

Approach to Urinary Tract Infections (UTIs): Judicious use of antibiotics is important to prevent adverse events & antibiotic resistance

- ❑ Ensure the individual has symptomatic versus asymptomatic bacteriuria, by looking for the following symptoms, which is key to treatment approach.

ASYMPTOMATIC Bacteriuria:

- There is a high prevalence of asymptomatic bacteriuria in older adults (the bladder is normally colonized in many older adults).
 - The prevalence of asymptomatic bacteriuria in adults >70 years: ¹
 - In the community: up to 19%
 - In long-term care: up to 50%
 - Individuals with a long-term indwelling catheter: **100%**
- **Routine screening & treatment is NOT recommended for asymptomatic bacteriuria**, except for individuals undergoing genitourinary or prosthetic procedures (single doses of antibiotics given pre-op) or who are immunosuppressed.
- A positive urinalysis or culture in the absence of symptoms (see below) indicates **colonization, not infection**.
- Changes in the urine (e.g. smell, cloudiness) or mental status without localized genitourinary symptoms alone does **NOT** indicate a UTI.
- Asymptomatic bacteriuria does not ↑ risk of mortality, & treatment does not ↓ risk of symptomatic UTI but can ↑ risk of adverse events & antimicrobial resistance.

The Many Risks Associated with Unnecessary Antibiotic Use

- ↑ risk of drug interactions (e.g. SMX/TMP + warfarin = ↑ INR)
- Unnecessary medication cost (~\$20 to 40/course for oral treatment)
- ↑ risk of antibiotic resistance
 - Antibiotic resistance results in difficult to treat individuals
 - Individuals will be ill for a longer period of time
 - ↑ chance illness will spread to others (especially in LTC homes via residents, staff, family or other visitors)
- Risk of *C. difficile*-associated diarrhea

It's HARD to Ignore a Positive C&S Test Result!

- Asymptomatic bacteriuria will produce a positive urine C&S, despite the absence of an active infection.
- Due to the high prevalence of asymptomatic bacteriuria in older adults, it is imperative that the individual be symptomatic to ensure an accurate diagnosis of an UTI.
- In individuals with a long-term indwelling catheter, a urine culture loses its diagnostic abilities as the prevalence of asymptomatic bacteriuria nears 100%, therefore the presence of symptoms must be relied upon for diagnosis. In this scenario, a urine culture serves only to direct antibacterial selection.
- Over-testing (testing when symptoms are not present) combined with the prevalent colonization of the bladder in older adults will not only result in unnecessary prescriptions, but may result in a clinician overlooking the real diagnosis.

Criteria for SYMPTOMATIC Bacteriuria in LTC Residents (*What to look for*)

Intermittent Catheterization, Condom Catheter, No Indwelling Catheter

ONE of the following:

- ❑ Acute dysuria (pain on urination) **OR** acute pain, swelling or tenderness of the testes, epididymis or prostate
- ❑ Fever (oral temperature >37.8°C or 1.1°C above baseline) ^{*} **OR** chills **OR** leukocytosis **AND** at least one of the following:
 - New or increased urinary urgency **OR** frequency **OR** incontinence
 - Gross hematuria
 - New flank/costovertebral angle **OR** suprapubic pain/tenderness
- ❑ At least 2 or more of the following symptoms:
 - New or increased urinary urgency **OR** frequency **OR** incontinence
 - Gross hematuria
 - New flank/costovertebral angle **OR** suprapubic pain/tenderness

Indwelling Catheter (≥1 of the following):

ONE of the following:

- ❑ Fever (oral temperature >37.8°C or 1.1°C above baseline) ^{*} **OR** new onset hypotension with no alternate site of infection **OR** rigors
- ❑ Leukocytosis **AND** acute change in mental status **OR** acute functional decline
- ❑ New flank/costovertebral angle **OR** suprapubic pain/tenderness
- ❑ Purulent discharge from around the catheter **OR** acute pain, swelling or tenderness of the testes, epididymis or prostate

^{*} **Fever:** older adults may not present with a fever, & may instead even be hypothermic. Assess if the resident recently received any medication(s) that can mask a fever or lower baseline temperature (e.g. acetaminophen ^{TYLENOL}, NSAIDs).

Clinical Challenge: Residents with impaired communication or dementia may be unable to report symptoms.

Do not let non-specific symptoms complicate the assessment as these symptoms may be due to a variety of causes other than a UTI.

- **Foul smelling or cloudy urine** are not symptoms of a urinary tract infection but rather may be related to diet, dehydration, medication or hygiene.
- A **change in mental status, fatigue, or a fall** may be due to: pain, depression, constipation, dehydration, poor sleep, pneumonia, metabolic imbalance (e.g. low sodium), head trauma, environmental change or medication side effects.

It is important to consider a range of possible causes to prevent missing the real diagnosis.

Causes of non-specific symptoms may be evaluated by doing the following:

- Monitor vital signs and symptoms for several days
- Watch closely for progression of symptoms or change in clinical status
- Encourage fluid intake if appropriate
- Review for alternate causes noted above

❑ Send a urine sample for culture & sensitivity (C&S) prior to starting empiric antibiotic therapy to confirm UTI & to guide antibiotic selection.

- If the resident has had an indwelling catheter ≥14 days, **change catheter prior to** obtaining urine sample. (Often, removal of catheter & hydration all that is required.)
 - When symptoms of a UTI develop in an individual who is catheterized, changing the catheter before collecting urine improves the accuracy of urine culture results. Changing the catheter may also improve the response to antibiotic therapy by removing the biofilm that likely contains the infecting organisms and that can serve as a nidus (or source) for reinfection.² Biofilms can also cause persistent infections that are resistant to antimicrobial therapy.³
- If the resident has had an indwelling catheter <14 days, collect urine via aspiration of the catheter tubing port (i.e. do not collect from the urine/collection bag).
- If unable to obtain a urine sample from a resident that does not have an indwelling catheter, use a condom catheter in men & in-and-out catheterization in women.

Dip stick: A negative dip stick result **rules out a UTI**; a positive dip stick result for leukocyte esterase, blood or nitrite is **NOT diagnostic for a UTI** but may assist in directing further testing (i.e. urine for C&S). The use of dip sticks is not recommended – symptoms should guide the need to collect a urine sample for C&S.

❑ Consider starting empiric antibiotic therapy. Base empiric therapy on the following:

- UTI treatment algorithms (see following pages)
 - Short-term indwelling catheters (<30 days): *E. coli* is the most common pathogen
 - Long-term indwelling catheters (≥30 days): usually polymicrobial
- Local antibiograms/resistance rates, when available
- Presence of antibiotic allergies
- Recent antibiotic use (note any antibiotic therapy used over the past 3 months, and avoid using these agents to minimize the risk of resistance)
- Estimated calculated CrCl, e.g. $CrCl = [(140 - age) \div SCr] \times 90$ (and $\times 0.85$ for females)
 - **If the most recent SCr was taken >3 months ago, send blood work to the lab to obtain a current SCr**
- Consider potential for drug-drug interactions (caution with antibiotics & sulfonyleureas^{hypoglycemia} and warfarin^{bleeding risk}, or hyperkalemia^{trimethoprim-induced})

❑ Determine the duration of therapy for empiric antibiotic use.

See next column for community dwelling older adults info.

- Lower urinary tract infection in LTC residents: 7 to 10 days
- Upper or complicated urinary tract infection: 7 to 14 days

All UTIs in older men are considered complicated UTIs due to potential prostate involvement

❑ Review urine C&S results once available.

- If bacteria is present in the urine, step down to a narrow spectrum antibiotic based on the C&S results
- If bacteria is not present in the urine, discontinue empirically started antibiotics
- A urine sample is contaminated if the urine C&S shows ≥3 organisms
- It is not recommended that a C&S be repeated after a course of antibiotics

If the individual was on a prophylactic regimen but still developed a UTI, discontinue the prophylaxis (i.e. prophylaxis is not working).

UTIs in Older Adults Living in the Community (i.e. not LTC residents) ^{4, 5, 6, 7, 8, 9, 10, 11}

- Use same treatment approach as you would in adults <65 years of age
- Older females living independently in the community with uncomplicated UTIs may be treated with short courses of antibiotics, providing local resistance rates to empiric therapy are low (e.g. nitrofurantoin x 5 days, SMX/TMP x 3 to 5 days, ciprofloxacin x 3 days)

Prophylaxis for Recurrent UTIs in Women¹²

- **Recurrent UTIs** are defined as ≥2 UTIs in 6 months or ≥3 UTIs in 12 months (same or different organism)
- **Antibiotics:** Routine use of low dose antibiotics is not recommended for the prevention of recurrent UTIs. Antibiotic prophylaxis does not ↓ the frequency of symptomatic UTIs, but promotes bacterial resistance making recurrent UTIs more difficult to treat.
 - Prophylaxis may be warranted in rare cases, e.g. aplastic anemia, history of sepsis due to UTI, etc.
- **Cranberry Products:**¹³ cranberry products are believed to inhibit adherence of *Escherichia coli* to the urogenital mucosa; however, this is clinically unproven.^{14, 15}
- Current evidence does not support the use of cranberry juice/tablets for the prevention of UTIs.¹⁶ Drinking cranberry juice may help hydrate an individual leading to ↓ UTIs (hydration important), but may also lead to weight gain due the sugar in the juice. The evidence related to the effectiveness of the various cranberry products is not of great quality, and the study results are at times conflicting:
 - A Cochrane review of 24 RCTs that looked at both the juice/concentrate^{13 RCTs} and tablets/capsules^{10 RCTs – 1 looked at both} found no significant difference in the number of recurrent UTIs (including the elderly and catheterized patients).¹⁷
 - A meta-analysis of 13 RCTs that also looked at both the juice/concentrate^{8 RCTs} and tablets/capsules^{4 RCTs – 1 looked at both} found a NNT of 12 to avoid a recurrent UTI over ~6 months.¹⁸
 - **Other considerations:** Cranberry juice/cocktail costs ~\$0.45 to 0.66 and contains 120 to 150 calories per 250mL. Assuming 2 cups per day and the most positive data:¹⁹ A one in 12 chance of avoiding UTI over 6 months would cost ~\$180 and ~45,000 calories. (5.8kg potential weight gain).²⁰
- **Vaginal Estrogen:** may be of benefit in postmenopausal women, especially when local resistance rates to antibiotics are high. The effect of vaginal estrogens on the reduction of UTIs could take at least 12 weeks.²¹ The optimal duration of treatment is unknown, (trial durations were 8 and 9 months).²² Oral, transdermal & topical (other than vaginal) estrogen is not recommended (oral estrogens did not reduce UTI compared to placebo).
- **Probiotics - *Lactobacillus*:** may prevent recurrent UTIs in postmenopausal women, however more studies are needed to confirm effectiveness and confirm the optimal dosing regimen.²³

Urinary Tract Infections (UTI) in Older Adults continued

For more detailed medication information, see the RxFiles Drug Comparison Charts

Empiric Therapy for UNCOMPLICATED UTIs ^{*Duration of treatment: 7 to 10 days}

Note: All UTIs in **older men** are considered complicated UTIs due to potential prostate involvement (see following page for Complicated UTIs).

1ST LINE THERAPY

Nitrofurantoin	50-100mg QID ^{MACRODANTIN} or 100mg BID ^{MACROBID}
	CrCl <30mL/min: not recommended. Literature varies; historically, most sources have stated to avoid <60mL/min.; recent <i>Beers</i> changed to <30mL/min. ^{24,29}
Sulfamethoxazole & Trimethoprim (SMX/TMP)* <small>BACTRIM / SEPTRA</small>	2 tablets of 400/80mg BID, or 1 DS (double strength) tablet 800/160mg BID CrCl 15-30mL/min: ½ the dose CrCl <15mL/min: not recommended
Trimethoprim (TMP) ^{PROLOPRIM}	100mg BID or 200mg daily CrCl 10-30mL/min: 100mg q18h CrCl <10mL/min: 100mg daily
Fosfomycin ^{MONUROL}	3g powder sachet x 1 dose (dissolve in ½ cup of water) (orange flavoured powder)
Amoxicillin ^{AMOXIL} *	500mg TID or 1 gram BID CrCl <50mL/min: 500mg BID
Cephalexin ^{KEFLEX} *	250-500mg QID CrCl 10-50mL/min: 250-500mg BID to TID CrCl <10mL/min: 250-500mg daily to BID

2ND LINE THERAPY

Amoxicillin/Clavulanate <small>CLAVULIN</small>	500mg TID or 875mg BID CrCl <50mL/min: 500mg BID
Ciprofloxacin ^{CIPRO, CIPRO XL} *	250mg BID or 500mg XL daily no dose ↓ required for uncomplicated UTI
Levofloxacin ^{LEVAQUIN} *	250mg daily no dose ↓ required for uncomplicated UTI
Norfloxacin ^{NOROXIN} *	400mg BID CrCl 10-50mL/min: 400mg daily - BID CrCl <10mL/min: 400mg daily

* See column to the right regarding concerns with resistance rates to *E.coli*.

Additional Potential Antibiotics Options for Uncomplicated UTIs:

- **Cefixime** ^{SUPRAX} 400mg daily (**CrCl <20mL/min:** 200mg [½ tablet] daily)

Antibiotics to AVOID for UTIs:

- **Moxifloxacin** ^{AVELOX} : **DOES NOT CONCENTRATE IN THE URINE;** do NOT use to treat UTIs.

Antibiotics for UNCOMPLICATED UTIs (listed alphabetically)

Antibiotic	Considerations for Older Adults
Amoxicillin ^{AMOXIL}	<p><u>When the medication may be an option:</u></p> <ul style="list-style-type: none"> • 1st Line: for an UNCOMPLICATED UTI when susceptibility is <u>confirmed</u> with a C&S (ideal) or local % susceptibility is high <p><u>When the medication may be problematic:</u></p> <ul style="list-style-type: none"> • Caution with empiric use in regions with HIGH RESISTANCE RATES – Saskatchewan amoxicillin resistance rates for <i>E.coli</i>: ~40-60%
Amoxicillin/Clavulanate ^{CLAVULIN}	<p><u>When the medication may be an option:</u></p> <ul style="list-style-type: none"> • 2nd Line: for an UNCOMPLICATED UTI <p><u>When the medication may be problematic:</u></p> <ul style="list-style-type: none"> • Not recommended as 1ST LINE FOR AN UNCOMPLICATED UTI
Cephalexin ^{KEFLEX}	<p><u>When the medication may be an option:</u></p> <ul style="list-style-type: none"> • 1st Line: for an UNCOMPLICATED UTI when susceptibility is <u>confirmed</u> with a C&S (ideal) or local % susceptibility is high <p><u>When the medication may be problematic:</u></p> <ul style="list-style-type: none"> • Caution with empiric use in regions with HIGH RESISTANCE RATES – Cefazolin susceptibility does not predict cephalexin susceptibility to <i>E.coli</i>, <i>Proteus mirabilis</i> or <i>Klebsiella spp.</i>
FLUOROQUINOLONES	<p><u>When the medication may be an option:</u></p> <ul style="list-style-type: none"> • 2nd Line: for an UNCOMPLICATED UTI • Ciprofloxacin: UTI caused by <i>Pseudomonas aeruginosa</i> <p><u>When the medication may be problematic:</u></p> <ul style="list-style-type: none"> • Not recommended as 1st line therapy for an UNCOMPLICATED UTI • Caution with empiric use in regions with HIGH RESISTANCE RATES – Saskatchewan ciprofloxacin resistance rates for <i>E.coli</i>: 15-61%
Ciprofloxacin ^{CIPRO, CIPRO XL} Levofloxacin ^{LEVAQUIN} Norfloxacin ^{NOROXIN}	<p>See below note on Moxifloxacin</p>
Fosfomycin ^{MONUROL}	<p><u>When the medication may be an option:</u></p> <ul style="list-style-type: none"> • 1st Line: for an UNCOMPLICATED UTI
Nitrofurantoin ^{MACRODANTIN} OR ^{MACROBID}	<p><u>When the medication may be an option:</u></p> <ul style="list-style-type: none"> • 1st Line: for an UNCOMPLICATED UTI with a CrCl >40-60mL/min <p><u>When the medication may be problematic:</u></p> <ul style="list-style-type: none"> • Avoid if CrCl <30mL/min or for LONG-TERM SUPPRESSION – Potential for pulmonary toxicity, hepatotoxicity & peripheral neuropathy, especially with long-term use. Safer alternatives available. <i>QE = Low; SR = Strong</i> <p><i>Controversy: how low is too low when it comes to renal function & avoiding the use of nitrofurantoin? Literature varies from <30mL/min to <60mL/min. Avoid the use of nitrofurantoin when eGFR^{CKD-EPI} <30mL/min. ^{1,25, 29 Beers}</i></p>
**There is some controversy as to the exact CrCl &/or eGFR level at which therapy is ineffective	
Sulfamethoxazole & Trimethoprim (SMX/TMP) ^{BACTRIM / SEPTRA}	<p><u>When the medication may be an option:</u></p> <ul style="list-style-type: none"> • 1st Line: for an UNCOMPLICATED UTI <p><u>When the medication may be problematic:</u></p> <ul style="list-style-type: none"> • CrCl <15mL/min: not recommended • Avoid in individuals with a SULFA ALLERGY (SMX component) • Individuals with DM are prone to UTIs due to Group B <i>Streptococci</i>, however <i>E.coli</i> is still the most common pathogen. SMX/TMP does not cover Group B <i>Streptococci</i>; confirm sensitivity with urine C&S. – Saskatchewan SMX/TMP resistance rates for <i>E.coli</i>: 21-44%
Trimethoprim (TMP) ^{PROLOPRIM}	<p><u>When the medication may be an option:</u></p> <ul style="list-style-type: none"> • 1st Line: for an UNCOMPLICATED UTI • Can be used in an individual with a SULFA ALLERGY • If C&S shows sensitivity to SMX/TMP, then sensitive to TMP

Urinary Tract Infections (UTI) in Older Adults continued

For more detailed medication information, see the RxFiles Drug Comparison Charts

Empiric Therapy for **COMPLICATED** UTIs *Duration of treatment: 7 to 14 days

Complicated UTIs: upper tract UTIs in women, any UTI in older males or females with a structural abnormality, urinary catheter, kidney stone, urinary retention, renal or perinephric abscess formation, diabetes, or who are immunosuppressed.

1ST LINE THERAPY

Sulfamethoxazole & Trimethoprim (SMX/TMP)*
BACTRIM / SEPTRA
2 tablets of 400/80mg BID, or 1 DS (double strength) tablet 800/160mg BID
CrCl 15-30mL/min: ½ the dose
CrCl <15mL/min: not recommended

Trimethoprim (TMP) PROLOPRIM
200mg daily
CrCl 10-30mL/min: 100mg q18hr
CrCl <10mL/min: 100mg daily

Ciprofloxacin CIPRO, CIPRO XL *
500mg BID or 1 gram XL daily
CrCl ≤30mL/min: max 500mg/day

Levofloxacin LEVAQUIN *
500mg daily
CrCl 10-19mL/min: 250mg q48hr

Norfloxacin NOROXIN *
400mg BID
CrCl 10-50mL/min: 400mg daily - BID
CrCl <10mL/min: 400mg daily

2ND LINE THERAPY

Amoxicillin/Clavulanate
CLAVULIN
500mg TID or 875mg BID
CrCl <50mL/min: 500mg BID

* See column to the right regarding concerns with resistance rates to *E.coli*.

Additional Potential Antibiotic Options for Complicated UTIs:

- **Cefixime** SUPRAX 400mg daily (**CrCl <20mL/min:** 200mg [½ tablet] daily)
- **Cephalexin** KEFLEX 500mg QID
 - Avoid as empiric therapy. May step down to cephalexin if sensitivity confirmed with C&S.
 - Not recommended for an **UPPER TRACT UTI**

Antibiotics to **AVOID** for Complicated UTIs:

- **Amoxicillin** AMOXIL: not recommended for a **COMPLICATED UTI** (unless combined with clavulanate)
- **Cephalexin** KEFLEX : not recommended for an **UPPER TRACT UTI**
- **Fosfomycin** MONUROL: not recommended for an **UPPER TRACT UTI**
- **Moxifloxacin** AVELOX : **DOES NOT CONCENTRATE IN THE URINE**; do NOT use to treat UTIs.
- **Nitrofurantoin** MACRODANTIN OR MACROBID : not recommended for an **UPPER TRACT UTI**

Antibiotics for **COMPLICATED** UTIs (listed alphabetically)

Antibiotic	Considerations for Older Adults
Amoxicillin/Clavulanate <small>CLAVULIN</small>	<p><u>When the medication may be an option:</u></p> <ul style="list-style-type: none"> • 2nd Line: for an UNCOMPLICATED UTI, COMPLICATED UTI or for a UTI IN SYMPTOMATIC CHRONIC CATHETERIZED individuals <p><u>When the medication may be problematic:</u></p> <ul style="list-style-type: none"> • Not recommended as 1ST LINE FOR AN UNCOMPLICATED OR COMPLICATED UTI (broad spectrum antibiotic)
FLUOROQUINOLONES Ciprofloxacin <small>CIPRO, CIPRO XL</small> Levofloxacin <small>LEVAQUIN</small> Norfloxacin <small>NOROXIN</small>	<p><u>When the medication may be an option:</u></p> <ul style="list-style-type: none"> • 1st Line: for a COMPLICATED UTI when resistance levels are low or for a UTI IN SYMPTOMATIC CHRONIC CATHETERIZED individuals • 2nd Line: for an UNCOMPLICATED UTI • Ciprofloxacin: UTI caused by <i>Pseudomonas aeruginosa</i> <p><u>When the medication may be problematic:</u></p> <ul style="list-style-type: none"> • Not recommended as 1st line therapy for an UNCOMPLICATED UTI. • Avoid empiric use in regions with HIGH RESISTANCE RATES <ul style="list-style-type: none"> – Saskatchewan ciprofloxacin resistance rates for <i>E.coli</i>: 15-61%
See below note on moxifloxacin	
Sulfamethoxazole & Trimethoprim (SMX/TMP) <small>BACTRIM / SEPTRA</small>	<p><u>When the medication may be an option:</u></p> <ul style="list-style-type: none"> • 1st Line: for an UNCOMPLICATED or COMPLICATED UTI <p><u>When the medication may be problematic:</u></p> <ul style="list-style-type: none"> • CrCl <15mL/min: not recommended • Avoid in individuals with a SULFA ALLERGY (SMX component) • Individuals with DM are prone to UTIs due to Group B <i>Streptococci</i>, however <i>E.coli</i> is still the most common pathogen. SMX/TMP does not cover Group B <i>Streptococci</i>; ensure C&S obtained if SMX/TMP started empirically. <ul style="list-style-type: none"> – Saskatchewan SMX/TMP resistance rates for <i>E.coli</i>: 21-44%
Trimethoprim (TMP) <small>PROLOPRIM</small>	<p><u>When the medication may be an option:</u></p> <ul style="list-style-type: none"> • 1st Line: for an UNCOMPLICATED or COMPLICATED UTI • Can be used in an individual with a SULFA ALLERGY • If C&S shows sensitivity to SMX/TMP, then sensitive to TMP

Why is it important to obtain a urine culture & sensitivity (C&S) in older adults?

- Treatment algorithms & local antibiograms are helpful when selecting empiric antibiotic therapy, but both have caveats to consider:
 - Treatment algorithms may include broad geographic resistance rates versus local data
 - Local antibiograms may report sensitivities for all isolates versus separating out by urine specimens or population (e.g. LTC residents). Samples are also more likely to be collected for patients with complicated UTIs which may skew data for uncomplicated UTIs.
- **Amoxicillin, cephalexin, fluoroquinolones & SMX/TMP** are treatment options for UTIs, but antibiotic resistance rates to *E.coli* are high in certain geographic areas.
- The 2010 IDSA Guidelines suggest that SMX/TMP should not be used as empiric therapy if local resistance rates are >20% (Grade B-III recommendation).²⁶ A recent Canadian study found a national SMX/TMP resistance rate to *E.coli* of 16%.²⁷ This rate was ↑ to 21.4% in females ≤50 years of age & ↓ to 10.7% in females >50 years of age.²⁸
- A urine C&S can confirm the pathogen & antibiotic susceptibility to empiric therapy.

GERI-RXFILES UTI REFERENCES

- ¹ Colgan R, Nicolle LE, McGlone A, Hooton TM. Asymptomatic Bacteriuria in Adults. *Am Fam Physician*. 2006 Sep; 15;74(6):985-990.
- ² Trautner BW, Darouiche RO. Role of biofilm in catheter-associated urinary tract infection. *Am J Infect Control*. 2004 May;32(3):177-83. Review. PubMed PMID: 15153930; PubMed Central PMCID: PMC2963581.
- ³ Trautner BW, Darouiche RO. Role of biofilm in catheter-associated urinary tract infection. *Am J Infect Control*. 2004 May;32(3):177-83. Review. PubMed PMID: 15153930; PubMed Central PMCID: PMC2963581.
- ⁴ Anti-infective Review Panel. **Anti-infective guidelines for community-acquired infections**. Toronto: MUMS Guideline Clearinghouse; 2012
- ⁵ Blondel-Hill E, Fryters S. **Bugs & Drugs: An antimicrobial/infectious disease reference**. Alberta Health Services, Alberta Health, British Columbia of Health Pharmaceutical Services Division; 2012.
- ⁶ Regier L. Urinary Tract Infections: Adult Treatment Options. **RxFiles 9th** edition. Saskatoon SK; 2012.
- ⁷ **Saskatchewan Infection Prevention & Control Program**. Guidelines for the Prevention & Treatment of Urinary Tract Infections in Continuing Care Settings. Government of Saskatchewan; April 2013.
- ⁸ Gupta K, Hooton TM, Naber KG et al; **Infectious Diseases Society of America**; European Society for Microbiology and Infectious Diseases. International clinical practice guidelines for the treatment of acute uncomplicated cystitis and pyelonephritis in women: A 2010 update by the Infectious Diseases Society of America and the European Society for Microbiology and Infectious Diseases. *Clin Infect Dis*. 2011 Mar 1;52(5):e103-20.
- ⁹ Lutters M, Vogt-Ferrier NB. Antibiotic duration for treating uncomplicated, symptomatic lower urinary tract infections in elderly women. *Cochrane Database Syst Rev*. 2008 Jul 16;(3):CD001535.
- ¹⁰ Vogel T, Verreault R, Gourdeau M et al. Optimal duration of antibiotic therapy for uncomplicated urinary tract infection in older women: a double-blind randomized controlled trial. *CMAJ*. 2004 Feb 17;170(4):469-73.
- ¹¹ Matthews SJ, Lancaster JW. Urinary tract infections in the elderly population. *Am J Geriatr Pharmacother*. 2011 Oct;9(5):286-309.
- ¹² Perrotta C, Aznar M, Mejia R, Albert X, Ng CW. Oestrogens for preventing recurrent urinary tract infection in postmenopausal women. *Cochrane Database Syst Rev*. 2008 Apr 16;(2):CD005131.
- ¹³ Allan M, Nicolle L. Cranberry juice/tablets for the prevention of urinary tract infection: naturally the best? *Tools for Practice*, March 4, 2013.
- ¹⁴ Jepson RG, Williams G, Craig JC. *Cochrane Database Syst Rev*. 2012 Oct 17; 10:CD001321.
- ¹⁵ Wang CH, Fang CC, Chen NC, et al. *Arch Intern Med*. 2012 Jul 9; 172(13):988-96.
- ¹⁶ Allan M, Nicolle L. Cranberry juice/tablets for the prevention of urinary tract infection: naturally the best? *Tools for Practice*, March 4, 2013.
- ¹⁷ Jepson RG, Williams G, Craig JC. *Cochrane Database Syst Rev*. 2012 Oct 17; 10:CD001321.
- ¹⁸ Wang CH, Fang CC, Chen NC, et al. *Arch Intern Med*. 2012 Jul 9; 172(13):988-96.
- ¹⁹ Wang CH, Fang CC, Chen NC, et al. *Arch Intern Med*. 2012 Jul 9; 172(13):988-96.
- ²⁰ Allan M, Nicolle L. Cranberry juice/tablets for the prevention of urinary tract infection: naturally the best? *Tools for Practice*, March 4, 2013.
- ²¹ Perrotta C, Aznar M, Mejia R, Albert X, Ng CW. Oestrogens for preventing recurrent urinary tract infection in postmenopausal women. *Cochrane Database Syst Rev*. 2008 Apr 16;(2):CD005131.
- ²² Perrotta C, Aznar M, Mejia R, Albert X, Ng CW. Oestrogens for preventing recurrent urinary tract infection in postmenopausal women. *Cochrane Database Syst Rev*. 2008 Apr 16;(2):CD005131.
- ²³ Grin PM, Kowalewska PM, Alhazzan W, Fox-Robichaud AE. Lactobacillus for preventing recurrent urinary tract infections in women: meta-analysis. *Can J Urol*. 2013 Feb;20(1):6607-14. Review. PubMed PMID: 23433130.

²⁴ Singh N, Gandhi S, McArthur E, Moist L, Jain AK, Liu AR, Sood MM, Garg AX. Kidney function and the use of nitrofurantoin to treat urinary tract infections in older women. *CMAJ*. 2015 Jun 16;187(9):648-56. doi: 10.1503/cmaj.150067. Epub 2015 Apr 27. PubMed PMID: 25918178; PubMed Central PMCID: PMC4467927.

²⁵ Singh N, Gandhi S, McArthur E, Moist L, Jain AK, Liu AR, Sood MM, Garg AX. Kidney function and the use of nitrofurantoin to treat urinary tract infections in older women. *CMAJ*. 2015 Jun 16;187(9):648-56. doi: 10.1503/cmaj.150067. Epub 2015 Apr 27. PubMed PMID: 25918178; PubMed Central PMCID: PMC4467927.

²⁶ Gupta K, Hooton TM, Naber KG et al; **Infectious Diseases Society of America**; European Society for Microbiology and Infectious Diseases. International clinical practice guidelines for the treatment of acute uncomplicated cystitis and pyelonephritis in women: A 2010 update by the Infectious Diseases Society of America and the European Society for Microbiology and Infectious Diseases. *Clin Infect Dis*. 2011 Mar 1;52(5):e103-20.

²⁷ Lutters M, Vogt-Ferrier NB. Antibiotic duration for treating uncomplicated, symptomatic lower urinary tract infections in elderly women. *Cochrane Database Syst Rev*. 2008 Jul 16;(3):CD001535.

²⁸ McIsaac W, Moineddin R, Meaney C et al. Antibiotic-resistant *Escherichia coli* in women with acute cystitis in Canada. *Can J Infect Dis Med Microbiol*. 2013; 24(3):143-149.

Additional References:

²⁸ O'Mahony D, O'Sullivan D, Byrne S, O'Connor MN, Ryan C, Gallagher P. **STOPP/START** criteria for potentially inappropriate prescribing in older people: version 2. *Age Ageing*. 2014 Oct 16.

²⁹ The American Geriatrics Society 2012 **Beers Criteria** Update Expert Panel. American Geriatrics Society updated Beers criteria for potentially inappropriate medication use in older adults. *J Am Geriatr Soc* 2012;60:616-31. Updated 2015.

³⁰ PL Detail-Document, Potentially Harmful Drugs in the Elderly: Beers List. *Pharmacist's Letter/Prescriber's Letter*. June 2012.

³¹ PL Detail-Document, **STARTing** and **STOPPING** Medications in the Elderly. *Pharmacist's Letter/Prescriber's Letter*. September 2011.

³² **Toward Optimized Practice**. Guideline for the Diagnosis & Management of Urinary Tract Infections in Long-Term Care. 2010.

³³ **KFL&A Public Health**. Antibiotic Stewardship: Treatment Guidelines for Long-term Care Facilities; December 2012.

³⁴ **Pharmacists Letter**. Detail-Document: Choosing a UTI Antibiotic for Elderly Patients. December 2011.

³⁵ Ferraro G, Ambrosi G, Bucci L et al. Fosfomycin trometamol versus norfloxacin in the treatment of uncomplicated lower urinary tract infections of the elderly. *Chemotherapy*. 1990; 36 Suppl 1:46-9.



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