March 15, 2023, crowdsourcing efforts began via social media to identify experts interested in contributing to the guideline development. Authors were selected based on their active professional licenses and relevant clinical expertise, with additional participants chosen for their technical expertise, such as medical librarianship, epidemiology, and biostatistics. The steering committee, elected by the board of directors, selected the chair and cochair to oversee the development of the guideline. On May 1, 2023, we solicited questions from authors about UTI prevention, diagnosis, and management, and organized by theme. Specialized groups were formed, and section leads were appointed by the cochairs to address the 5 distinct themes. Volunteer authors and section leads produced each section through performing extensive literature reviews in PubMed, Medline, and other databases without date or language restrictions. Initial drafts created by the groups were reviewed and refined by the primary and senior authors, followed by collaborative review and feedback from the entire group. Consensus was achieved through a structured process involving a series of meetings, literature reviews, and iterative revisions, with the final approval requiring either a consensus or, if necessary, a majority vote among the committee members. After multiple rounds of revisions and feedback, a finalized version for each section was realized and compiled into a cohesive manuscript by the primary and senior authors.

Results

Section 1: Prophylaxis and Prevention

An overview of findings relating to empirical treatment can be found in **Table 1**. Additional information can be found in eAppendix 1 in the Supplement.

Question 1: What Is the Role of Pharmacotherapy for the Prevention of UTIs?

The clinical review found insufficient quality of evidence to enable a clear recommendation. Pharmacotherapy can be considered for the prevention of UTIs in women with recurrent UTIs (Table 1). Postcoital administration of trimethoprim/sulfamethoxazole (TMP/SMX) or ciprofloxacin appears to reduce the incidence of UTIs in women compared with placebo.[1] No significant difference in effectiveness between intermittent, defined as the use of antibiotics after a trigger such as coitus, and continuous strategies has been demonstrated in high quality studies.[2] Benefits of antibiotic prophylaxis appear confined to their usage period and the optimal duration that balances individual and ecological risks with effectiveness are unclear. Observational data indicate that nitrofurantoin, norfloxacin, and TMP/SMX are comparatively effective; however, conclusions are limited based on the study design.[3] There is limited and conflicting data on antibiotic prophylaxis for children.[4-6]

Question 2: Is There a Role for Cranberry Juice or Supplements in the Prevention of UTIs?

A sufficient quality and quantity of evidence was found to provide a clear recommendation for the role of cranberry juice or supplements in the prevention of UTIs. Most prospective studies have indicated that cranberry products can reduce the risk of symptomatic, culture-verified UTIs in women with recurrent UTIs, children, and individuals susceptible to UTIs after interventions (Table 1).[7-23] Evidence for their use in older adults, those with bladder emptying problems, or pregnant women is insufficient to make a clear recommendation for or against use.

Question 3: Can Water Intake Play a Role in the Prevention of UTIs?

The clinical review found insufficient quality of evidence to enable a clear recommendation. One RCT[24] that explored the effect of hydration on UTIs found that increased water intake significantly reduced cystitis frequency in healthy women. This RCT included 140 healthy women with recurrent cystitis, defined as 3 or more episodes in the past year, who drank less than 1.5 L of fluid per day. Participants were randomly assigned to either drink an additional 1.5 L of water daily or no additional fluids for 12 months. An observational nursing home study[25] was unable to demonstrate a benefit; however, it was underpowered. Beyond this single RCT,[24] studies are limited and further research is needed to confirm these findings and explore this intervention in broader populations (Table 1).

Table 1. Strategies to Prevent UTIs

Strategy	Level of evidence	Intervention	Comments
Continuous or postcoital antimicrobial prophylaxis	Clinical review	TMP/SMX: continuous, 40 mg/200 mg once daily or 40 mg/200 mg 3 times weekly; postcoital, 40 mg/200 mg or 80 mg/200 mg once postcoitus; Nitrofurantoin: continuous, 50 mg or 100 mg daily; postcoital, 50 mg or 100 mg once postcoitus	The decision to use antibiotic prophylaxis must balance the need for prevention against the risk of adverse drug events, antimicrobial resistance, and microbiome disruption.[a]
Cranberry products	Clear recommendation	Cranberry products containing proanthocyanidin levels of 36 mg	Cranberry products can reduce the recurrent UTIs in women, children, and individuals susceptible to UTIs. Data for older people, those with bladder emptying problems, or pregnant women is insufficient.
Probiotics	Clinical review	No recommendation	Studies were heterogenous with regard to patient populations, specific probiotics, route of administration, and study design.
Vaginal estrogen	Clear recommendation	Vaginal estrogen, such as vaginal rings, vaginal insert or vaginal cream	There is a wide variety of formulations and local delivery methods. Availability may vary in different countries or geographic regions.
Increased water intake	Clinical review	Additional 1.5L of water	Water intake was shown to decrease UTIs in 1 RCT among healthy women. Given the low-risk nature of the intervention, pending a confirmatory study, it is reasonable to offer this intervention to healthy women with recurrent UTIs.
Methenamine hippurate	Clear recommendation	Methenamine hippurate: 1 g twice daily; methenamine mandelate: 1 g every 6 hours	Methenamine is an appealing antimicrobial-sparing intervention to reduce UTIs in patients without incontinence and a fully functional bladder.

Abbreviations: RCT, randomized clinical trial; TMP/SMX, trimethoprim sulfamethoxazole; UTI, urinary tract infection.

[a] Consider use of other options reviewed in eAppendix 1 of the Supplement in more detail prior to continuous or postcoital antimicrobials.

Question 4: Is There a Role for Topical Estrogen in the Prevention of UTIs?

A sufficient quality and quantity of evidence was found to provide a clear recommendation for the use of topical estrogen to prevent UTIs. Based on available evidence from 30 RCTs and 1 large retrospective observational study, topical estrogen is effective at reducing recurrent UTIs in postmenopausal women (Table 1).[26] The loss of estrogen during perimenopause causes changes within the vaginal microbiome, which can lead to a loss of *Lactobacillus* species, an increase in vaginal pH, and an increased risk of UTIs.[27] The use of topical estrogen may help to reduce vaginal atrophy, restore the vaginal microbiome, and reduce the frequency of UTIs.[28] Recent evidence supports using vaginal estrogen therapy for breast cancer patients with genitourinary symptoms when nonhormonal treatments fail.[29] Topical estrogen is thought to have minimal systemic absorption and no concerning safety signals with regard to the risk of stroke, venous thromboembolism, invasive breast cancer, colorectal cancer, or endometrial cancer were identified in a large prospective cohort study of more than 45 000 women.[30] It remains reasonable for biological females with a history of estrogen-related malignant neoplasms to discuss the risk and benefit of this treatment with their health care team prior to initiation.

Question 5: Is There a Role for Methenamine Hippurate in the Prevention of UTIs?

A sufficient quality and quantity of evidence was found to provide a clear recommendation for the use of methenamine hippurate to prevent UTIs. Methenamine, which was approved in 1967 for recurrent UTI prophylaxis in those aged 12 years and older, works by releasing formaldehyde in acidic urine, thus resulting in bacteriostasis. A systematic review,[31] which included a multicenter, open-label, randomized noninferiority trial conducted in the UK from June 2016 to June 2018, compared the efficacy of methenamine with daily low-dose antibiotics in preventing recurrent UTIs in women aged 18 years and older and found that methenamine was noninferior to antibiotics for the prevention of UTIs. Similarly, a nonblinded RCT compared methenamine with trimethoprim for preventing recurrent UTIs over 12 months in women aged 18 years and older found noninferiority for methenamine, with no significant difference in UTI recurrence rates between the 2 groups and similar adverse effects.[32] Therefore, we recommend the use of methenamine as an alternative to prophylactic antibiotics in patients with intact bladder anatomy (Table 1).

Question 6: Are Probiotics Effective in the Prevention of UTIs?

The clinical review found insufficient quality of evidence to enable a clear recommendation. There is inconclusive evidence to recommend for or against the use of oral or vaginal probiotics to prevent UTIs (Table 1). Studies were heterogeneous as it pertains to the patient populations (children, premenopausal women, postmenopausal women, complicated UTI in patients with comorbidities), specific probiotics, route of administration, and study design.[33-36]

Question 7: Is There a Role for *D*-Mannose in the Prevention of UTIs?

The clinical review found insufficient quality of evidence to enable a clear recommendation. Despite biological plausibility for effectiveness,[37] there is currently insufficient evidence to support or refute the use of *D*-mannose for the prevention of UTIs. Only 3 RCTs,[38-40] 1 small open-label prospective cohort study,[41] and a subgroup of another prospective cohort study[42] evaluated *D*-mannose alone for only prevention (not treatment) of UTIs. Discordant or uncertain results among the prospective studies along with small sample sizes and heterogeneity of specific *D*-mannose regimens, study populations, comparators, UTI definitions, potential for reporting bias, and follow-up periods preclude a clear recommendation for or against its use. Although poorly reported, adverse effects were seemingly infrequent, and most included gastrointestinal symptoms and vaginal burning.[40,43,44]

Section 2: Diagnosis and Diagnostic Stewardship

An overview of findings relating to diagnosis and diagnostic stewardship can be found in **Table 2**. Additional information can be found in eAppendix 2 in the Supplement.

Question 8: What Are the Clinical Definitions of Cystitis, Complicated UTIs, and Pyelonephritis?

The clinical review found insufficient quality of evidence to enable a clear recommendation. Cystitis and pyelonephritis are typically diagnosed clinically through signs and symptoms with evidence of inflammation (pyuria) and the presence of pathogenic bacteria in the urine (Table 2). Typical nomenclature includes the use of terms, such as cystitis, uncomplicated UTI, complicated UTI, and pyelonephritis. Cystitis, an inflammation of the bladder often indicated by dysuria, urgency, and suprapubic pain, is typically described not to show systemic infection signs like fever. Unfortunately, complicated UTI lacks a standard clinical definition due to diverse criteria in literature and guidelines. Complicated UTIs may involve catheters or other foreign bodies, complicating factors like structural anomalies or immunosuppression, or systemic symptoms. Pyelonephritis, kidney inflammation due to infection, includes cystitis symptoms plus systemic signs like fever and flank pain. More precise clinical definitions, based on clinical studies linked to outcomes, are needed. Most WikiGuidelines authors strongly encourage the use of more precise descriptions of UTI in clinical practice rather than continuing to use vague terms, such as complicated or uncomplicated.

Question 9: What Is the Role and the Sensitivity and Specificity of a Urinalysis (UA) for the Diagnosis of UTIs and When Should Clinicians Order Urine Cultures?

The clinical review found insufficient quality of evidence to enable a clear recommendation. A UA encompasses physical, chemical, and microscopic evaluations designed to aid in diagnosing kidney, metabolic, oncologic, and infectious disorders. Unfortunately, the diagnostic value of UA for UTI is limited.[45,46] While the absence of pyuria can help rule out infection in most patient populations, the positive predictive value of pyuria for diagnosing infection is exceedingly low as it often indicates the presence of genitourinary inflammation due to many other possible noninfectious reasons (**Table 3**). For these reasons, WikiGuidelines authors believe that evidence-based diagnosis of UTI should be primarily based on clinical symptoms. Clinical symptoms may be integrated with UA findings, but authors caution clinicians to not rely solely on the UA alone. Urine cultures are reasonable for complicated cases and/or recurrent UTIs, particularly in suspected pyelonephritis, to guide targeted therapy. In simple uncomplicated cystitis in healthy nonpregnant patients, routine cultures are not necessary.[47,48]

Question 10: What Is the Role of UA and Urine Culture Testing for the Workup of Fever?

The clinical review found insufficient quality of evidence to enable a clear recommendation. Routine use of UA and urine cultures for the workup of fever in hospitalized patients leads to unnecessary testing and antimicrobial use.[46,49,50] Studies show that UTIs, including catheter-associated UTIs (CAUTI), are infrequently the source of fever, particularly in the absence of urinary tract obstruction,

Table 2. Clinical Practice Guideline Definitions of UTI Syndromes in Adults[a]

Defining term(s)	Proposed IDSA	Current IDSA	EAU	AUA, CUA, and SUFU
Complicated UTI and acute pyelonephritis	Any infection beyond the bladder, includes pyelonephritis, CAUTI, febrile or bacteremic patients	Urinary symptoms plus functional or structural abnormalities of the urinary tract. CVA pain and tenderness, often with fever (pyelonephritis)	Dysuria, urgency, frequency, flank pain, CVA tenderness, suprapubic pain, fever, chills, nausea, vomiting; anatomical or functional abnormalities of the urinary tract (eg, obstruction, incomplete voiding due to detrusor muscle dysfunction; presence of diabetes or immunosuppression	Anatomical or functional abnormality of the urinary tract (eg, stone disease, diverticulum, neurogenic bladder); immunocompromised host; multidrug resistant bacteria
Uncomplicated UTI	All other infections not defined as complicated	Frequency, urgency, dysuria, or suprapubic pain in a woman with a normal genitourinary tract	Dysuria, frequency and urgency and the absence of vaginal discharge; limited to nonpregnant women with no known relevant anatomical and functional abnormalities or comorbidities	Dysuria in conjunction with variable degrees of increased urinary urgency and frequency, hematuria, or new or worsening incontinence; female host; no known factors that would increase susceptibility to develop UTI

Abbreviations: AUA, American Urological Association; CAUTI, catheter-associated urinary tract infection; CUA, Canadian Urological Association; CVA, costovertebral angle; EAU, European Association of Urology; IDSA, Infectious Disease Society of America; SUFU, Society of Urodynamics, Female Pelvic Medicine and Urogenital Reconstruction; UTI, urinary tract infection.

[a] See eAppendix 2 of the Supplement for detailed supporting information.

recent urological procedures, or immunocompromise.[51] Consequently, urine testing should not be automatic in febrile patients, especially geriatric patients, or those with known nonurinary sources of fever and should be reserved for cases with specific urinary or related symptoms. Further research is needed to establish clear criteria for urine testing in febrile patients.

Question 11: How Can Diagnostic Stewardship Strategies Be Effectively Implemented in the Management of UTIs to Prevent Unnecessary Treatment of Asymptomatic Bacteriuria?

The clinical review found insufficient quality of evidence to enable a clear recommendation. Effective management of UTI hinges on appropriate diagnostic testing and antimicrobial stewardship, aiming to prevent the misuse of antibiotics for ASB. Symptom-based testing is key to ensure appropriate urine culture testing and proper diagnosis of UTI.[52,53] A 2017 systematic review[54] showed 45% of included patients experienced inappropriate initiation of antimicrobial treatment for ASB; various interventions, such as education on diagnostic protocols, provided a significant absolute risk reduction of 33%. Avoiding overtesting and resulting overtreatment of ASB is essential to preserving antimicrobial effectiveness.

Question 12: What Is the Role of Novel Molecular Tests in the Diagnosis of UTI?

The clinical review found insufficient quality of evidence to enable a clear recommendation. The role of molecular techniques for UTI diagnosis is currently limited. Molecular diagnostics cannot distinguish true infection from ASB. Urine culture is the current reference standard for confirming the etiologic pathogen in patients with suspected infection. Although 100 000 colony forming unit (CFU)/mL has been considered the historical standard threshold for bacteriuria and diagnosing UTIs, lower CFU counts can still indicate significant infections in symptomatic patients.[55-58] In contrast, molecular techniques are generally unable to determine bacterial viability or quantitation in urine specimens.[59] These factors are crucial to differentiate colonization vs infection and to delineate pathogenic organisms vs commensal flora. The increased sensitivity of these molecular tests may lead to overtreatment by detecting clinically insignificant bacteria, especially now that metagenomics has identified endogenous genitourinary microflora,[60-64] underscoring the need for clear guidelines to avoid unnecessary therapy. More research is required to determine the ideal role of molecular testing in UTI diagnosis.

Table 3. Diagnostic Testing Performance for Urinary Tract Infections[a]

Test results	Sensitivity (%)	Specificity (%)	PPV (%)	NPV (%)
Dipstick				
Positive leukocyte esterase	72-97	41-86	43-56	82-91
Positive nitrite	19-48	92-100	50-83	70-88
Positive leukocyte esterase or nitrite	46-100	42-98	52-68	78-98
Microscopy, WBC/μL				
>5[b]	90-96	47-50	56-59	83-95
10	100	36	NA	NA
50	98	66	NA	NA
100	93	71	NA	NA
200	89	86	NA	NA
300	84	88	NA	NA
400	77	92	NA	NA
Imaging				
Ultrasonography	74.3	56.7	NA	NA
Computerized tomography	81-84	87.5	NA	NA
Magnetic resonance imaging	100	81.8	NA	NA

Abbreviations: HPF, high power field; NA, not applicable; NPV, negative predictive value; PPV, positive predictive value; WBC, white blood cell.

[a] See Section 2 of the Supplement for detailed supporting information.

[b] WBC/HPF.

Question 13: What Is the Role of Different Imaging Modalities, Such as Ultrasonography and Computed Tomography, for the Diagnosis of UTIs, and What Is the Sensitivity and Specificity These Imaging Modalities?

The clinical review found insufficient quality of evidence to enable a clear recommendation. Computed tomography (CT) scans do not appear to be useful in the routine initial diagnostic workup of cystitis or pyelonephritis and may not routinely alter treatment[65,66] CT imaging may be useful if symptoms persist or worsen beyond 72 hours or if there are concerns for kidney calculi, kidney abscess, or an alternative focus of infection.[67-69] Contrast CT imaging is best discussed with the radiologist but may have advantages in terms of detecting kidney abscesses. Ultrasonography, while safer and more accessible, has limited accuracy but may be a preferrable first imaging modality in younger patients, pregnancy, and/or kidney transplant recipients because there is no associated ionizing radiation, and may be able to more directly visualize the transplanted organ(s) (**Table 4**). Magnetic resonance with or without contrast and/or diffusion-weighted imaging is less effective for early disease detection and stone visualization but may also have an advantage in identifying graft infection (Table 4).[70,71] We caution clinicians to only obtain radiographic studies if they are likely to alter management for a patient with known or suspected UTI.

Question 14: What Are the Limitations of Usual Diagnostics in Patients With Indwelling Urinary Catheters or Ileal Conduits?

The clinical review found insufficient quality of evidence to enable a clear recommendation. UA has a very low specificity in diagnosing UTIs in patients with indwelling urinary catheters or ileal conduits but has excellent negative predictive value.[72] This suggests that a negative UA can rule out CAUTI for patients with functioning bone marrow, but given the low specificity of UA in patients with urinary catheters or ileal conduits, a positive UA does not mean the patient has a CAUTI. In addition, urine cultures are not reliable tests for patients with chronic urinary catheters or ileal conduits.[73-75] In these cases, bacteriuria is almost always present regardless of symptoms and are a likely source of inappropriate initiation of antimicrobial treatment.

Section 3: Empirical Treatment

An overview of findings relating to empirical treatment can be found in Table 3. Additional information can be found in eAppendix 3 in the Supplement.

Question 15: What Are Reasonable Empirical Treatment Regimen(s) for Pediatric or Adult Patients Diagnosed With a UTI?

A sufficient quality and quantity of evidence was found to provide a clear recommendation for empirical treatment regimens for pediatric and adult patients diagnosed with UTIs. Empirical treatment regimens for pediatric and adult patients should contain antimicrobials that have historically demonstrated efficacy and safety in the treatment of UTIs, achieve adequate urinary concentrations, and provide reliable activity against the most common pathogens based on local resistance rates. A proposed framework for selecting empirical treatment regimens is presented in eFigure 1 and eFigure 2 in the Supplement. Presence of risk factors for antimicrobial resistance along with clinical severity also play an important role in the selection of empirical choices.[76,77,182] For patients with uncomplicated cystitis, nitrofurantoin is a reasonable drug of choice, based on robust evidence of efficacy and its ability to spare use of more systemically active agents for treating other infections.[78] For patients with pyelonephritis, TMP/SMX or a first-generation cephalosporin represent reasonable first-line agents but should be dependent upon local resistance rates. Due to low resistance rates and clinical effectiveness, ceftriaxone is the recommended empirical choice for patients who require intravenous therapy, barring any risk factors for multidrug resistance.[79,80] In general, agents with antipseudomonal activity should only be used in patients with risk factors for nosocomial pathogens. However, it may be reasonable to use carbapenem therapy empirically in

Table 4. Duration of Treatment Based on Syndrome and Antimicrobial Class Used

Syndrome and antimicrobial class	Duration of therapy (level of evidence)	Comments
Adult cystitis[a]		
Aminoglycosides	Clinical review, not enough evidence to provide a clear recommendation for duration of treatment	Multiple observational studies suggest a single dose of an aminoglycoside achieve high clinical and/or microbiological cure rates; no comparative literature exists
β-lactams	Clinical review, not enough evidence to provide a clear recommendation for duration of treatment	Optimal duration may depend on the specific agent and dosing used. Heterogeneity in study design and β-lactam agent and dose used in studies precludes a clear recommendation
Fluoroquinolones	3 d (clear recommendation)	Due to risk of individual and ecological collateral damage, should not be used if other treatment options exist.
Fosfomycin (oral)	Single dose (clear recommendation)	Alternative dosing strategies have only been studied in RCTs and observational studies of febrile UTI, bacteremic UTI, and pyelonephritis
Nitrofurantoin	5 d (clear recommendation)	5-d and 7-d Courses result in comparable clinical outcomes; may use with CrCl as low as 30 mL/min
Pivmecillinam	3 d (clear recommendation)	3 d Regimens appear to have comparable efficacy as longer regimens and various regimens of comparators commonly used in contemporary practice.
TMP/SMX	3 d (clear recommendation)	Contemporary *Escherichia coli* resistance rates in most geographical regions limit utility as first-line treatment.
Adult pyelonephritis[b]		
Aminoglycosides	Clinical review, not enough evidence to provide a clear recommendation for duration of treatment	Multiple observational studies suggest monotherapy may be effective, however the optimal duration is unknown.
β-lactams	7 d (clear recommendation)	Dose optimization is critical based on analogous data supporting β-lactam use in the treatment of gram-negative bloodstream infection and outcomes of RCTs using IV β-lactams. 3 RCTs demonstrate comparable outcomes with 7 d of treatment vs 2-, 3-, and 6- wk regimens.
Fluoroquinolones	5 to 7 d (clear recommendation)	RCTs supporting 5 d of treatment used ofloxacin or levofloxacin; RCTs supporting 7 d of treatment used ciprofloxacin or fleroxacin. Ofloxacin is a second generation fluoroquinolone similar to ciprofloxacin, so may be reasonable to use 5 d of treatment when using ciprofloxacin as well.
Fosfomycin	Clinical review, not enough evidence to provide a clear recommendation for duration of treatment	IV fosfomycin available in some countries may be reasonable empirical treatment for pyelonephritis, but there is a lack of strong data supporting the use of oral fosfomycin for the treatment of pyelonephritis.
TMP/SMX	Clinical review, not enough evidence to provide a clear recommendation for duration of treatment	Historical durations of 14 d were used based on a series of very small RCTs in the 1970s to 1990s; outcomes of patients who received TMP/SMX in more recent RCTs suggest 7 d may be adequate, but further prospective investigation is needed.
Adult febrile UTI[b]	Clinical review, not enough evidence to provide a clear recommendation for duration of treatment	When considering the available data for pyelonephritis and gram negative bacteremia from a urinary source, it may be reasonable for febrile UTI to be treated in a similar fashion to pyelonephritis.
Catheter-associated UTI[c]	Clinical review, not enough evidence to provide a clear recommendation for duration of treatment	Data are limited to observational studies and small subgroups of RCTs, precluding a clear recommendation. Observational data suggest 5 to 7 d may be as effective as longer durations.
Gram-negative bacteremia from a urinary source[d,e]	7 d (clear recommendation)	Heterogeneity in trial design and selection and dosing of antimicrobials used limits ability to recommend specific antimicrobial classes. Fluoroquinolones, TMP/SMX, and β-lactams were included in published RCTs demonstrating noninferiority of 7 d to 14 d.

(continued)

Table 4. Duration of Treatment Based on Syndrome and Antimicrobial Class Used (continued)

Syndrome and antimicrobial class	Duration of therapy (level of evidence)	Comments
Prostatitis[f]	Clinical review, not enough evidence to provide a clear recommendation for duration of treatment for either ABP or CBP.	There is a dearth of data for both acute and chronic bacterial prostatitis that precludes a clear recommendation for duration of treatment in either scenario. Historical durations range from 14 d for ABP to 6 weeks or longer for CBP.
Pediatric cystitis (>2 mos of age)[g]	Clinical review, not enough evidence to provide a clear recommendation for duration of treatment	Heterogeneity in trial design, inclusion of clinically relevant outcomes precludes a clear recommendation. Numerous RCTs suggest shorter durations are likely effective (3 to 5 d).
Pediatric pyelonephritis (age >2 y)[h]	Clinical review, not enough evidence to provide a clear recommendation for duration of treatment	Quantity and heterogenity of existing data preclude a clear recommendation. Observational data suggest comparably high rates of clinical success when patients are treated for 5 to 9 d compared with longer (10 to 14 d) durations.
Kidney and perinephric abscess[i]	Clinical review, not enough evidence to provide a clear recommendation for duration of treatment	Source control is of utmost importance. Expert opinion does not distinguish between 14 and 21 d of treatment.
Emphysematous cystitis and pyelonephritis[j]	Clinical review, not enough evidence to provide a clear recommendation for duration of treatment or emphysematous cystitis or pyelonephritis	May vary widely depending on clinical response and whether percutaneous drainage was performed. When considering the available data for pyelonephritis and Gram-negative bacteremia from a urinary source, it may be reasonable for emphysematous cystitis and pyelonephritis to be treated in a similar fashion to other more clinically severe UTIs, such as febrile UTI, pyelonephritis, and gram negative bacteremia from a urinary source.

Abbreviations: ABP, acute prostatitis; CBP, chronic prostatitis; CrCl, creatinine clearance; IV, intravenous; RCT, randomized clinical trials; TMP/SMX, trimethoprim sulfamethoxazole; UTI, urinary tract infection.

[a] See question 21 in eAppendix 4 in the Supplement.

[b] See question 22 in eAppendix 4 in the Supplement.

[c] See question 23 in eAppendix 4 in the Supplement.

[d] See question 24 in eAppendix 4 in the Supplement.

[e] No specific class of antimicrobial can be clearly recommended.

[f] See question 35 in eAppendix 5 in the Supplement.

[g] See question 19 in eAppendix 4 in the Supplement.

[h] See question 20 in eAppendix 4 in the Supplement.

[i] See question 34 in eAppendix 5 in the Supplement.

[j] See question 33 in eAppendix 5 in the Supplement.

hemodynamically unstable patients for whom there is a specific concern regarding extended-spectrum β-lactamase-producing bacteria. Overall, selection should be guided by local susceptibilities and patient-specific risk factors.

Question 16: What Are Reasonable Empirical Treatment Regimens for Treatment of a CAUTI?

The clinical review found insufficient quality of evidence to enable a clear recommendation. There is an absence of high-quality data to inform empirical treatment in patients with CAUTI. Observational data suggest that, where possible, it may be preferable to replace or discontinue existing catheters prior to the collection of cultures and initiation of antimicrobial treatment.[81] UTIs diagnosed after catheter exchange are likely to respond similarly to noncatheterized patients. Empirical treatment decisions can be made based on review of the individual patient's urinary tract anatomy or dysfunction, allergies medication list for interactions, microbiological and prior treatment history, the type of UTI (eg, cystitis vs pyelonephritis), and the clinical severity of presentation.

Question 17: What Are the Established Risk Factors for UTI Due to Multidrug Resistant Organisms and When Should Empirical Treatment Account for These Pathogens?

The clinical review found insufficient quality of evidence to enable a clear recommendation. Although no validated models exist, prior health care exposure, previous antibiotic use, and a history of UTI or known colonization seem to be the most consistent and important estimators of development of a UTI due to a multidrug resistant organism (MDRO).[82-84] Due to heterogeneity in the populations and methods of available studies, the timing and/or combination of the exposure(s) and the subsequent effects on the outcome are unclear. There is insufficient data available to clearly guide decisions on when empirical treatment should include the possibility of an MDRO. In the absence of such data, it may be reasonable to suggest that the severity of an infection may be an important driver of empirical antibiotic choice when combined with local resistance patterns, proposed epidemiologic risk factors, and an individualized microbiologic history.

Section 4: Definitive Treatment and Antimicrobial Stewardship

An overview of findings relating to definitive treatment can be found in Table 4. Additional information can be found in eAppendix 4 in the Supplement.

Question 18: What Is Considered Treatment Failure of a UTI and Are There Host-Related Risk Factors That May Influence the Risk of Treatment Failure?

The clinical review found insufficient quality of evidence to enable a clear recommendation. There is no agreed upon universal definition of treatment failure. In general, treatment failure may result from clinical failure, microbiological failure, or a combination thereof. Current US Food and Drug Administration guidance suggests a composite endpoint that includes both clinical and microbiological responses. The true implications of the combination of clinical cure with microbiologic failure at follow-up remains uncertain. An analysis of individual participant data from several phase 3 studies found an increased risk of late clinical failure in patients with clinical cure but microbiological persistence,[85] but this phenomenon is often difficult to distinguish from a new infection. Notably, in 2 recent large RCTs, positive urine cultures at follow-up in patients who had resolved clinical signs and symptoms of infection did not appear to predict a higher risk of relapse of infection within the follow-up period.[86,87] Commonly identified epidemiologic risk factors for treatment failure identified in observational studies include older age, diagnosis of diabetes, presentation with septic shock, pregnancy, and immunosuppression.[88-99] No compelling data exist to support adjusting UTI treatment based on the potential risk factors for treatment failure that have been identified in these retrospective studies.

Question 19: What Is the Appropriate Duration of Treatment of Acute Cystitis in Pediatric Patients Older Than 2 Months of Age?

The clinical review found insufficient quality of evidence to enable a clear recommendation. Based on several randomized trials, shorter courses (3 to 5 days, depending on the antimicrobial used) result in comparable outcomes to longer courses (7 to 14 days) and are reasonable for the treatment of cystitis in children older than 2 months of age when the likelihood of pyelonephritis is deemed to be low.[100-102] Small study size, heterogeneity in trial design (various durations, various antibiotics), end point definitions (with frequent use of positive culture at follow-up defining treatment failure), and outcomes, preclude a clear recommendation for duration of treatment. Several observational studies suggest that a single parenteral dose of an aminoglycoside may be a reasonable alternative treatment option.[103] No data exists to suggest that initial (or any) parenteral treatment for cystitis is necessary in patients who can tolerate oral treatment.

Question 20: What Is the Appropriate Duration of Treatment of Acute Pyelonephritis in Pediatric Patients Older Than 2 Months of Age?

The clinical review found insufficient quality of evidence to enable a clear recommendation. Available randomized trial data are inadequate to provide a clear recommendation on the optimal duration of treatment for acute pyelonephritis in children older than 2 months of age.[86,104,105] Most existing data suggest similarly high rates of clinical success when patients receive 5 to 9 days (depending on the antimicrobial used) when compared with 10 to 14 days total.[106,107]

Question 21: What Is the Appropriate Duration of Treatment for Acute Cystitis in Adults?

Based on the totality of the evidence available, we can provide clear recommendations on the optimal durations of treatment for cystitis (regardless of biological sex) for the antimicrobial classes listed below:

- Nitrofurantoin: 5 days[108-110]
- TMP/SMX: 3 days[109,111,112]
- Fluoroquinolones: 3 days[109,113-118]
- Oral fosfomycin: single dose[78,119-127]

- Pivmecillinam: 3 days[109,128-132]
- Gepotidacin: 5 days[133]

Data are insufficient to enable clear recommendations for duration of treatment for other potential treatment options, including β-lactams and parenteral aminoglycosides. Some pediatric data support a 5-day treatment duration when oral β-lactams are used to treat cystitis.[105]

Question 22: What Is the Appropriate Duration of Treatment for Acute Pyelonephritis and/or Febrile UTI in Adults?

Based on several randomized clinical trials, we can provide a clear recommendation on the duration of therapy for the following antimicrobial classes (regardless of biological sex) for the treatment of acute pyelonephritis:

- Fluoroquinolones: 5 to 7 days[134-139]
- Dose-optimized β-lactams: 7 days[140-143]

The clinical review found insufficient quality of evidence to enable a clear recommendation for fosfomycin, TMP/SMX, and aminoglycoside monotherapy. We cannot provide clear recommendations for pyelonephritis treatment duration with TMP/SMX, fosfomycin, or aminoglycoside monotherapy due to the lack of reproducible high-quality data or heterogeneity across small studies. We are unable to provide a clear recommendation for the treatment duration for febrile UTI. When considering the available data for pyelonephritis and gram-negative bacteremia from a urinary source, it may be reasonable for febrile UTI to be treated in a similar fashion to pyelonephritis.

Question 23: What Is the Appropriate Duration of Treatment for CAUTIs?

The clinical review found insufficient quality of evidence to enable a clear recommendation. The optimal duration of antimicrobial therapy for CAUTIs has not been rigorously evaluated in large RCTs.[81] Data are limited to observational studies or small subgroups of RCTs evaluating complicated UTIs, so a clear recommendation cannot be made. Based on available observational data, 5 to 7 days appears as effective as longer treatment courses and represents a reasonable duration of treatment for most cases of CAUTI in conjunction with catheter exchange and/or removal, if possible.[144] No existing data demonstrate an association between longer courses and improved patient outcomes.

Question 24: What Are Optimal Oral Agents and an Appropriate Duration of Treatment for Gram-Negative Bacteremia From a Urinary Source?

A sufficient quality and quantity of evidence was found to provide a clear recommendation. Multiple RCTs comprised patients with gram negative bacteremia from predominantly urinary sources demonstrate noninferiority of 7 days compared with 14 total days of treatment for a variety of patient-oriented outcomes, such as clinical cure, clinical failure, relapse, and all-cause mortality.[145-148] Thus, we can provide a clear recommendation for 7 days of treatment for gram negative bacteremia from a urinary source when source control has been addressed (if applicable). Whether shorter durations might also be effective is unknown as they have not been studied. These trials tested duration as a strategy and not specific drugs; thus, while no specific class of medications can be recommended, it is also reasonable to ensure that the choice of drug and the doses used are optimized for the patient and a urinary focus of infection.

Question 25: What Are Potential Treatment Option(s) and Appropriate Durations of Treatment for Asymptomatic Bacteriuria in Populations in Which Treatment Is Indicated?

The clinical review found insufficient quality of evidence to enable a clear recommendation. Unnecessary treatment of asymptomatic bacteriuria (ASB) risks side effects without benefit represents low value care and poses a threat to antimicrobial sustainability.[53,149-152] There is no conclusive evidence that there is any population in which treatment of ASB is required and randomized clinical trials are welcomed. There are theoretical reasons and limited evidence which

support treatment of ASB in pregnant patients[153,154] and in those undergoing invasive urologic procedures associated with expected mucosal bleeding.[155-158] When treating ASB, the ideal duration of treatment is unknown. In pregnancy, it may be reasonable not to exceed the duration used for symptomatic cystitis (eg, 3 to 5 days, depending on the antimicrobial used). For patients undergoing invasive urologic procedures, most authors believe that many patients could receive a single dose of preoperative prophylaxis prior to the scheduled procedure.

Question 26: What Are Potential Treatment Option(s) and Duration of Treatment for UTIs Caused by Multidrug Resistant Organisms?

The clinical review found insufficient quality of evidence to enable a clear recommendation. The potential treatment option(s) depend on the organism identified and specific resistance mechanisms. To our knowledge, no data exist to suggest that the duration of treatment for UTIs caused by multidrug resistant organisms (MDROs) needs to be modified compared with those caused by nonresistant organisms. We feel it is reasonable to determine a treatment duration based on the anatomical location and clinical severity (eg, cystitis or pyelonephritis) as well as the clinical response to treatment provided that (1) the antimicrobial being used has demonstrated activity against the organism, (2) the antimicrobial has proven or a high likelihood of efficacy for treatment of UTIs, and (3) any applicable source control has been obtained.

Question 27: What Are Effective Antimicrobial Stewardship Strategies That Can Optimize the Rational and Sustainable Use of Antimicrobials in the Setting of Treatment of UTIs?

A sufficient quality and quantity of evidence was found to provide a clear recommendation for deescalation and mostly or all oral treatment. Randomized clinical trials have demonstrated the individual and ecological benefits to antibiotic deescalation and all authors encourage its use when able during the treatment of UTIs.[159,160] Additionally, multiple RCTs demonstrate treatment of a variety of UTIs with all or mostly oral regimens result in comparable outcomes with intravenous-only treatment and may reduce hospital length of stay and adverse events associated with antibiotics and/or central venous catheters.[161-174]

The clinical review found insufficient quality of evidence to enable a clear recommendation for allergy assessment and cascade reporting. Our review did not yield any RCTs evaluating antibiotic allergy assessment specifically for the management of UTIs; however all authors of this consensus statement agree that thorough allergy assessment (and challenge, if indicated) can likely prevent a variety of harms based on existing data and recommendations from specialists in allergy or immunology.[175-177] Although we cannot provide a clear recommendation due to the observational nature of the data, we agree that optimizing the reporting of antimicrobial susceptibility results through selective or cascade reporting is a reasonable strategy to optimize treatment selection.[178-180]

Section 5: Special Populations and Genitourinary Syndromes

An overview of findings relating to special populations can be found in eAppendix 5 in the Supplement.

Question 28: What Are Special Considerations for the Diagnosis and Treatment of UTI in Older Adults?

The clinical review found insufficient quality of evidence to enable a clear recommendation. Asymptomatic bacteriuria is prevalent in the older adults, particularly in institutionalized individuals, with treatment showing no benefit over placebo.[181,182]Overtesting and overtreatment with antibiotics for these nonsymptomatic cases remains high.[183,184] UTIs are more frequent in the institutionalized older adult populations and clinical tools for assessing symptoms exist to help discourage tests for nondelirium behavioral changes or falls.[183] Using clinical scores alongside microbiological tests is crucial due to the high rates of bacteriuria with pyuria, and the potential

misinterpretation of UA results, which often leads to unnecessary antibiotic use.[185,186] Further research comparing clinical prediction scores for UTIs is needed.

Question 29: What Is the Role and Utility of UA and Urine Culture Testing in Pediatric Populations?

The clinical review found insufficient quality of evidence to enable a clear recommendation. In pediatric care, the workup for febrile illness often includes UA and urine culture, particularly in younger populations where symptoms cannot be elicited.[187] These practices can lead to the overtreatment and overdiagnosis of UTI. Major societies recommend using proper microbiological methods for diagnosis, yet clinical practices deviate, depending on less reliable methods like bagged urine samples.[188-190] The interpretation of UA and colony forming unit counts in urine cultures in the pediatric population are not clearly defined, leading to variability in the diagnosis and treatment of pediatric UTI.

Question 30: For Pediatric Patients, How Do We Delineate Cystitis vs Pyelonephritis When the Child Is Unable to Verbalize Symptoms Characteristic of UTI?

The clinical review found insufficient quality of evidence to enable a clear recommendation. Pediatric cystitis and pyelonephritis are common yet complex conditions in children, impacting quality of life and requiring comprehensive management.[191,192] In pediatric patients, distinguishing cystitis from pyelonephritis can be challenging, particularly in young children who are unable to verbalize symptoms. Clinical evaluation, including assessment for systemic signs such as fever and poor feeding, along with UA and imaging studies, are essential in making this differentiation.[47,193] While infections are mainly caused by gram-negative bacteria, noninfectious causes also contribute to the diagnostic challenge. Prevention of long-term kidney damage from pyelonephritis necessitates prompt recognition and treatment, considering genetic, urinary, and environmental factors.

Question 31: What Is the Optimal Follow-Up Timeframe for Pediatric Patients With UTI?

The clinical review found insufficient quality of evidence to enable a clear recommendation. Observational data suggests that clinical improvement, including fever resolution, typically occurs after 48 to 72 hours of treatment in children.[194,195] Authors believe it to be reasonable to conduct additional work-up (eg, kidney and bladder ultrasonography) and/or reassess the current treatment plan if patients do not experience clinical improvement within that timeframe.[194,196-200] Assuming the patient improves as expected, previously described treatment durations of 3 to 5 days for cystitis and 7 to 10 days for pyelonephritis are reasonable (more detail in questions 19 and 20). Routine follow-up is not necessary unless the patient is younger than age 2 years and experiences a febrile UTI or a child of any age experiences a recurrence of febrile UTI. It is reasonable to deescalate and/or target treatment as soon as culture and susceptibility results are available based on the discussion in question 27 and other studies of children who are hospitalized.[201,202]

Question 32: For Kidney Transplant Recipients, What Is the Significance of a Positive Urine Culture?

The clinical review found insufficient quality of evidence to enable a clear recommendation. UTIs are an important postkidney transplant complication.[203,204] The spectrum of causative microorganisms is broad and includes typical uropathogens, atypical pathogens, and MDROs.[205] This complexity demands a nuanced understanding of microbial behavior in the context of immunosuppressed individuals. Cultures need to be interpreted within their clinical context, including specific timing posttransplantation and symptoms. Routine treatment of ASB in kidney transplant recipients increases colonization with resistant organisms without providing clear benefit and should be avoided after the first 2 months from transplantation.[206]

Question 33: What Is the Empirical and Definitive Treatment of Emphysematous Cystitis and Pyelonephritis?

The clinical review found insufficient quality of evidence to enable a clear recommendation. The treatment of emphysematous cystitis and pyelonephritis (caused by gas producing pathogens) lacks robust data, with recommendations mostly relying on clinical judgment and case studies.[207] Early appropriate antibiotics targeting common pathogens like *Escherichia coli* and *Klebsiella* species is reasonable, with a general treatment approach mirroring that for nonemphysematous UTIs.[208] While most cases respond to medical therapy, severe instances may need surgical intervention. Percutaneous catheter drainage, along with antibiotics, shows lower mortality for emphysematous pyelonephritis and is advisable in severe cases to include broader coverage until culture results are available.[209] Most authors believe a treatment duration of 7 to 14 days (adjusted per clinical response) is reasonable.[210]

Question 34: What Is the Clinical Presentation and Diagnostic Approach for Kidney or Perinephric Abscess? What Is the Empirical and Definitive Treatment of Kidney Abscess and Perinephric Abscess?

The clinical review found insufficient quality of evidence to enable a clear recommendation. Perinephric abscesses are serious conditions with varied presentations.[211] Typical symptoms include lumbar pain and fever, with many patients presenting with costovertebral angle tenderness. CT imaging is crucial for diagnosis and management, which may include medical therapy, percutaneous drainage, or surgery for refractory cases.[211] These abscesses are commonly caused by gram-negative bacteria or hematogenous seeding from organisms like *Staphylococcus aureus*. Decision to opt for drainage of the abscess is often influenced by the size,[212,213] however, some form of drainage is often necessary for definitive treatment. Further research is needed on optimal source control intervention strategies and when medical management alone may be used.[214-216]

Question 35: What Is the Clinical Presentation, Diagnostic Approach, and Treatment for Acute and Chronic Prostatitis?

The clinical review found insufficient quality of evidence to enable a clear recommendation. Acute bacterial prostatitis (ABP) and chronic bacterial prostatitis (CBP) are inflammatory prostate syndromes with ABP often presenting abruptly with febrile UTI symptoms and CBP involving more persistent symptoms or recurrent UTIs.[217,218] Diagnosis for ABP relies on clinical presentation and laboratory tests. CBP diagnosis involves comparing bacteria levels in prostatic fluid and urinary cultures, yet definitive testing is debated. Testing for prostate specific antigen (PSA) appears of limited utility.[219] Maneuvers to express prostatic fluid, such as prostate massage, are of limited clinical utility and urology consultation may be needed.[219,220] The optimal durations of treatment for ABP or CBP are unknown and have not been established by high-quality studies. Additional prospective studies are needed to determine the appropriate duration of treatment for ABP and CBP.

Question 36: What Is the Optimal Clinical Approach for Patients With Nephrolithiasis, Foreign Objects, Nephrostomy Tubes, and/or Ureteral Stents?

A sufficient quality and quantity of evidence was found to provide a clear recommendation for the optimal clinical approach for patients with nephrolithiasis, foreign objects, nephrostomy tubes, and/or ureteral stents. Routine cystoscopy and urodynamic studies do not require antimicrobial prophylaxis in asymptomatic patients. Preoperative antibiotics do not appear to reduce infectious complications from routine cystoscopic stent removal nor nephrostomy tube placement.[221,222] The majority of patients with uncomplicated urologic cases undergoing percutaneous nephrolithotomy, a single dose of antimicrobial prophylaxis appears to reduce the risk of infection.[158,223-225] However, in a recent meta-analysis,[226] single dose was found to be associated with higher rates of systemic inflammatory response syndrome (SIRS) postnephrolithotomy compared with extended perioperative dosing in patients considered high risk; however, the use of a nonspecific measure,

such as SIRS, to detect complications may overidentify complications.[227] If there are particularly vulnerable patients, such as in pregnancy or kidney transplant, extended preoperative dosing schedules are reasonable to consider. Published RCTs use a 7-day duration preoperatively, however, it is unclear if that long of a course is routinely necessary.[228,229]

Question 37: What Are Nonbacterial Causes of UTI to Consider in Certain Special Populations?

The clinical review found insufficient quality of evidence to enable a clear recommendation. Most nonbacterial UTIs are due to *Candida* species[230] While 25% of intensive care unit UTIs in the US are attributed to *Candida* species, most cases of candiduria are asymptomatic and benign. If symptomatic, fluconazole and amphotericin B are preferred due to favorable urinary pharmacokinetics and pharmacodynamics, but no RCTs are available to determine the best treatment choice or duration.[230,231] Viral UTIs (especially BK polyomavirus and adenovirus) are less common but a noteworthy risk in immunocompromised patients.[232-234] A reduction in the intensity of existing immunosuppression is the primary treatment. Small case reports detail individual experiences with antivirals with in vitro activity against these viruses exist, but their retrospective nature and small size limit generalizability.[235-237]

Discussion

Despite decades of research and nearly 1000 studies reviewed, we remain unable to provide a clear recommendation on many, even some essential, aspects of the prevention, diagnosis, and treatment of urinary tract infections. This consensus statement highlights the dramatic impact of historical practice patterns on certain aspects of UTI treatment, such as duration of therapy, while also highlighting critical gaps in knowledge that impact our understanding of how effective our treatments are, such as the impact of clinical improvement without resolution of bacteriuria. Additionally, there is an obvious need to use more precise terminology to describe site(s) and extent of infections rather than the vague terms that have become commonplace in clinical practice. This will ensure that there are more clearly defined study populations, reduced heterogeneity in generalizability of those studies, and ensure that individual patients receive the highest value, most appropriate care for their specific infection.

Limitations

This consensus statement has limitations. The main limitation of this guideline is the overall dearth of hypothesis-confirming evidence. Using the WikiGuidelines method of guideline development, only 6 clear recommendations were able to be established out of 37 questions, highlighting the need for additional high-quality prospective studies in all aspects of the management of urinary tract infections. Additionally, certain sections of the article may be less generalizable than others, such as in the empiric treatment section, which is heavily influenced by local epidemiology. Despite these limitations, we attempted to equip readers with the foundational principles that they may apply to their individual practice settings. We made an effort within this guideline to include experts internationally; however, most of the guideline authors are from high-income countries and in the future, we hope to incorporate the essential perspective of and thus provide guidance for clinicians practicing in low and middle-income countries and other resource-constrained settings.

Conclusions

This consensus statement presents evidence-based strategies for managing UTIs and clinical reviews in areas where strong evidence is lacking. The guidance is based on information available up to early 2024. Pressing research gaps remain, including the need for high-quality studies to validate novel diagnostic methods, optimize treatment durations, establish standard definitions, and refine

antimicrobial stewardship strategies for asymptomatic bacteriuria and MDROs. Suggestions for alternative evidence or recommendations are welcome for consideration by the authors, with updates to the guideline made as needed. No single guideline can encompass all clinical scenarios; therefore, this document is not intended to set legal medical standards or replace professional judgment for individual patient cases.

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SUPPLEMENT.

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