Management of Urinary Tract Infections Across the Healthcare Continuum

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Speaker Disclosures

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Learning Objectives

By the end of the session, participants will be able to:

- Recognize the difference between asymptomatic bacteriuria and a urinary tract infection
- Describe the management approach of suspected urinary tract infections
- Discuss the antimicrobial stewardship principles specific to the management of UTI in various healthcare settings

Definitions

- Urinary tract infection (UTI): Refers to an infection anywhere in the genitourinary tract

- Cystitis: Urinary symptoms are usually confined to the bladder.
    - Dysuria,
    - Frequency
    - Gross hematuria
    - Suprapubic tenderness
    - New or worsening urinary incontinence or urgency

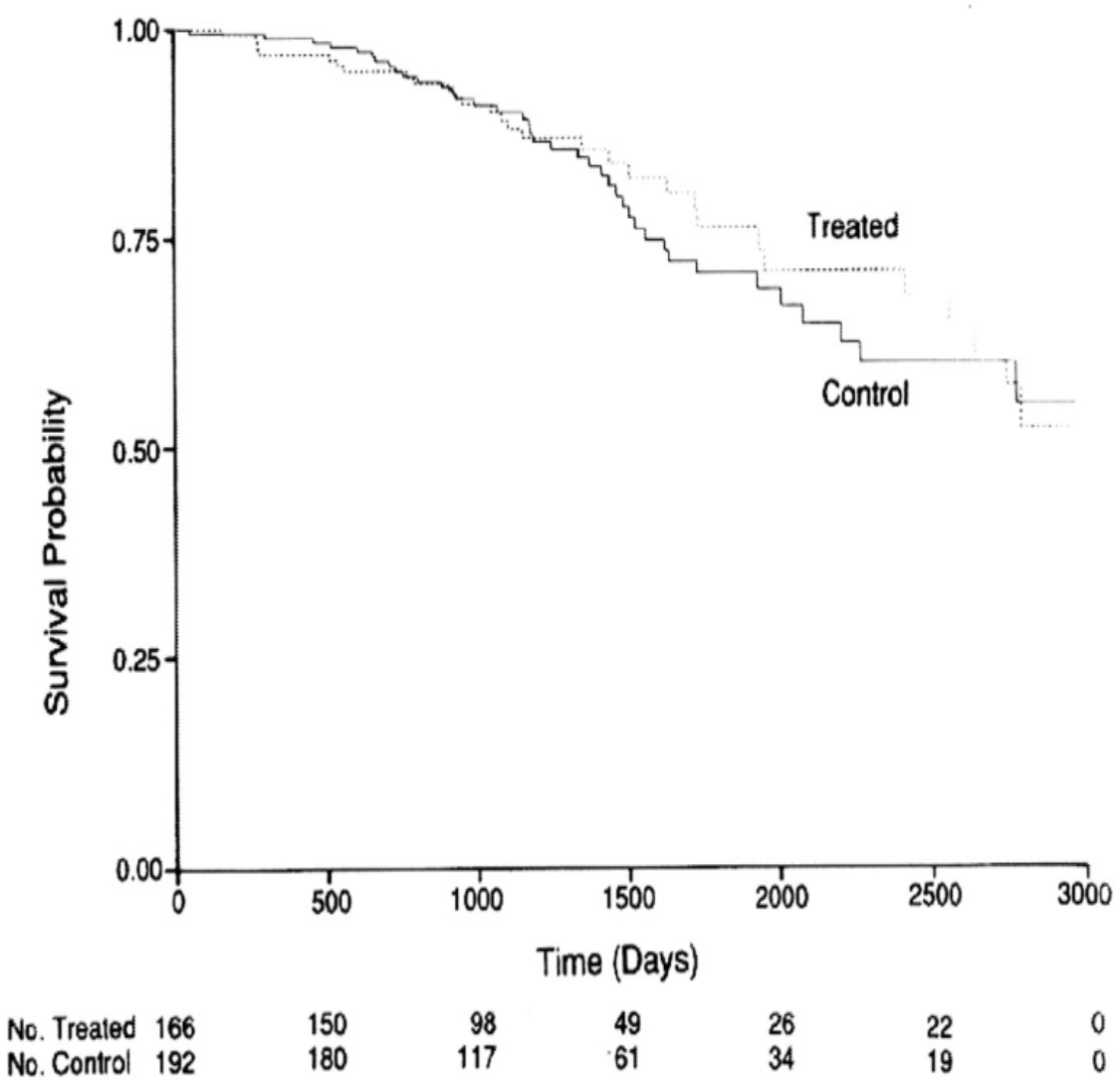
- Pyelonephritis: Less common but more severe infection involving the renal parenchyma
    - Fever
    - Chills
    - Back pain
    - Nausea
    - Vomiting
    - Localizing bladder symptoms may or may not be present.

- Catheter-associated urinary tract infection (CAUTI): Refers to UTIs that develop in individuals with an indwelling urinary catheter

- Asymptomatic Bacteriuria: Presence of bacteria in the urine without signs or symptoms of infection that localize to the urinary tract

Asymptomatic Bacteriuria Treatment Has No Impact on Survival

- A 9-year cohort study and a controlled clinical trial involving elderly ambulatory women without indwelling catheter
- Urine cultures done every 6 months
- Control group did not receive antibiotics for positive culture but treatment group received antibiotic course
- The cure rates among treated and untreated individuals were 82.9% and 15.6%, respectively.
- No statistically significant difference in mortality between the two groups (death rate in treated vs. control groups: 13.8 vs. 15.1 /100 000 resident-days)



Abrutyn et al., Ann Intern Med 1994; 120(10): 827 – 33

Asymptomatic Bacteriuria Treatment Promotes Antimicrobial Resistance

- Randomized Control Trial: 35 patients with long-term indwelling catheters (18 in control and 17 in treatment group)
- Urine cultures obtained weekly
- Whenever bacteriuria is detected, treated with 10 days of cephalexin in the treatment group

No difference in mean bacterial strains/ patient

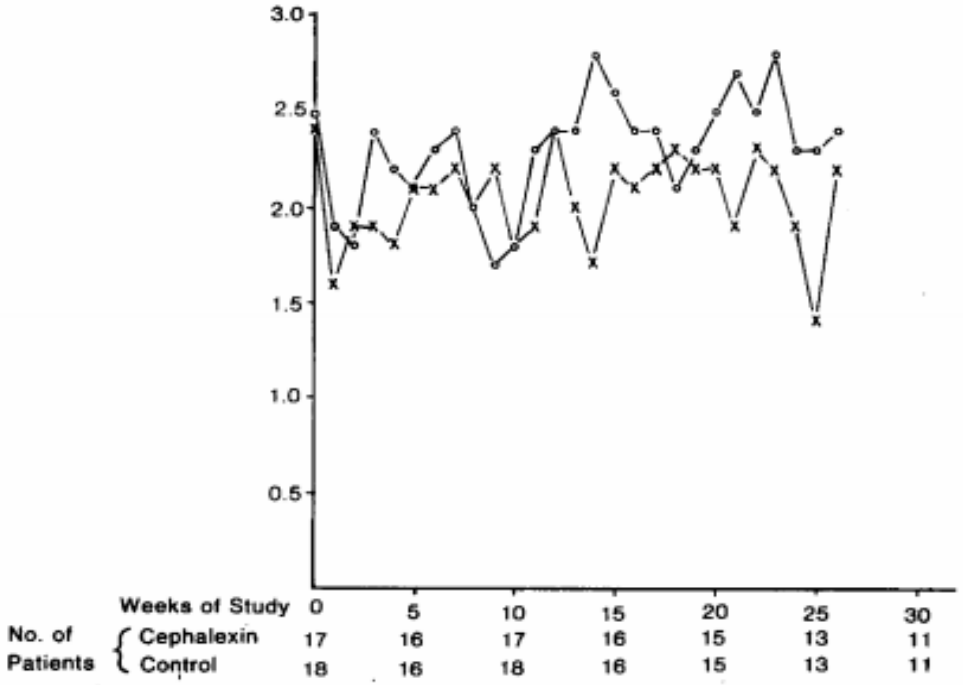


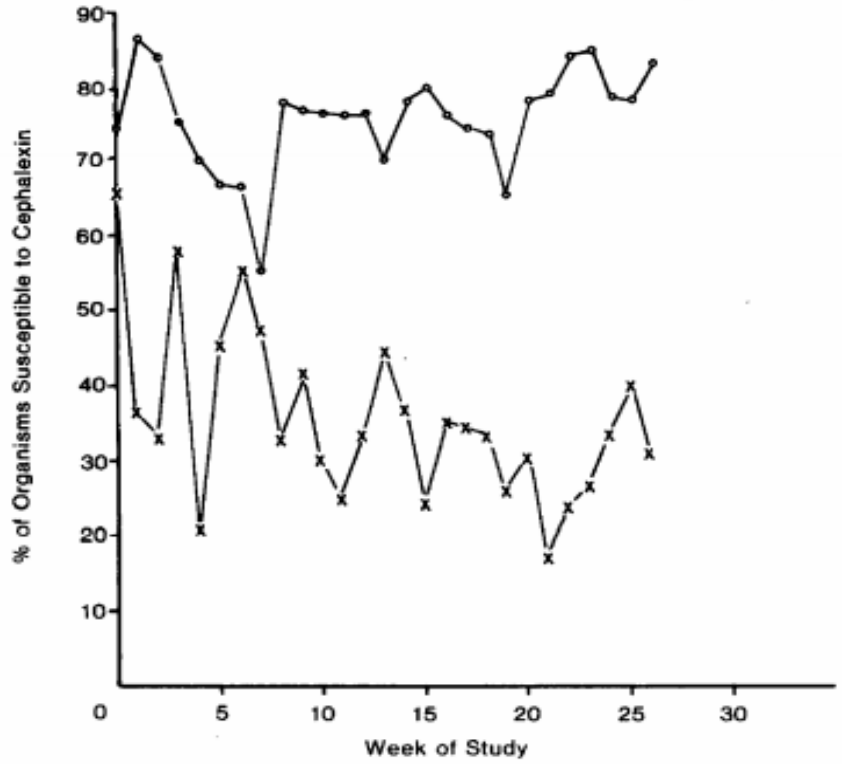
Fig 1.—Mean number of bacterial strains ($\geq 10^5$ colony-forming units [cfu]/mL) per patient, isolated from weekly urine specimens. Xs indicate cephalexin monohydrate group; circles, controls.

108 fever days in control group

100 fever days in treatment group

Fig 2.—Bacterial strains susceptible to cephalexin as percentage of total weekly urine isolates. Xs indicate cephalexin monohydrate group; circles, controls.

Increase resistance in treatment group



Warren JW et al. JAMA. 1982 Jul 23;248(4):454-8.

Management of Asymptomatic Bacteriuria

- New (2019) IDSA guidelines **recommend against screening for and treating** asymptomatic bacteriuria in most clinical scenarios.

- The treatment is recommended in specific clinical scenarios:

  - Pregnant women
    - Usually require 4–7 days of antimicrobial treatment

  - Patients undergoing endoscopic urologic procedures associated with mucosal trauma
    - A urine culture be obtained prior to the procedure and antimicrobial therapy should be targeted to the organism identified
    - A short course (1 to 2 doses) of antimicrobial therapy is recommended initiated 30 to 60 minutes before the procedure

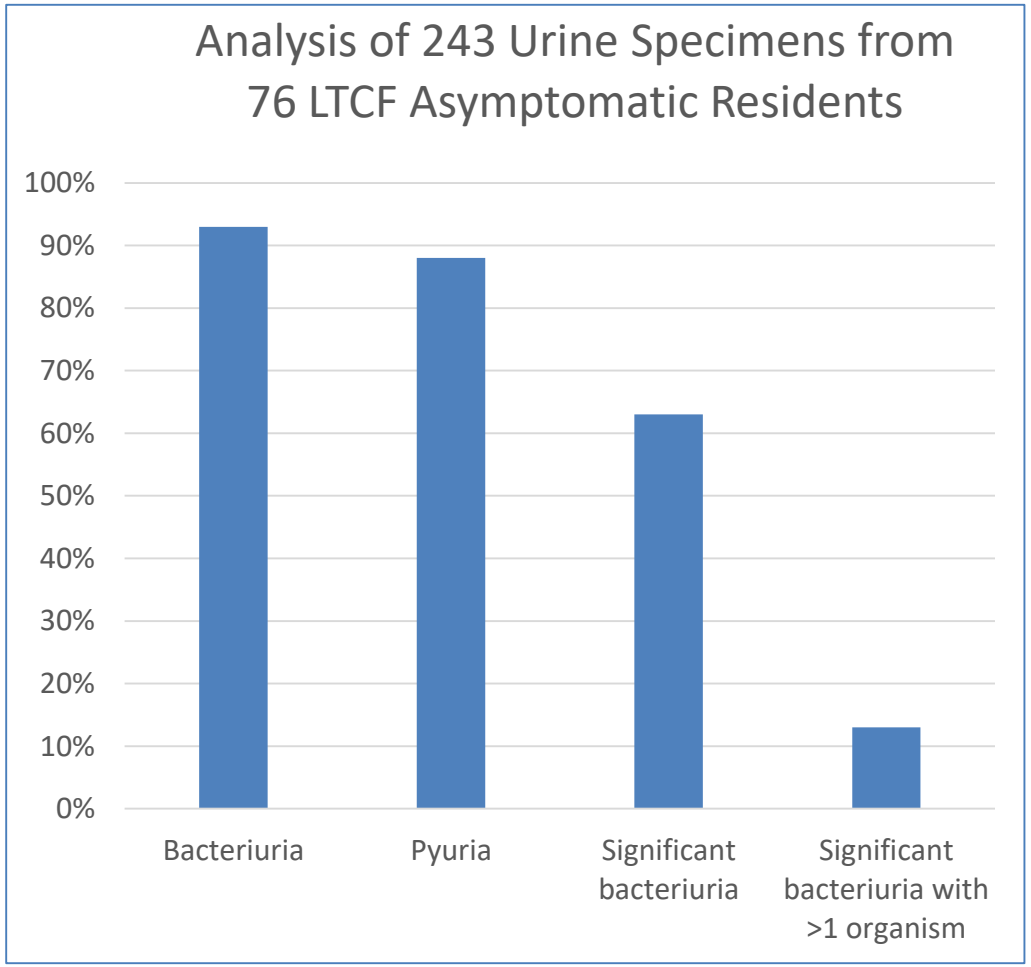
Nicolle LE et al. Clin Infect Dis. 2019 Mar 21. pii: ciy1121

Limitations of Diagnostic Testing for UTI

TABLE 2. Comparison of Dipstick Test Results for Leukocyte Esterase and Nitrite With Laboratory Evidence of Urinary Tract Infection (UTI) in 101 Nursing Home Residents

Dipstick test results for leukocyte esterase and nitrite	Laboratory evidence of UTI		
	Positive	Negative	Total
Positive for either	40	49	89
Negative for both	0	12	12
Total	40	61	101

NOTE. When the presence of leukocyte esterase and nitrite were assessed together, sensitivity was 100%, specificity was 20%, positive predictive value was 45%, and negative predictive value was 100%. UTI was defined as >100,000 colony forming units/mL on urine culture and >10 white blood cells/mm^3 on urinalysis. The dipstick test for leukocyte esterase was defined as positive if the result in the medical record was trace, +, or ++.



Juthani Mehta M et al. Infect Control Hosp Epidemiol. 2007 Jul;28(7):889-91.

Rodgers K et al. Can J Infect Dis. 1991;2(4):142-6.

Non-Specific Signs and Symptoms are Not Diagnostic for UTI

Table 1. Baseline Characteristics, Presenting Features, and Culture Results

Characteristic	Total N = 265	UTI n = 150	Non-UTI n = 115	*P*-Value UTI vs Non-UTI
Geriatric syndromes, n (%)				
Falls	79 (29.8)	47 (31.3)	32 (27.8)	.42
New or worsened confusion	117 (44.2)	70 (46.7)	47 (40.9)	.21
New or worsened urinary incontinence	27 (10.2)	17 (11.3)	10 (8.7)	.38
Functional decline	108 (40.7)	66 (44.0)	42 (36.5)	.11
Any geriatric syndrome	205 (77.4)	117 (78.0)	88 (76.5)	.70
Clinical signs, n (%)				
Suprapubic tenderness	29 (10.9)	20 (13.3)	9 (7.8)	.08
Costovertebral angle tenderness	7 (2.6)	7 (4.7)	0	.02
Pyrexia > 37°C	87 (32.8)	60 (40.0)	27 (23.5)	< .001
Urine pungent	24 (9.1)	14 (9.3)	10 (8.7)	.82
Urine discolored	11 (4.2)	9 (6.0)	2 (1.7)	.05
Patient smells of urine	15 (5.7)	8 (5.3)	7 (6.1)	.71

Presenting Features Suggestive of UTI

Table 1. Baseline Characteristics, Presenting Features, and Culture Results

Characteristic	Total N = 265	UTI n = 150	Non-UTI n = 115	*P*-Value UTI vs Non-UTI
Presenting features				
Urinary tract symptoms, n (%)				
Dysuria	35 (12.1)	31 (20.7)	4 (3.5)	<.001
Hematuria	3 (1.1)	3 (2.0)	0	.13
Frequency	27 (10.2)	22 (14.7)	5 (4.3)	.002
Urgency	6 (2.3)	3 (2.0)	3 (2.6)	.64
Retention	18 (6.8)	17 (11.3)	1 (0.9)	.0004
Suprapubic pain	15 (5.7)	12 (8.0)	3 (2.6)	.03
Flank pain	9 (3.4)	9 (6.0)	0	.007
Rigors	16 (6.0)	14 (9.3)	2 (1.7)	.005
Any of the above	85 (32.1)	73 (48.7)	12 (10.4)	<.001

Woodford HJ et al. J Am Geriatr Soc 57:107–114, 2009

Diagnosis of UTI in Frail Older Adults

- Loeb Minimum Criteria for the initiation of antibiotics in residents of long-term-care facilities **(2001)** [Infect Control Hosp Epidemiol. 2001 Feb;22(2):120-4]
- Revised Mc Geer Criteria for Infections in Long-Term Care Facilities **(2012)** [Infect Control Hosp Epidemiol. 2012 Oct; 33(10): 965–977]
- Crnich Algorithm for diagnosing UTIs in residents of long-term care facilities **(2014)** [Annals of Long-Term Care: Clinical Care and Aging. 2014;22(9):32-36]
- International Expert Consensus Decision Tool for Empiric UTI Treatment in Frail Older Adult **(2018)** [J Am Med Dir Assoc. 2018 Sep;19(9):757-764]
- IOU Consensus Guidelines for the Diagnosis of Uncomplicated Cystitis in Nursing Home Residents **(2018)** [J Am Med Dir Assoc. 2018 Sep;19(9):765-769.e3]

IOU Consensus Guidelines for the Diagnosis of Uncomplicated Cystitis in Nursing Home Residents.

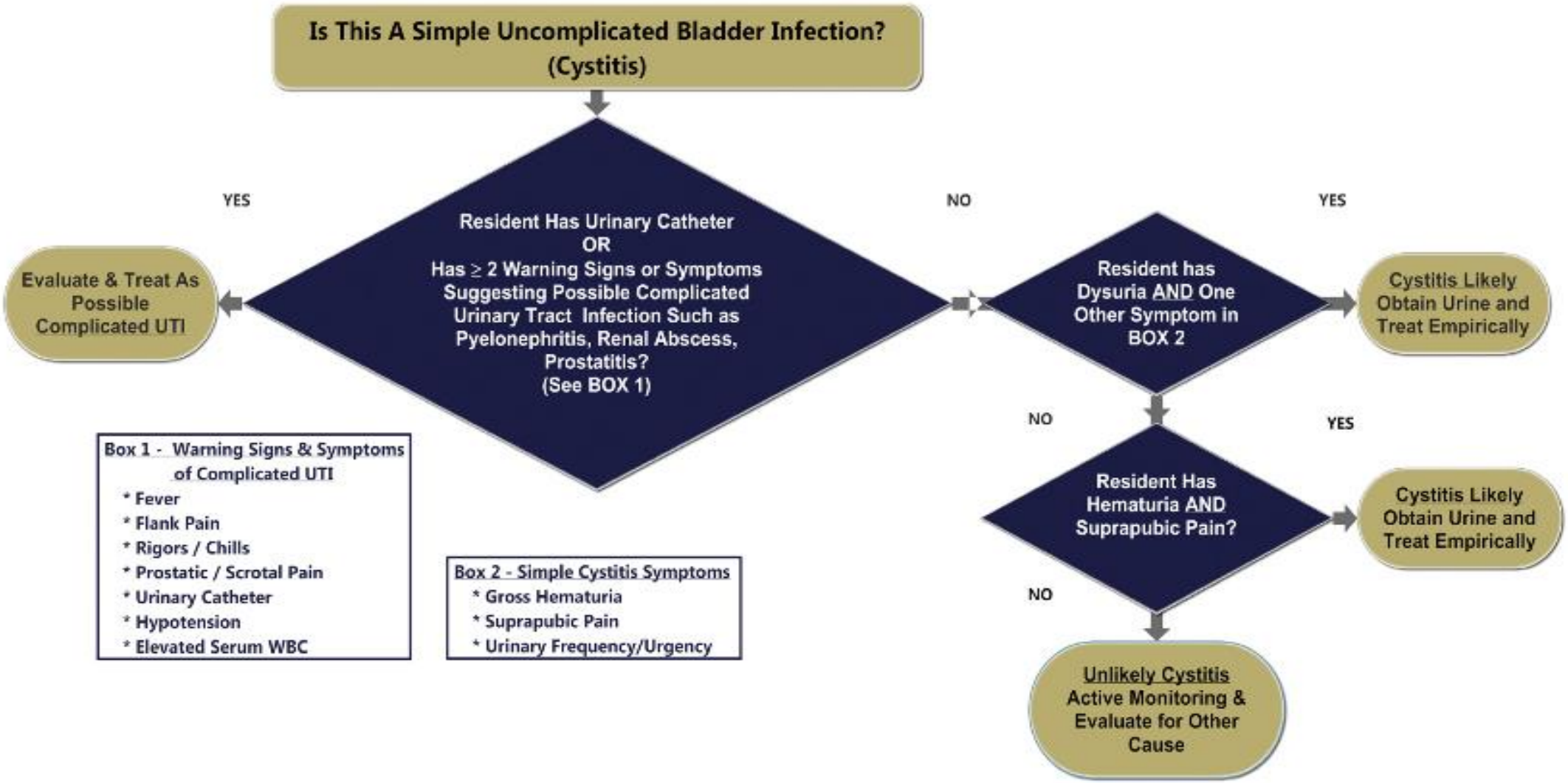


Fig. 1. Algorithm for the diagnostic approach to uncomplicated cystitis in noncatheterized nursing home residents.

Nace DA et al. J Am Med Dir Assoc. 2018 Sep;19(9):765-769.e3

Active Monitoring

Active monitoring includes:

- Frequent assessment of vital signs for early detection of sepsis,
- Assessment for hydration and keeping resident hydrated,
- Criteria for notifying the physician or other provider if patient's condition worsen.

☐ Obtain vital signs (BP, Pulse, Resp Rate, Temp, Pulse Ox) every ____ hours for ____ days.

☐ Record fluid intake each shift for _____ days.

☐ Notify physician if fluid intake is less than _____ cc daily.

☐ Offer resident _____ ounces of water / juice every _____ hours.

☐ Notify physician, NP, or PA if condition worsens, or if no improvement in _____ hours.

☐ Obtain the following blood work _____ .

☐ Consult pharmacist to review medication regimen.

☐ Contact the physician, NP, PA with an update on the resident's condition on _____.

Cortes-Penfield NW et al. Infect Dis Clin N Am 31 (2017) 673–688
Nace DA et al. J Am Med Dir Assoc. 2014 Feb;15(2):133-9

Effectiveness of Assessment/ Communication Tool That Incorporates Active Monitoring

A – Assessment (check boxes and determine recommendation prior to call)

Resident with indwelling catheter:

- ☐ fever of 100◦F (38◦C)or 2◦F (1◦C) greater than baseline
- ☐ new costovertebral tenderness
- ☐ rigors
- ☐ new delirium
- ☐ hypotension

Any one of the above present

Resident without indwelling catheter:

- ☐ Acute dysuria alone;

OR

- ☐ Single temperature of 100◦F (38◦C), multiple at 99◦F (37◦C) or above, or 2◦F (1◦C) degrees greater than baseline AND at least one new or worsening of the following:
  - ☐ urgency
  - ☐ suprapubic pain
  - ☐ frequency
  - ☐ gross hematuria
  - ☐ costovertebral angle tenderness
  - ☐ new/worsening urinary incontinence

Yes

No

Yes

No

R - Recommendation

☐ **Protocol criteria ARE met.**

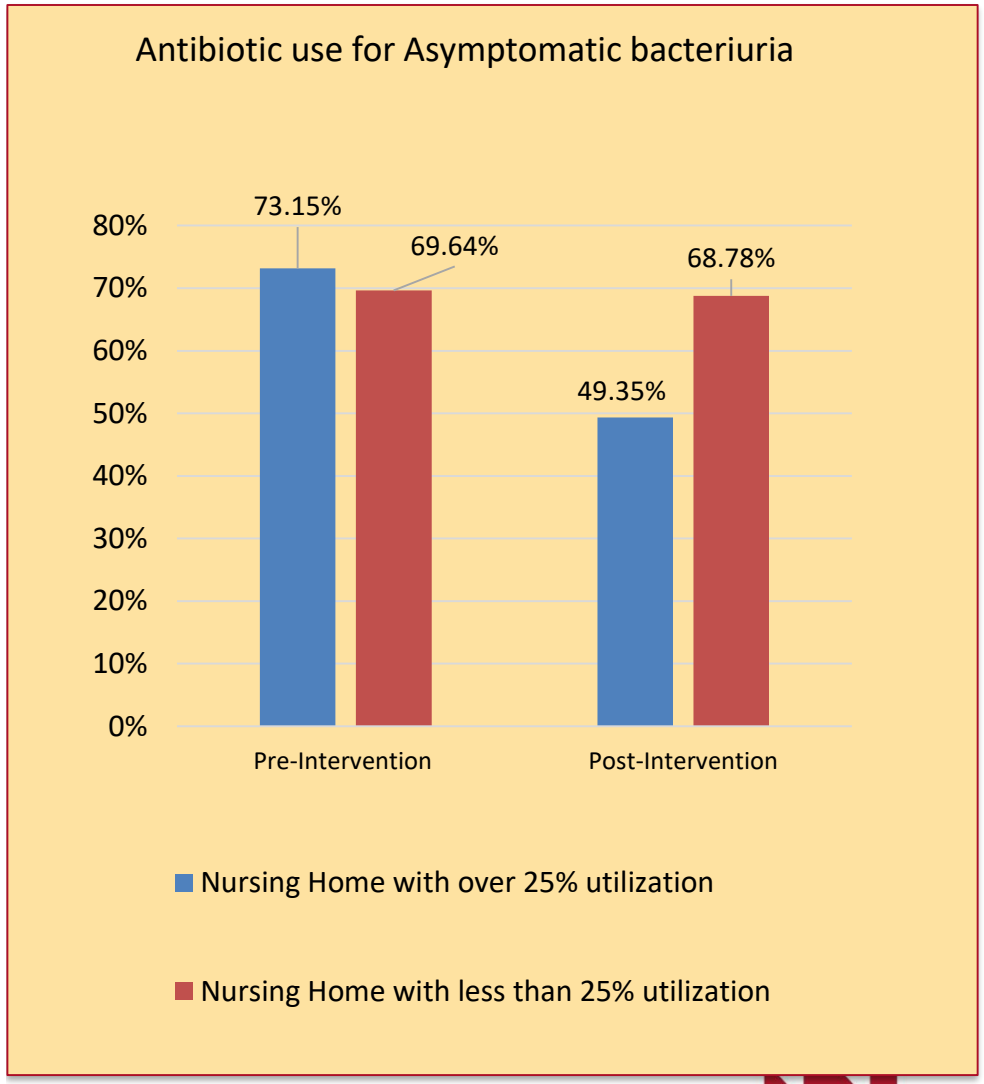
According to our understanding of best practices and our facility protocols the resident may have a urinary tract infection and need a prescription for an antibiotic agent.

Staff:

Please Check Box for Course of Action Recommended

☐ **Protocol criteria are NOT met.**

According to our understanding of best practices and our facility protocols, the information is insufficient to indicate an active urinary tract infection. The resident does NOT need an immediate prescription for an antibiotic, but may need additional observation.



McMaughan DK et al. BMC Geriatr. 2016 Apr 15;16:81

Suspected UTI SBAR

Complete this form before contacting the resident's physician.

Date/Time _____

Nursing Home Name _____

Resident Name _____ Date of Birth _____

Physician/NP/PA _____ Phone _____

Fax _____

Nurse _____ Facility Phone _____

Submitted by ☐ Phone ☐ Fax ☐ In Person ☐ Other _____

S Situation

I am contacting you about a suspected UTI for the above resident.

Vital Signs BP _____ / _____ HR _____ Resp. rate _____ Temp. _____

B Background

Active diagnoses or other symptoms (especially, bladder, kidney/genitourinary conditions)

Specify _____

☐ No ☐ Yes The resident has an indwelling catheter

☐ No ☐ Yes Patient is on dialysis

☐ No ☐ Yes The resident is incontinent **If yes,** new/worsening? ☐ No ☐ Yes

☐ No ☐ Yes Advance directives for limiting treatment related to antibiotics and/or hospitalizations

Specify _____

☐ No ☐ Yes Medication Allergies

Specify _____

☐ No ☐ Yes The resident is on Warfarin (Coumadin®)

AHRQ Agency for Healthcare Research and Quality
Advancing Excellence in Health Care • www.ahrq.gov

HAIs

www.ahrq.gov/NH-ASPGuide · June 2014
AHRQ Pub. No. 14-0010-2-EF

https://www.ahrq.gov/sites/default/files/wysiwyg/nhguide/4_TK1_T1-SBAR_UTI_Final.pdf

Sample SBAR Tool for Suspected Urinary Tract Infection

[Facility Logo] | Resident Label

S — Situation

I am concerned about a suspected UTI for the above resident.

B — Background

Indwelling catheter ☐Yes ☐No If yes, ☐ Urethral ☐ Suprapubic

Incontinence ☐Yes ☐No If yes, is this new or worsening ☐Yes ☐No

UTI in last 6 months ☐Yes ☐No If yes, Date: _____ Organism: _____ Treatment: _____

Active diagnosis (especially bladder, kidney, genitourinary conditions; diabetes; receiving dialysis, anticoagulants):

_____

Advance directives for limiting treatment (especially antibiotic use): _____

Medication allergies: _____

A — Assessment

Vital signs: BP____ /____ HR_____ Resp. rate_____ Temp._____ O_2 Sats._____

Resident WITH indwelling catheter

The criteria are met to initiate antibiotics if one of the following are selected:

No Yes

☐ ☐ Fever of 100°F (38°C), or 2°F (1.1°C) above baseline, or repeated temperatures of 99°F (37°C)

☐ ☐ New back or flank pain

☐ ☐ Rigors / shaking / chills

☐ ☐ New onset delirium (new dramatic change in mental status)

☐ ☐ Hypotension (significant change in baseline BP or SBP <90)

☐ ☐ Acute suprapubic pain

☐ ☐ Acute pain, swelling or tenderness of the scrotal area

Resident WITHOUT indwelling catheter

Criteria are met to initiate antibiotics if one of the three situations are met:

No Yes

☐ ☐ Any one of the following two:
- ☐ Acute dysuria alone (pain or burning while urinating)
- ☐ Acute pain, swelling or tenderness of the scrotal area

OR

☐ ☐ Single temp of 100°F (38°C), or 2°F (1.1°C) above baseline, or repeated temperatures of 99°F (37°C) **and** at least one of the following new or worsening symptoms:
- ☐ Urgency ☐ Suprapubic pain ☐ Frequency
- ☐ Gross hematuria ☐ Back or flank pain ☐ Urinary incontinence

OR

☐ ☐ No fever, but two or more of the following new or worsening symptoms:
- ☐ Urgency ☐ Suprapubic pain ☐ Frequency
- ☐ Gross hematuria ☐ Urinary incontinence

R — Recommendation

☐ **Protocol criteria met**. Resident may require UA and urine culture or an antibiotic.

☐ **Protocol criteria are NOT met**. Resident **DOES NOT** need immediate antibiotic but may need additional observation.

Nurse's Signature: _____ **Date/Time:** _____

☐ **Notification of Family/POA Name:** _____ **Date/Time:** _____

☐ **Faxed or** ☐ **Called to:** _____ **By:** _____ **Date/Time:** _____

Physician Orders/Response (Please check all that apply)

☐ I have reviewed the above **SBAR**.

☐ Urine culture (if indicated)

☐ Encourage 4oz of cranberry juice or another liquid (_____) TID, until symptoms resolve

☐ Record fluid intake & output until symptoms resolve (output can also be measured from urinal or by weighing diapers, etc.)

☐ Assess vital signs, including temp; every _____ hours for _____ hours

☐ Monitor and notify PCP if symptoms worsen or unresolved in _____ hours

☐ Other: _____

☐ For antibiotic orders (if needed) please complete script below:

Drug: _____ Dose: _____ Route: _____ Frequency: _____ Duration: _____ Indication: _____

Physician Signature:	**Date/Time:**

Please Fax Back To: _____ or ☐ **Telephone Order**

File Under Physician Order/Progress Notes

https://asap.nebraskamed.com/long-term-care/tools-templates-long-term-care/

ASAP

Diagnosis of UTI in Healthy Premenopausal, Non-Pregnant Women

- Infection suspected on the basis of typical symptoms
  - Dysuria (also common with urethritis or vaginitis)
  - Frequency
  - Urgency
  - Suprapubic pain
  - Hematuria
  - Fever (temperature >38°C), chills, flank pain, costovertebral-angle tenderness, and nausea or vomiting, with or without symptoms of cystitis is suggestive of pyelonephritis

Cystitis

- Sudden onset of symptoms or severe symptoms localizing to bladder as well as absence of vaginal irritation and discharge are more likely to be suggestive of cystitis
- Probability of cystitis is greater than 90% in women who have dysuria and frequency without vaginal discharge or irritation
- Urinalysis and urine culture not routinely needed for suspected cystitis
- Obtain urinalysis and urine culture for suspected pyelonephritis

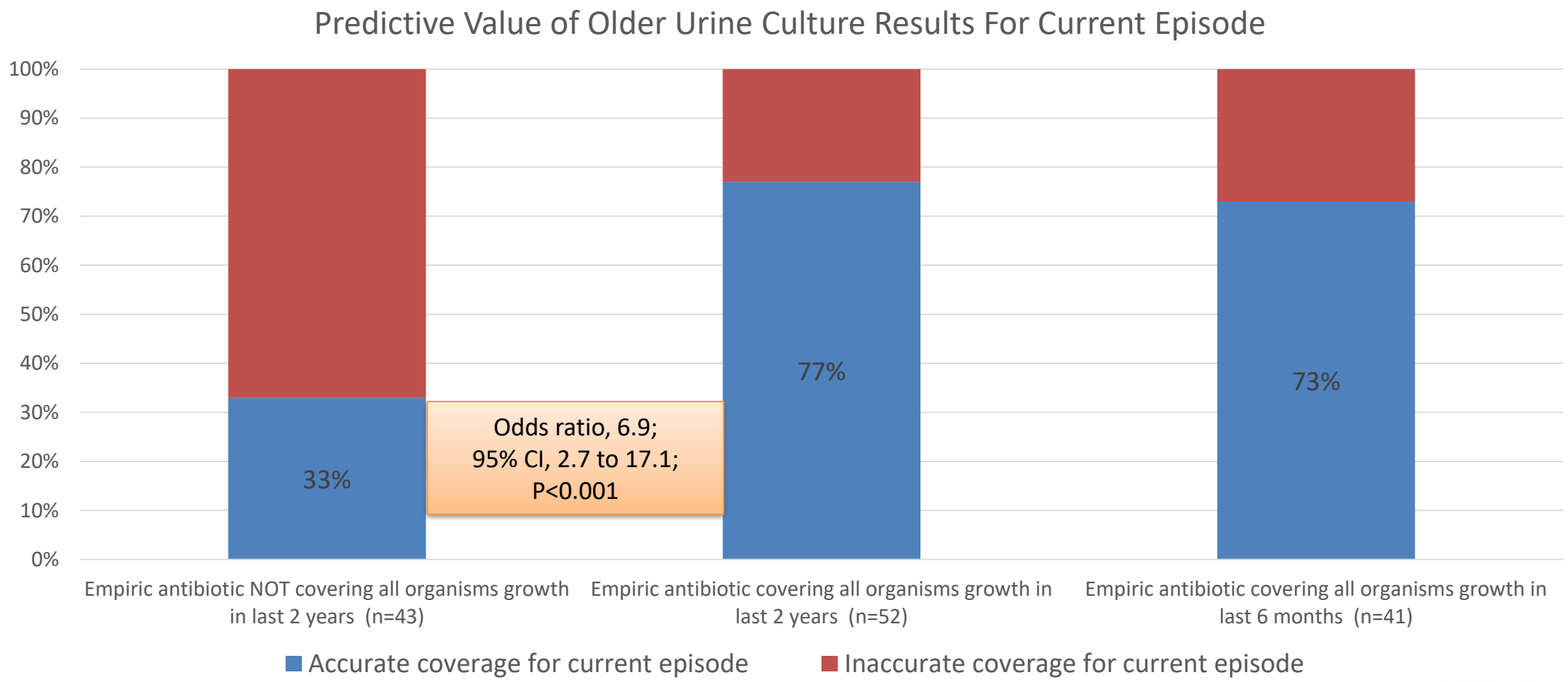
Hooton TM. N Engl J Med 2012;366:1028-37.

Choosing Empiric Antibiotic Coverage

Points to consider when choosing antibiotic coverage in addition to allergies:

- Type of UTI syndrome being treated
- Any previous urine culture results in the recent past (6 months to 2 years)
- Antibiotic susceptibility pattern (Local Antibiogram) especially if previous urine cultures are not available
- Renal/ Hepatic function
- Drug-drug interactions
- Other comorbidities

Importance of Reviewing Older Culture Results When Deciding Empiric Treatment



Linsenmeyer K et al. Antimicrob Agents Chemother 2015;59(12):7593–6.

Duration of Therapy Based on Agent and UTI Syndrome

UTI Syndrome	Typical Duration of Therapy
Uncomplicated Cystitis	5 days for Nitrofurantoin 3 days for Trimethoprim/Sulfamethoxazole 1 dose for Fosfomycin 3 days for Fluoroquinolones (Second line agent) 3-7 days for Beta-lactams (Second line agent)
Pyelonephritis	14 days for Trimethoprim/Sulfamethoxazole 10 to 14 days for Beta-Lactams 7 days for Fluoroquinolones
Catheter-associated UTI or cystitis in presence of complicating factors	7 days if prompt resolution of symptoms 10-14 days if delayed response to therapy

https://asap.nebraskamed.com/long-term-care/guidance-document-long-term-care/

Gupta K et al. Clin Infect Dis 2011;52:e103-20
Rowe TA et al. Infect Dis Clin North Am 2014;28:75-89
Hooten TM et al. Clin Infect Dis 2010;50:625-63.
Nicolle LE et al. Can J Infect Dis Med Microbiol 2005;16:349-60

Potential Complicating Factors

Factors	Examples	
Obstruction	Ureteric or urethral strictures Nephrolithiasis Diverticula Renal cysts	Tumors of the urinary tract Prostatic hypertrophy Pelvicalyceal obstruction Congenital abnormalities
Instrumentation	Indwelling urethral catheter Ureteric stent Urologic procedures	Intermittent catheterization Nephrostomy tube
Impaired voiding	Neurogenic bladder Vesicoureteral reflux	Cystocele Ileal conduit
Metabolic abnormalities	Nephrocalcinosis Renal failure (eCrCl <30 mL/min)[17]	Medullary sponge kidney
Others	Immunosuppressed (renal transplant) Pregnancy	Male sex

Abbreviations: eCrCl = estimated creatinine clearance

https://asap.nebraskamed.com/long-term-care/guidance-document-long-term-care/

Can J Infect Dis Med Microbiol Vol 16 No 6 November/December 2005

Managing UTI in Hospitalized Critically Ill Patients

- Initiate parenteral therapy
- Third generation cephalosporin is a good choice if patient not at risk for multi-drug resistant organisms
- Broader spectrum agent can be started if at risk for multi-drug resistant pathogens
- Carbapenems are preferred agent for treatment of severe infections when suspecting infection with ESBL organism
- Consider adding vancomycin if Gram stain shows Gram-positive cocci
- Deescalate antibiotics when culture results are back

Example of an Empiric Antibiotic Selection Pathway for Sepsis and Septic Shock

Urinary Tract	Ceftriaxone 2g IV Daily +/- Gentamicin 7 mg/kg IV EIAD (consider if history of MDR pathogen or Pseudomonas) History ESBL colonization Ertapenem 1g qday **alone** <u>Severe beta-lactam allergy (anaphylaxis, hives):</u> Aztreonam 2g q8h **PLUS** Gentamicin 7mg/kg IV EIAD

https://www.nebraskamed.com/for-providers/asp/plans

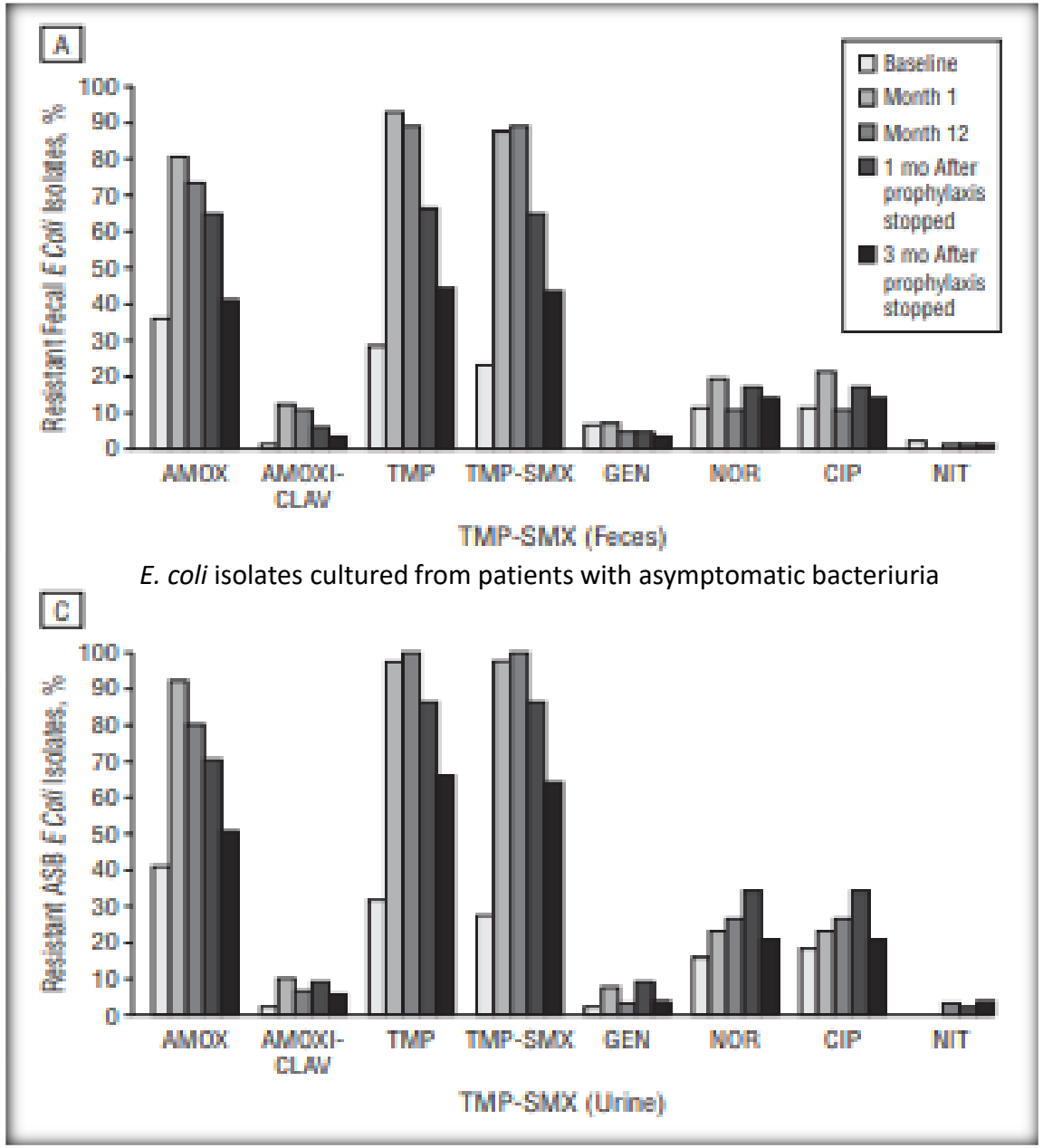
Note: This is the 2019 version of guidance which will replace the currently uploaded version on the website in the next couple of month

Hooton TM. N Engl J Med 2012;366:1028-37.

Prevention of UTI in Older Adults

Prevention Strategy	Supported by Evidence	References
Cranberry formulations	No	Jepson RG et al. JAMA. 2016 Nov 8;316(18):1879-1887 Cochrane Database Syst Rev. 2012 Oct 17
Vaginal estrogens	Yes	Eriksen B. Am J Obstet Gynecol. 1999 May;180(5):1072-9. Raz R et al. N Engl J Med. 1993;329(11):753-756.
Physical activity/mobility	Unclear	Lavado El et al. Clin Rehabil. 2013 Feb;27(2):142-9 Rogers MA et al. BMC Geriatr. 2008 Nov 25;8:31. Bula CJ et al. J Am Geriatr Soc. 2004 May;52(5):700-6.
Methenamine salts	No	Lee BS et al. Cochrane Database Syst Rev. 2012 Oct 17;10:CD003265
Long-term antibiotics	No (due to concerns of adverse events and increased antimicrobial resistance)	Ahmed H et al. BMJ Open. 2017 May 29;7(5):e015233. Beerepoot MA et al. Arch Intern Med. 2012 May 14;172(9):704-12 McMurdo ME at al. J Antimicrob Chemother. 2009 Feb;63(2):389-95

Impact of Antibiotic Prophylaxis on Antibiotic Resistance



E. coli isolates cultured from patients with asymptomatic bacteriuria

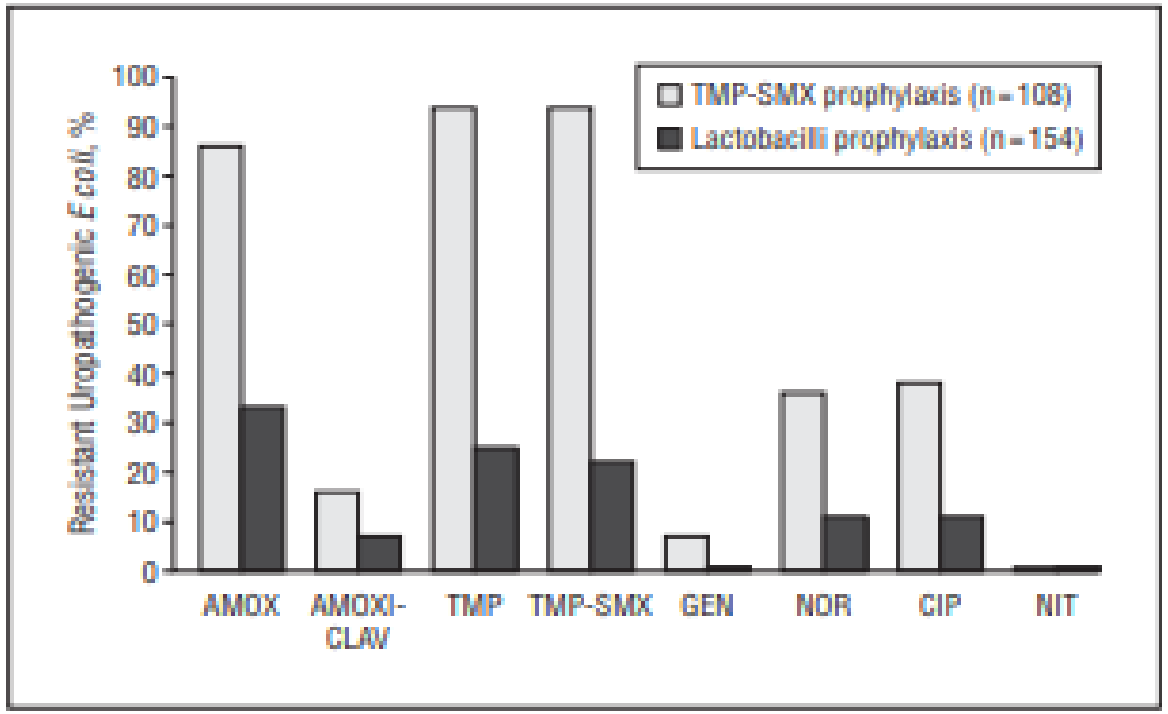


Figure 4. Antibiotic resistance among *Escherichia coli* isolated from patients with symptomatic urinary tract infection. AMOX indicates amoxicillin; AMOX-CLAV, amoxicillin-clavulanic acid; CIP, ciprofloxacin; GEN, gentamicin; NIT, nitrofurantoin; NOR, norfloxacin; and TMP-SMX, trimethoprim-sulfamethoxazole.

TMP-SMX group – 2.9 UTI episodes/year
Lactobacilli group – 3.3 UTI episodes/year

Beerepoot MA et al. Arch Intern Med. 2012 May 14;172(9):704-12

Recurrent UTI in Healthy Premenopausal, Non-Pregnant Women

- Urinary symptoms that persist or recur within a week or two of treatment for uncomplicated cystitis suggest infection with an antimicrobial-resistant strain or, rarely, relapse (Culture should be obtained and broader spectrum agent should be used)
- Symptoms recurred after 1 month – (Use first line agent for treatment; if recurred within 6 months consider using a different first line agent especially if trimethoprim-sulfamethoxazole was used last time)
- Consider behavioral counselling (frequency of intercourse, stopping use of spermicide, urinating soon after intercourse etc.)
- Use of biologic mediators (such as cranberry juice) can be offered although effectiveness is questionable.
- Antimicrobial prophylaxis should be used as a last resort.
- Motivated women with previous culture-confirmed cystitis who will comply with the treatment can be offered self diagnosis & treatment by prescribing first line antibiotic treatment for future use (but re-evaluate periodically)
- Choice of antibiotics for post-coital or continuous (discontinue and re-evaluate in 6 month) antimicrobial prophylaxis should be based on susceptibility of the most recently identified pathogen and pregnancy implications.

Hooton TM. N Engl J Med 2012;366:1028-37.

Strategies to Consider for Improving Antibiotic Prescribing Practices

Outpatient	Hospital	LTCF
▪ Implement strategies (e.g. pocket cards, educational posters, etc.) to promote use of evidence-based diagnostic criteria and treatment recommendations ▪ Communications skills training for clinicians ▪ Incorporate evidence-based guidelines into EHR order sets ▪ Establish culture follow up program	▪ Facility specific diagnosis and/or treatment guidelines ▪ Prospective audit and feedback ▪ Requiring prior authorization for certain class of antibiotics (e.g. fluoroquinolones) ▪ Antibiotic time-out ▪ Implementing IV to PO conversion protocols ▪ Pharmacy- driven dose adjustment & optimization	• Implement SBAR tool • Establish standing orders for active monitoring for non-specific signs and symptoms • Facility-specific diagnosis and/or treatment guidelines • Implement mandatory review of necessity by medical directors for all outside antibiotic orders • Antibiotic time-out • Provider Feedback

Thank you

Questions?