# Assorted Antimicrobial Stewardship Guidelines


It was on a short-cut through the hospital kitchens that Albert was first approached by a member of the Antibiotic Res

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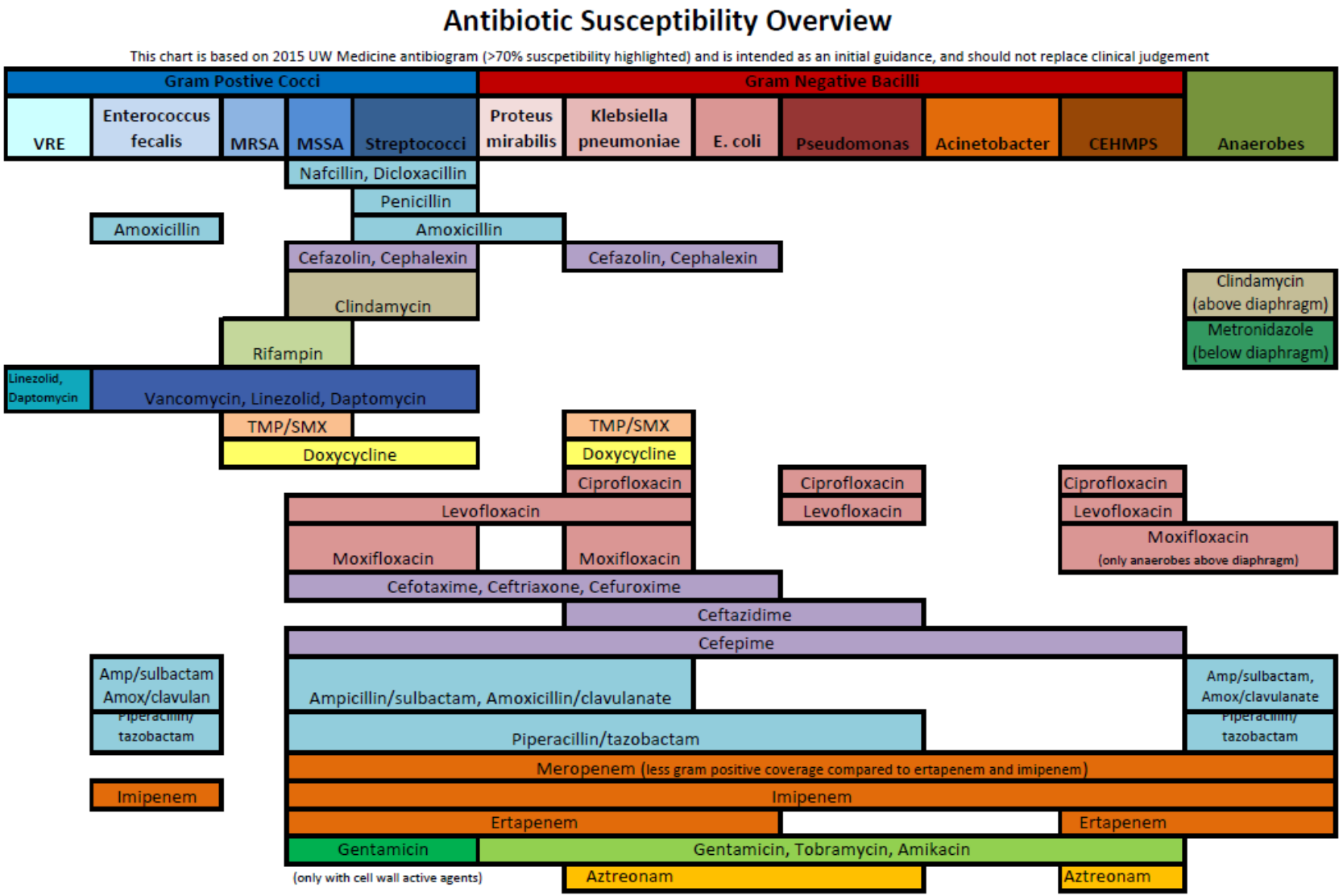
# Antibiotic Susceptibility Chart (UW Medicine, 2015)




CEHMPS = Citrobacter freundii, Enterobacter spp., Hafnia alvei, Morganella spp., Providencia spp., Serratia spp., and may harbor AmpC inducile beta lactamases.
TMP/SMX = trimethoprim/sulfamethoxazole, VRE = vancomycin resistant enterococci

Cleveland Clinic – Guidelines for Antimicrobial Usage, 2012-2013

# TABLE 1 Typical Gram Stain Morphology of Selected Organisms[1]

**Gram-Positive Cocci (GPC)**
- Clusters:
  - *Staphylococcus* sp
- Pairs, chains:
  - *Streptococcus* sp
  - *Enterococcus* sp
  - *Peptostreptococcus* sp (anaerobe)

**Gram-Positive Bacilli (GPB)**
- Irregular:
  - Diphtheroid:
    - *Corynebacterium* sp
    - *Propionibacterium* sp (anaerobe)
- Large, with spores:
  - *Clostridium* sp (anaerobe)
  - *Bacillus* sp
- Branching, beaded, rods:
  - *Nocardia* sp
  - *Actinomyces* sp (anaerobe)
- Other:
  - *Listeria* monocytogenes (blood/cerebrospinal fluid)
  - *Lactobacillus* sp (vaginal/blood)

**Gram-Negative Cocci (GNC)**
- Diplococci
  - Pairs:
    - *Neisseria meningitidis*
    - *Neisseria gonorrhoeae*
    - *Moraxella catarrhalis*
- Other:
  - *Acinetobacter* sp (coccobacilli)

**Gram-Negative Bacilli (GNB)**
- Enterobacteriaceae:
  - *Escherichia coli*
  - *Serratia* sp
  - *Klebsiella* sp
  - *Enterobacter* sp
  - *Citrobacter* sp
- Nonfermentative:
  - *Pseudomonas aeruginosa*
  - *Stenotrophomonas maltophilia*
  - Many others
- *Haemophilus influenzae* (coccobacilli)
- *Bacteroides fragilis* group (anaerobe)
- Fusiform (long, pointed):
  - *Fusobacterium* sp (anaerobe)
  - *Capnocytophaga* sp

1 These organisms represent a subset of possible identifications correlating with gram stain morphology observed on direct specimen preparations. Correlation with culture, specimen quality, and clinical findings is required.

Journal of Pharmacology & Pharmacotherapeutics



*Examples of drugs with excellent bioavailability **(>90%)** eligible for IV to PO switch over*

| Drugs | IV to PO conversion | |
|---|---|---|
| | IV dose | PO dose |
| Ciprofloxacin* | 200 mg q12h (every 12 hours) | 500 mg q12h |
| Doxycycline | 100-200 mg q12h | 100-200 mg q12h |
| Esomeprazole | 20-40 mg q24h | 20-40 mg q24h |
| Fluconazole | 100-200 mg q24h | 100-200 mg q24h |
| Hydrocortisone | 100 mg q24h | 50 mg q8h |
| Ketorolac | 30 mg q24h | 20 mg q24h |
| Levetiracetam | 500 mg q12h | 500 mg q12h |
| Levofloxacin* | 500 mg q24h | 500 mg q24h |
| Linezolid | 600 mg q12h | 600 mg q12h |
| Metronidazole | 500 mg q12h | 500 mg q12h |
| Minocycline | 200 mg q12h | 200 mg q12h |
| Moxifloxacin* | 400 mg q24h | 400 mg q24h |
| Phenytoin | 100 mg q8h | 100 mg q8h |
| Rifampicin | 600 mg q24h | 600 mg q24h |
| Voriconazole | 200 mg q24h | 200 mg q24h |

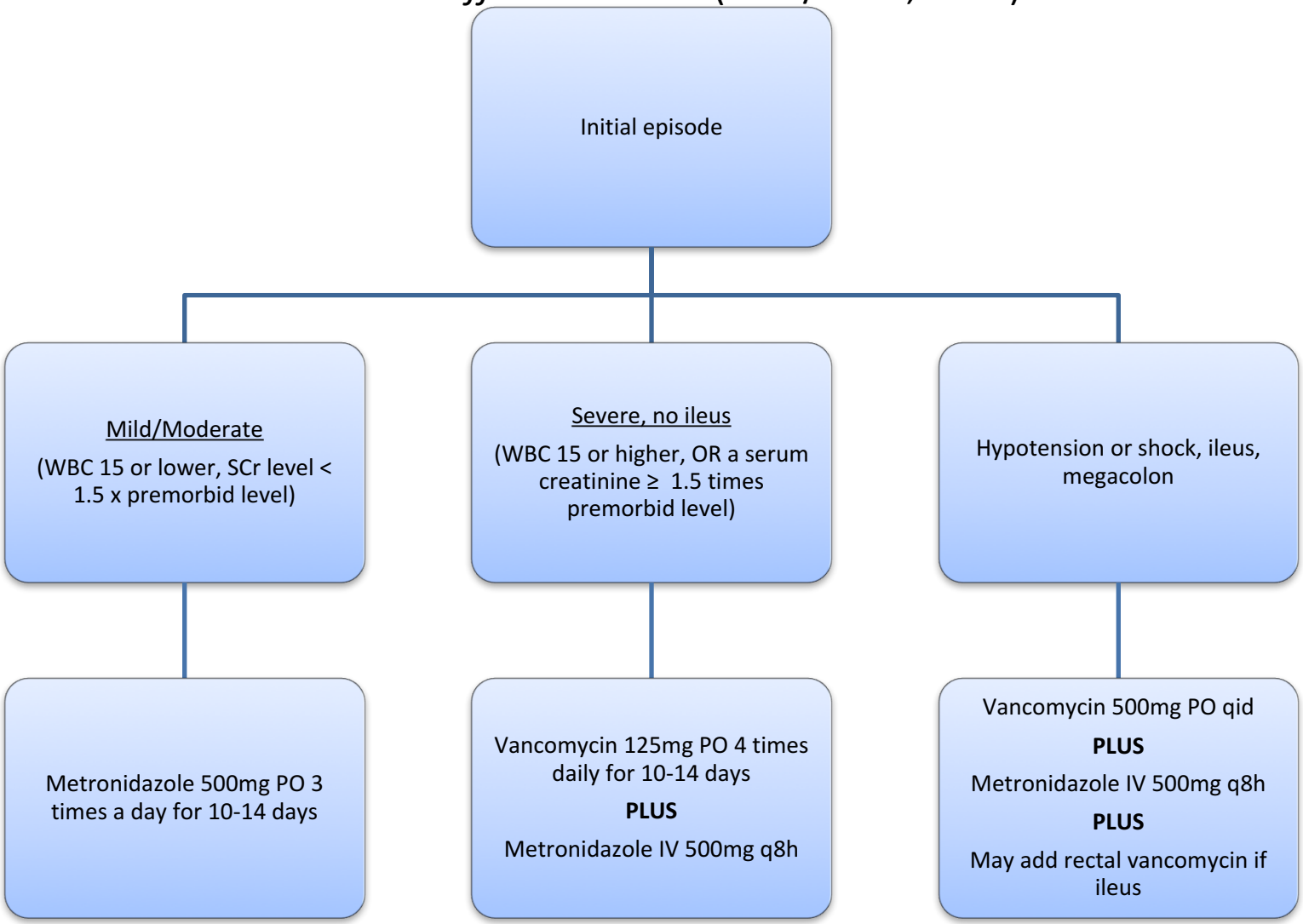
*Absorption of flouroquinolones is reduced by concurrent administration of products containing divalent and trivalent cations such as calcium, magnesium or aluminum, for example, antacids, multivitamin products containing minerals, iron, or zinc salts. Hence an interval of at least 4 hours should elapse between their oral administration

*Examples of drugs with good bioavailability **(60-90%)** eligible for IV to PO switch over*

| Drugs | IV to PO conversion | |
|---|---|---|
| | IV dose | PO dose |
| Ampicillin | 1gm q6h | 250-500 mg q6h |
| Azithromycin | 500 mg q24h | 250-500 mg q24h |
| Cefazolin | 1 gm q8h | Tab. cephalexin 500 mg q6h |
| Cefotaxime | 1 gm q12h | Tab. ciprofloxacin 500-750 mg q12h |
| Ceftazidime | 1-2 g q8h | Tab.ciprofloxacin 500-750 mg q12h |
| Cimetidine | 300-600 mg q12h | 200 mg q12h |
| Cefuroxime | 500-750 gm q8h | Tab. cefuroxime axetil 250-500 mg q12h |
| Clindamycin | 300-600 mg q8h | 300-450 mg q6h |
| Digoxin | 0.1-0.4 mg q24h | 0.125-0.5 mg q24h |
| Erythromycin | 500-1000 mg q6h | 500 mg q6h |
| Pantoprazole | 40 mg q24h | 40 mg q24h |

J Pharmacol Pharmacother. 2014 Apr-Jun; 5(2): 83–87.

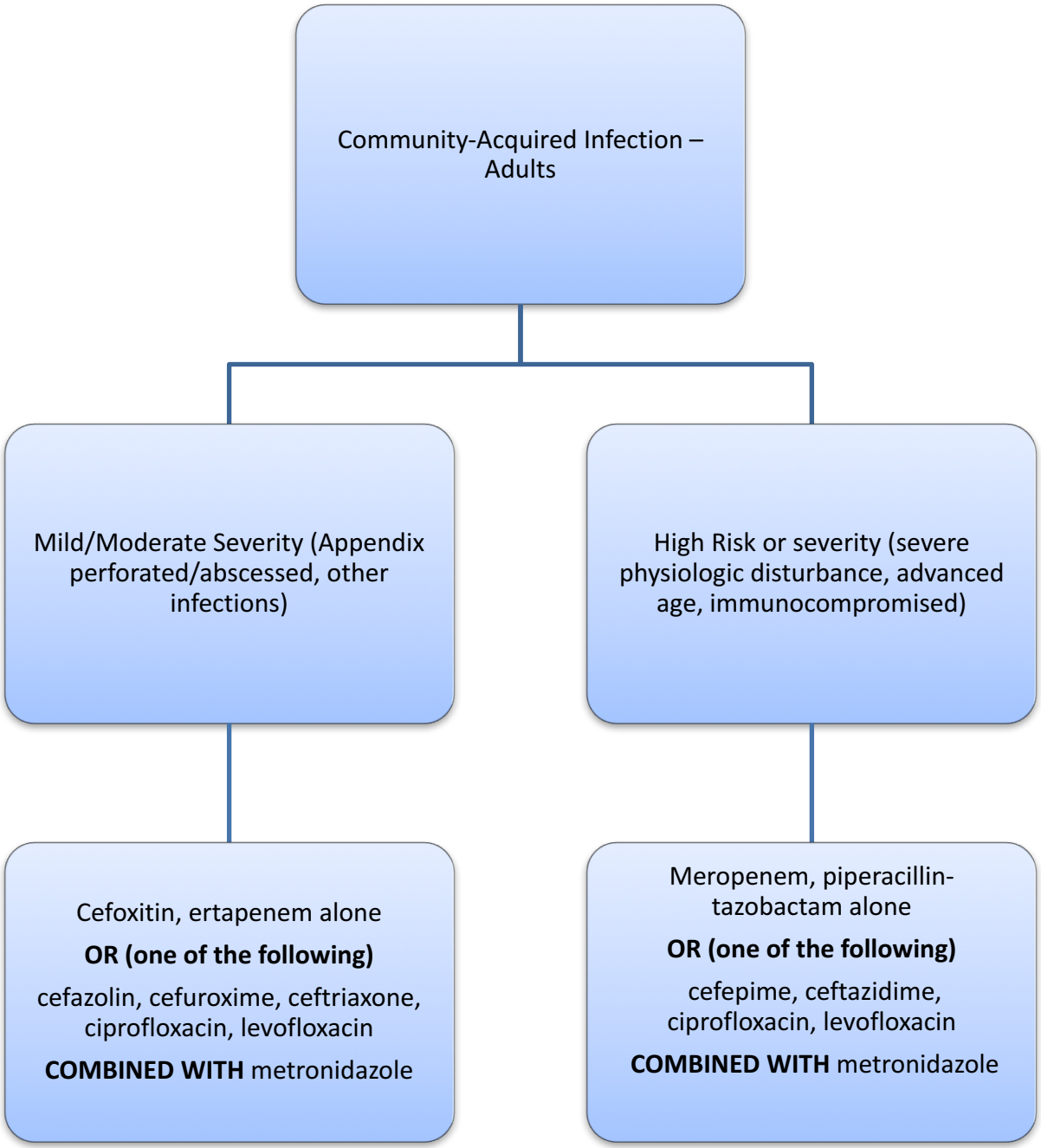
# *Clostridium difficile* Infection (IDSA/SHEA, 2010)




**Recurrent Episodes**

- **First**: Same as for an "initial" episode
- **Second**: Vancomycin in a tapered and/or pulsed regiment
  - Refer to literature

**Initial Empiric Treatment of Extra-biliary Complicated Intra-abdominal Infection (IDSA, 2010)**




Antibiotics…should be active against

- Enteric Gram-negative aerobic and facultative bacilli
- Enteric Gram-positive streptococci

Unasyn = not recommended

- High E.coli resistance

# Recommendations for Empiric Antimicrobial Therapy for Health-Care Associated Complicated Intra-abdominal Infection (IDSA, 2010)

| Organisms seen in health-care associated infection in local institution | Carbapenem (Meropenem only) | Piperacillin-tazobactam | Ceftazidime or cefepime, each with metronidazole | Aminoglycoside | Vancomycin |
|---|---|---|---|---|---|
| <20% resistant *P. aeruginosa*, ESBL-producing *Enterobacteriaceae*, *Acinetobacter*, or other MDR GNB* | Yes | Yes | Yes | No | No |
| ESBL-producing Enterobacteriaceae | Yes | Yes | No | Yes | No |
| *P. aeruginosa* > 20% resistant to ceftazidime* | Yes | Yes | No | Yes | No |
| MRSA | No | No | No | No | Yes |

ESBL: Extended-spectrum beta-lactamase
GNB: Gram-negative bacilli
MDR: Multi-drug resistant
*Refer to institution antibiogram if needed*

**Limit treatment to 4-7 days**

# Diabetic Foot Infection – Mild Severity (IDSA, 2012)

**Table 8. Suggested Empiric Antibiotic Regimens Based on Clinical Severity for Diabetic Foot Infections[a]**

| Infection Severity | Probable Pathogen(s) | Antibiotic Agent | Comments |
|---|---|---|---|
| Mild (usually treated with oral agent[s]) | *Staphylococcus aureus* (MSSA); Streptococcus spp | Dicloxacillin | Requires QID dosing; narrow-spectrum; inexpensive |
| | | Clindamycin[b] | Usually active against community-associated MRSA, but check macrolide sensitivity and consider ordering a "D-test" before using for MRSA. Inhibits protein synthesis of some bacterial toxins |
| | | **Cephalexin**[b] | Requires QID dosing; inexpensive |
| | | Levofloxacin[b] | Once-daily dosing; suboptimal against *S. aureus* |
| | | **Amoxicillin-clavulanate**[b] | Relatively broad-spectrum oral agent that includes anaerobic coverage |
| | Methicillin-resistant *S. aureus* (MRSA) | Doxycycline | Active against many MRSA & some gram-negatives; uncertain against streptococcus species |
| | | Trimethoprim/ sulfamethoxazole | Active against many MRSA & some gram-negatives; uncertain activity against streptococci |

**<u>For mild-moderate infections with no recent antibiotics</u>**:

- Therapy just targeting aerobic Gram +s is sufficient

**<u>For most severe infections:</u>**

- Start broad-spectrum empiric therapy

**<u>Consider covering for MRSA if:</u>**

- local prevalence is high or if patient has previous history of MRSA

Empiric therapy directed at *P. aeruginosa* is **usually unnecessary EXCEPT** for patients with risk factors for true infection

- "…In countries where P. aeruginosa is a frequent isolate, or in patients who have been soaking their feet, who have failed therapy with nonpseudomonal therapy, who have a severe infection, empiric antipseudomonal therapy may be advisable."

# Diabetic Foot Infection – Moderate Severity (IDSA, 2012)

| | | | |
|---|---|---|---|
| Moderate (may be treated with oral or initial parenteral agent[s]) or severe (usually treated with parenteral agent[s]) | MSSA; *Streptococcus* spp; Enterobacteriaceae; obligate anaerobes | Levofloxacin[b] | Once-daily dosing; suboptimal against *S. aureus* |
| | | Cefoxitin[b] | Second-generation cephalosporin with anaerobic coverage |
| | | Ceftriaxone | Once-daily dosing, third-generation cephalosporin |
| | | **Ampicillin-sulbactam**[b] | Adequate if low suspicion of *P. aeruginosa* |
| | | Moxifloxacin[b] | Once-daily oral dosing. Relatively broad-spectrum, including most obligate anaerobic organisms |
| | | ***Ertapenem***[b] | Once-daily dosing. Relatively broad-spectrum including anaerobes, but not active against *P. aeruginosa* |
| | | Tigecycline[b] | Active against MRSA. Spectrum may be excessively broad. High rates of nausea and vomiting and increased mortality warning. Nonequivalent to ertapenem + vancomycin in 1 randomized clinical trial |
| | | Levofloxacin[b] or ciprofloxacin[b] with clindamycin[b] | Limited evidence supporting clindamycin for severe *S. aureus* infections; PO & IV formulations for both drugs |
| | | **Imipenem-cilastatin**[b] | Very broad-spectrum (but not against MRSA); use only when this is required. Consider when ESBL-producing pathogens suspected |
| | MRSA | *Linezolid*[b] | Expensive; increased risk of toxicities when used >2 wk |
| | | Daptomycin[b] | Once-daily dosing. Requires serial monitoring of CPK |
| | | **Vancomycin**[b] | Vancomycin MICs for MRSA are gradually increasing |
| | *Pseudomonas aeruginosa* | ***Piperacillin-tazobactam***[b] | TID/QID dosing. Useful for broad-spectrum coverage. *P. aeruginosa* is an uncommon pathogen in diabetic foot infections except in special circumstances (2) |

# Diabetic Foot Infection – Moderate Severity Cont'd (IDSA, 2012)

*Table 8 continued.*

| Infection Severity | Probable Pathogen(s) | Antibiotic Agent | Comments |
|---|---|---|---|
| | MRSA, Enterobacteriacae, *Pseudomonas*, and obligate anaerobes | Vancomycin[c], ceftazidime, cefepime, *piperacillin-tazobactam*[b], aztreonam,[b] or a carbapenem[b] | Very broad-spectrum coverage; usually only used for empiric therapy of severe infection. Consider addition of obligate anaerobe coverage if ceftazidime, cefepime, or aztreonam selected |

Agents in boldface type are those that have been most commonly used as comparators in clinical trials (see Table 7). The only agents currently specifically FDA-approved for diabetic foot infections are shown in italics.

Narrow-spectrum agents (eg, vancomycin, linezolid, daptomycin) should be combined with other agents (eg, a fluoroquinolone) if a polymicrobial infection (especially moderate or severe) is suspected.

Use an agent active against MRSA for patients who have a severe infection, evidence of infection or colonization with this organism elsewhere, or epidemiological risk factors for MRSA infection.

Select definitive regimens after considering the results of culture and susceptibility tests from wound specimens, as well as the clinical response to the empiric regimen.

Similar agents of the same drug class can probably be substituted for suggested agents.

Some of these regimens do not have FDA approval for complicated skin and skin structure infections.

Abbreviations: CPK, creatine phosphokinase; ESBL, extended-spectrum β-lactamase; FDA, US Food and Drug Administration; IV, intravenous; MIC, minimum inhibitory concentration; MRSA, methicillin-resistant *Staphylococcus aureus*; MSSA, methicillin-sensitive *Staphylococcus aureus*; PO, oral; QID, 4 times a day; TID, 3 times a day.

[a] Agents approved for treating skin and skin structure infections on the basis of studies that excluded patients with diabetic foot infections (eg, ceftaroline, telavancin) are not included.

[b] Agents shown to be effective in clinical trials including patients with diabetic foot infections.

[c] Daptomycin or linezolid may be substituted for vancomycin.

"We suggest an initial antibiotic course for a soft tissue infection of about 1–2 weeks for mild infections and 2–3 weeks for moderate to severe infections"

# Prosthetic Joint Infections (IDSA, 2013) – Page 1

**Table 2. Intravenous or Highly Bioavailable Oral Antimicrobial Treatment of Common Microorganisms Causing Prosthetic Joint Infection (B-III Unless Otherwise Stated in Text)**

| Microorganism | Preferred Treatment[a] | Alternative Treatment[a] | Comments |
|---|---|---|---|
| Staphylococci, oxacillin-susceptible | Nafcillin[b] sodium 1.5–2 g IV q4-6 h<br>or<br>Cefazolin 1–2 g IV q8 h<br>or<br>Ceftriaxone[c] 1–2 g IV q24 h | Vancomycin IV 15 mg/kg q12 h<br>or<br>Daptomycin 6 mg/kg IV q 24 h<br>or<br>Linezolid 600 mg PO/IV every 12 h | See recommended use of rifampin as a companion drug for rifampin-susceptible PJI treated with debridement and retention or 1-stage exchange in text |
| Staphylococci, oxacillin-resistant | Vancomycin[d] IV 15 mg/kg q12 h | Daptomycin 6 mg/kg IV q24 h<br>or<br>Linezolid 600 mg PO/IV q12 h | See recommended use of rifampin as a companion drug for rifampin-susceptible PJI treated with debridement and retention or 1-stage exchange in text |
| *Enterococcus* spp, penicillin-susceptible | Penicillin G 20–24 million units IV q24 h continuously or in 6 divided doses<br>or<br>Ampicillin sodium 12 g IV q24 h continuously or in 6 divided doses | Vancomycin 15 mg/kg IV q12 h<br>or<br>Daptomycin 6 mg/kg IV q24 h<br>or<br>Linezolid 600 mg PO or IV q12 h | 4–6 wk. Aminoglycoside optional<br>Vancomycin should be used only in case of penicillin allergy |
| *Enterococcus* spp, penicillin-resistant | Vancomycin 15 mg/kg IV q12 h | Linezolid 600 mg PO or IV q12 h<br>or<br>Daptomycin 6 mg IV q24 h | 4–6 wk. Addition of aminoglycoside optional |
| *Pseudomonas aeruginosa* | Cefepime 2 g IV q12 h<br>or<br>Meropenem[e] 1 g IV q8 h | Ciprofloxacin 750 mg PO bid<br>or 400 mg IV q12 h<br>or<br>Ceftazidime 2 g IV q8 h | 4–6 wk<br>Addition of aminoglycoside optional<br>Use of 2 active drugs could be considered based on clinical circumstance of patient. If aminoglycoside in spacer, and organism aminoglycoside susceptible than double coverage being provided with recommended IV or oral monotherapy |
| *Enterobacter* spp | Cefepime 2 g IV q12 h<br>or<br>Ertapenem 1 g IV q24 h | Ciprofloxacin 750 mg PO<br>or 400 mg IV q12 h | 4–6 wk. |
| Enterobacteriaceae | IV β-lactam based on in vitro susceptibilities<br>or<br>Ciprofloxacin 750 mg PO bid | | 4–6 wk |
| β-hemolytic streptococci | Penicillin G 20–24 million units IV q24 h continuously or in 6 divided doses<br>or<br>Ceftriaxone 2 g IV q24 h | Vancomycin 15 mg/kg IV q12 h | 4–6 wk<br>Vancomycin only in case of allergy |

# Prosthetic Joint Infections (IDSA, 2013) – Page 2

| Microorganism | Preferred Treatment[a] | Alternative Treatment[a] | Comments |
|---|---|---|---|
| *Propionibacterium acnes* | Penicillin G 20 million units IV q24 h continuously or in 6 divided doses<br>or<br>Ceftriaxone 2 g IV q24 h | Clindamycin 600–900 mg IV q8 h or clindamycin 300–450 mg PO qid<br>or<br>Vancomycin 15 mg/kg IV q12 h | 4–6 wk<br><br>Vancomycin only in case of allergy |

Abbreviations: bid, twice daily; IV, intravenous; PJI, prosthetic joint infection; q, every; PO, per oral; qid, 4 times daily.

[a] Antimicrobial dosage needs to be adjusted based on patients' renal and hepatic function. Antimicrobials should be chosen based on in vitro susceptibility as well as patient drug allergies, intolerances, and potential drug interactions or contraindications to a specific antimicrobial. Clinical and laboratory monitoring for efficacy and safety should occur based on prior IDSA guidelines [6]. The possibility of prolonged QTc interval and tendinopathy should be discussed and monitored when using fluoroquinolones. The possibility of *Clostridium difficile* colitis should also be discussed when using any antimicrobial.

[b] Flucloxacillin may be used in Europe. Oxacillin can also be substituted.

[c] There was not a consensus on the use of ceftriaxone for methicillin-susceptible staphylococci (see text).

[d] Target troughs for vancomycin should be chosen with the guidance of a local infectious disease physician based on the pathogen, its in vitro susceptibility, and the use of rifampin or local vancomycin therapy. Recent guidelines [155, 164] for the treatment of methicillin-resistant *Staphylococcus aureus* (MRSA) infections have been published. (These guidelines suggest that dosing of vancomycin be considered to achieve a vancomycin trough at steady state of 15 to 20. Although this may be appropriate for MRSA PJI treated without rifampin or without the use of local vancomycin spacer, it is unknown if these higher trough concentrations are necessary when rifampin or vancomcyin impregnated spacers are utilized. Trough concentrations of at least 10 may be appropriate in this situation. It is also unknown if treatment of oxacillin-resistant, coagulase-negative staphylococci require vancomycin dosing to achieve these higher vancomycin levels.)

[e] Other antipseudomonal carbapenems can be utilized as well.

**Common causes of prosthetic-knee and prosthetic-hip infection**

- Gram-positive cocci (approximately 65%)
  - Coagulase-negative staphylococci
  - *Staphylococcus aureus*
  - Streptococcus species
  - Enterococcus species
- Aerobic gram-negative bacilli (approximately 6%)
  - Enterobacteriaceae
  - *Pseudomonas aeruginosa*
- Anaerobes (approximately 4%)
  - Propionibacterium species
  - Peptostreptococcus species
  - *Finegoldia magna*
- Polymicrobial (approximately 20%)
- Culture-negative (approximately 7%)
- Fungi (approximately 1%)

Following debridement + retention of prosthesis:

- **Staphylococcal**:
  - 2-6 weeks of pathogen-specific IV therapy PLUS rifampin 300-450mg bid
- **Non-staphyloccocal**:
  - 2-6 weeks of pathogen-specific IV or highly bioavailable PO therapy

N Engl J Med. 2009 August 20; 361(8): 787–794

# COPD (GOLD Guidelines, 2017)

The choice of the antibiotic should be based on the local bacterial resistance pattern. Usually initial empirical treatment is an aminopenicillin with clavulanic acid, macrolide, or tetracycline. In patients

Antibiotics should be given to patients who have 3 cardinal symptoms:

- Increase in dyspnea
- Sputum volume
- Sputum purulence

**OR**

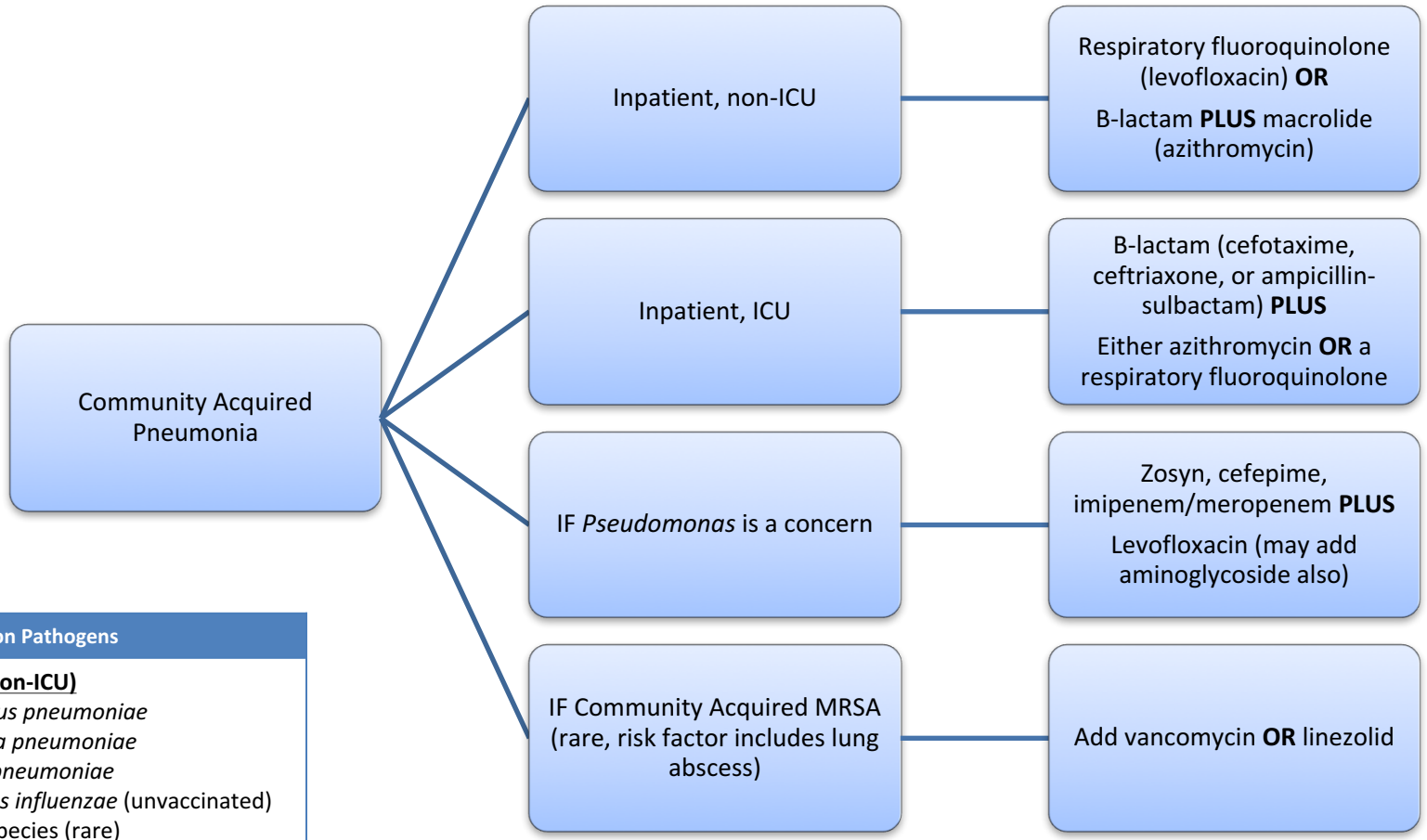
Two of the cardinal symptoms

- IF increased purulence is one of those 2
- or [patient requires] mechanical ventilation

*Culture if patient has frequent exacerbations*

*Treat with amoxicillin + clavulanic acid OR azithromycin for 5-7 days*

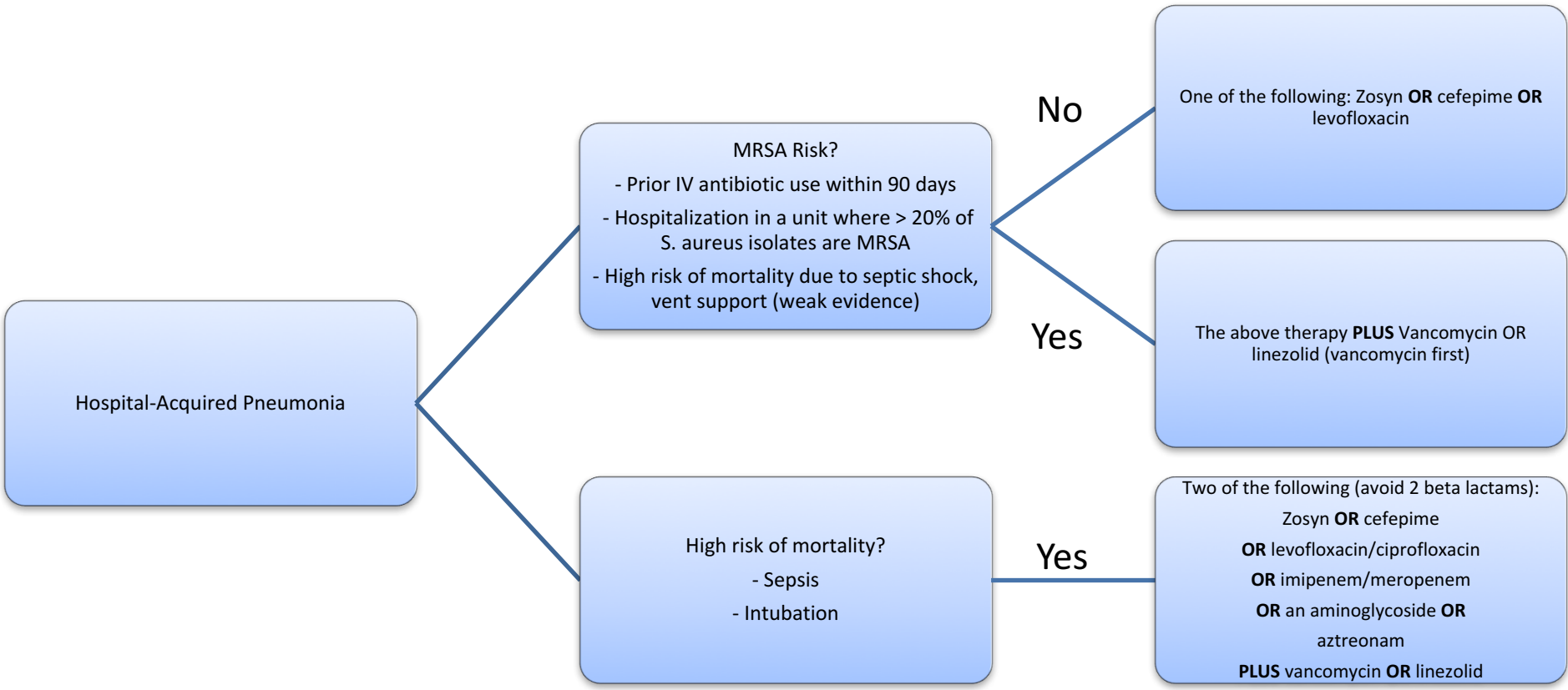
# Community-Acquired Pneumonia (IDSA, 2007)




| Most Common Pathogens |
|---|
| **Inpatient (non-ICU)**<br>*Streptococcus pneumoniae*<br>*Mycoplasma pneumoniae*<br>*Chlamydia pneumoniae*<br>*Haemophilus influenzae* (unvaccinated)<br>Legionella species (rare)<br>Stomach contents (aspiration)<br>Respiratory viruses |
| **Inpatient (ICU)**<br>*Streptococcus pneumoniae*<br>*Staphyloccocus aureus*<br>*Legionella* species (rarely)<br>Gram-negative bacilli<br>*H. influenzae* (unvaccinated) |

*Patients with CAP should be treated for a minimum of 5 days (level I evidence), should be afebrile for 48–72 h, and should have no more than 1 CAP-associated sign of clinical instability (table 10) before discontinuation of therapy

# Hospital-Acquired Pneumonia (HAP) (IDSA, 2016)




**Most Common Pathogens**

- *Pseudomonas aeroginosa*
- *Staphylococcus aureus*
- *Klebsiella pneumoniae*
- *Escherichia coli*
- *Acinetobacter* (less common)

**Risk Factors for multi-drug resistant organisms**

- Prior IV antibiotic use within 90 days

Pregnancy Categories – Cleveland Clinic Guidelines for Antibiotic Usage, 2012-2013

## TABLE 23 Antimicrobials in Pregnancy

### *Definitions of Pregnancy Category (continued)*

| | |
|---|---|
| Category A: | Controlled studies in women fail to demonstrate a risk to the fetus in the first trimester, and there is no evidence of a risk in later trimesters. The possibility of fetal harm appears remote. |
| Category B: | Either animal-reproduction studies have not demonstrated a fetal risk, but there are no controlled studies in pregnant women; or animal-reproduction studies have shown an adverse effect (other than a decrease in fertility) that was not confirmed in controlled studies in women in the first trimester (and there is no evidence of a risk in later trimesters). |
| Category C: | Either studies in animals have revealed adverse effects on the fetus (embryogenic, teratogenic, or other), and there are no controlled studies in women; or studies in women and animals are not available. Drugs should be given only if the potential benefit justifies the potential risk to the fetus. |
| Category D: | There is positive evidence of human fetal risk, but the benefits from use in pregnant women may be acceptable despite the risk (eg, the drug is needed in a life-threatening situation or for a serious disease for which safer drugs cannot be used or are ineffective). |
| Category X: | Studies in animals or human beings have demonstrated fetal abnormalities, there is evidence of fetal risk based on human experience, or both; and the risk of the use of the drug in pregnant women clearly outweighs any possible benefit. The drug is contraindicated in women who are or may become pregnant. |

# Pregnancy Categories – Commonly Used Antibiotics

| Antibiotic | Pregnancy Category | Antibiotic | Pregnancy Category |
|---|---|---|---|
| Amoxicillin | B | Clarithromycin | C |
| Ampicillin (with/without sulbactam) | B | Clindamycin | B |
| Azithromycin | B | Daptomycin | C |
| Aztreonam | B | Dicloxacillin | B |
| Cefazolin | B | Ertapenem | B |
| Cephalexin | B | Levofloxacin | C |
| Cefdinir | B | Meropenem | B |
| Cefepime | B | Metronidazole | B (But contraindicated in 1st trimester |
| Cefotaxime | B | Nitrofurantoin | B |
| Cefotetan | B | Penicillin G | B |
| Ceftazidime | B | Piperacillin/Tazobactam | B |
| Ceftriaxone | B | Sulfamethoxazole/ Trimethoprim | D |
| Cefuroxime | B | Vancomycin | C |
| Ciprofloxacin | C | | |

Source:
Lexicomp, Cleveland Clinic

# Sepsis Empiric Antimicrobial Therapy (UW Medicine, 2016) Page 1

## NEUTROPENIC FEVER

*Diagnosis: If possible, obtain blood culture x 2 (1 peripheral and 1 central) before antibiotics are infused. Do NOT delay antibiotics while waiting for cultures to be drawn. Review past microbiology for known colonization or infections with resistant organisms.*

*Typical Duration: until pt is afebrile and has ANC > 500*

**A. Stable with NO sepsis, NO history of resistant organisms, NO specific abdominal findings:** (susceptible gram-negative rods including *Pseudomonas, Acinetobacter, E.coli, Klebsiella, etc)*

- Ceftazidime 2gm IV q8h or Cefepime 2gm IV q8h
- Consider Vancomycin** IF suspected line infection, mucositis, sepsis, h/o colonization or infection with MRSA

**B. Stable with h/o MDR infection or colonization, or abdominal findings:** (susceptible gram-negative rods including *Pseudomonas, Acinetobacter, E.coli, Klebsiella,* and anaerobes)

- Meropenem 1g IV q8h *(requires ID consult > 72hrs)*
- ADD Vancomycin** IF suspected line infection, mucositis, sepsis, h/o colonization or infection with MRSA
- Consider Daptomycin 8mg/kg q24h instead of Vancomycin** IF history of VRE colonization or infection but discontinue when culture negative for VRE.

**C. Sepsis without focal findings:** (susceptible gram-negative rods including *Pseudomonas, Acinetobacter, E.coli, Klebsiella*, and anaerobes)

- Meropenem 1gm IV q8h STAT PLUS
- Tobramycin 5 mg/kg IV x1 STAT, based on ideal body weight, unless underweight or obese or renal dysfunction (call pharmacy) PLUS
- Vancomycin **

**D. For all pts: During flu seasons, send Flu testing and then give oseltamivir 75mg - 150mg PO/NGT q12.**

## *C.DIFFICILE* DIARRHEA

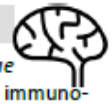
*Diagnosis: Only loose stools will be accepted by the lab for C.diff testing. Order C.diff testing (Toxigenic by PCR, not toxin assay) in CPOE.*
*DO NOT send stool for test of cure*

Mild to Moderate disease:
Metronidazole 500mg PO q8h, *duration: 10-14 days*

Severe disease (WBC > 15K, SCr 1.5 X baseline or ICU status): Vancomycin Solution 125mg PO q6h (Preferred agent for ICU) *Typical Duration: 14 days*

Severe Complicated (hypotension or shock, ileus, mega colon): Vancomycin 500mg PO/NG q6h PLUS Metronidazole 500mg IV q8h. Consider adding rectal vancomycin (500mg PR q6h) if complete ileus.
Also consider consulting GI, ID, and Surgery.
*Duration variable*

## MENINGITIS



(*S.pneumoniae, N.meningitidis and H.influenzae* Consider Listeria and HSV in patients age > 50, immunocompromised or alcoholic.)
*Diagnosis: Order antibiotics immediately; Do not wait for results of LP to initiate antimicrobials. LP for opening pressure, gram stain, culture, HSV PCR, cell count, glucose, and protein. Add cryptococcal antigen for HIV patients.*

Non-surgical, community-acquired:

- Consider Dexamethasone 0.15mg/kg IV q6 hours for 2 -4 days, give 15 minutes prior to abx if possible
- Ceftriaxone 2g IV q 12h PLUS
- Vancomycin**
- ADD Ampicillin 2g IV q4 hours for Listeria coverage
- ADD Acyclovir 10mg/kg IV q8h for HSV coverage when appropriate

*Typical duration: 7-21 days depending on organism*

Post-surgical meningitis: *(S.epidermidis, S.aureus, P.acnes,* gram-negative rods *(including P.aeruginosa)*

- Cefepime 2g IV q8h PLUS
- Metronidazole 500mg IV q8h PLUS
- Vancomycin**

*Duration: variable*

## SUSPECTED FUNGEMIA

Risk factors: *Septic pts on TPN, prolonged abx therapy, malignancy, femoral catheterization or Candida colonization at multiple sites.*

- Micafungin 100 mg IV q24h
- De-Escalate to Fluconazole 400 mg-800mg IV q24h if susceptible by MIC testing.
- Consult Infectious Diseases for line management.

*Typical Duration: 14 days after blood culture clearance*

## SEPSIS: SITE UNKNOWN

(MRSA, resistant Gram-negative bacilli)
*Diagnosis: Culture blood (all lumens), urine & sputum. Tailor antimicrobial within 48 hours*

- Vancomycin** PLUS
- Meropenem 1gm IV q8h *(requires ID consult > 72hrs)*
- If previous colonization or concerns for highly resistant Gram-negative pathogen such as *Acinetobacter, Pseudomonas*, or ESBL, CONSIDER ADDING:
  Ciprofloxacin 400 mg IV q8h OR
  Tobramycin 7mg/kg IV x1

*Typical Duration: 7-14 days*

## SIGNIFICANT PENICILLIN ALLERGY

- Example: anaphylaxis, airway compromise, etc.
- CONSULT ALLERGY for evaluation and possible skin testing

For all infections except hospital-acquired intra-abdominal infection:

- Replace Meropenem, Ceftazidime, Cefepime, or Piperacillin-Tazobactam with Ciprofloxacin 400mg IV q8h +/- Aztreonam 2gm IV q8h

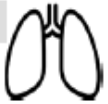
For intra-abdominal infections:

- Replace Ceftriaxone or Piperacillin-Tazobactam or Ertapenem with Levofloxacin 750mg PO/IV q24h + Metronidazole 500mg PO/IV q8h.

For CAP: Replace Ceftriaxone or Ampicillin-Sulbactam with Moxifloxacin 400mg PO/IV q24h
For NSTI: Omit Penicillin.
For meningitis: Replace Ceftriaxone or Ampicillin with Trimethoprim-Sulfamethoxazole 5mg/kg IV q8h PLUS Aztreonam 2g IV q8h PLUS Vancomycin**

# Sepsis Empiric Antimicrobial Therapy (UW Medicine, 2016) Page 2

## PNEUMONIA



**A. Community-acquired pneumonia [non-aspiration risk]** (*S. pneumoniae, atypicals*)
*Diagnosis: Send sputum gram stain & culture, CXR, urinary pneumococcal antigen and blood cultures.*

- Ceftriaxone 1 gm IV q24h PLUS
- Azithromycin 500 mg PO/IV q24h x 5 days
- If previous MRSA colonization or infection, CONSIDER ADDING: Vancomycin**

*Typical Duration: 7 days*

**B. CAP with cavitary lesion(s)** (*Oral anaerobes and MRSA*)

- Ampicillin/Sulbactam 3 gm IV q6h PLUS
- Azithromycin 500 mg PO/IV q24h PLUS
- Vancomycin**

*Typical Duration: 10-21 days*

**CF or Lung transplant patients: Call Pulmonary Transplant and Transplant Infectious Diseases Consult.**

**C. Healthcare associated pneumonia [i.e. from skilled nursing facility, etc]**

- Cefepime 2g IV q8h +/- Vancomycin** if h/o MRSA infection/colonization

*Typical Duration: 7 days*

**D. UWMC only: Ventilator-associated Pneumonia (VAP) regardless of hospitalization day**

- Treat as Healthcare associated pneumonia (section C)

**E. HMC only:**

- Early onset VAP (i.e. ≤ 4 days of hospitalization or ventilation) or aspiration: Ceftriaxone 1g IV q24h OR Ampicillin-sulbactam 3g IV q6h

*Typical Duration: 7 days*

- Late-onset [> 4 days inpatient], treat as Healthcare associated pneumonia (section C)

**F. For all Pneumonia pts:**

⇒ Anaerobic coverage such as Piperacillin-tazobactam is NOT recommended for HAP or VAP.

⇒ During flu seasons, send Flu testing and then give oseltamivir 75mg - 150mg PO/NGT q12.

⇒ Yeast in the sputum rarely represents true infection.

## BLOODSTREAM

**A. Suspected Line infection** (MRSA, Gram-negative rods)
*Diagnosis: Order antibiotics immediately and draw paired, simultaneous, quantitative blood cultures from all central line lumens AND one peripheral site. Central line CFU x2 more than peripheral site CFU strongly suggests line infection.*

- Vancomycin** PLUS
- Cefepime 2gm IV q8h
- Please consult Infectious Diseases if considering line salvage

**B. Suspected endocarditis, hemodynamically stable, no valve insufficiency:**
*Diagnosis: Draw 3 sets of blood cultures prior to antibiotics and consult Infectious Diseases.*

- Vancomycin** PLUS
- Ceftriaxone 2gm IV q24h
- Consult Infectious Diseases

## CELLULITIS

*Not-applicable to device-related infections (eg ICD, pacemakers, VADs, etc): Consult Infectious Diseases*

**A. Non-purulent skin/soft tissue infection:**
*(Streptococcus species)*

- Cefazolin 2g IV q8h
- PO option for Strep/MSSA: Cephalexin 500mg QID

**B. Purulent/abscess forming skin/soft tissue infection:**
(*S.aureus*: MSSA or MRSA)
*Diagnosis: I&D abscess; send pus (not wound swab) for gram stain and culture.*

- *Usually abx are unnecessary unless significant surrounding cellulitis or pt clinically unstable*
- Vancomycin**
- De-escalate when culture data available
- PO options for MRSA: Bactrim or Doxycycline (Consult ID)

*Typical Duration: 5-7 days; Consult Infectious Diseases for PO step-down options*

## NECROTIZING SOFT TISSUE INFECTION

(MRSA, Group A strep, *Clostridium sp* and mixed anaerobes, Gram-negative rods)
*Diagnosis: Suspect NSTI in septic patients, rapid skin lesion progression, pain out of proportion to physical findings & hyponatremia. STAT surgery and Infectious Diseases consult. Focus therapy based on culture results and patient response.*

- Vancomycin** PLUS
- Penicillin 4 million units IV q4h PLUS
- Clindamycin 1200 mg IV q6h PLUS EITHER
- Levofloxacin 750mg IV q24h OR
- For Neutropenic pts: Gentamicin 7 mg /kg IV q24 hours (replace Levofloxacin)
- For Fournier's: replace Penicillin with Piperacillin-tazobactam: 4.5gm x1, then 4 hours later, start 3.375gm IV q8h infused over 4 hrs

*Typical Duration: 10-14 days after debridement*

## INTRA-ABDOMINAL

**A. Community-acquired, mild-moderate** (Enteric Gram-negative rods, anaerobes)

- HMC only: Ertapenem 1g IV q24h
- UWMC only: Ceftriaxone 2g IV q24h PLUS Metronidazole 500mg PO/IV q8h
- For uncomplicated *biliary* infections, anaerobic coverage usually not necessary, use Ceftriaxone alone

*Typical Duration: 4 days following source control*

**B. Hospital-acquired, severe physiological disturbance, advanced age, immunocompromised**

- Vancomycin** PLUS
- Piperacillin-tazobactam 4.5gm X 1, then 4 hours later, start 3.375gm IV q8h infused over 4 hours

*Typical Duration: 4-7 days from source control; if source control is not attained, then duration is variable.*

**C. Intra-abdominal infections:**

⇒ Double anaerobic coverage is not required (i.e. metronidazole + piperacillin/tazobactam)

⇒ Abdominal Transplant patients: Same as above and consult Transplant Infectious Diseases

## URINARY

**A. Community Acquired Pyelonephritis** (Enteric Gram-negative rods)

*Diagnosis: Clean catch midstream U/A with reflexive gram stain and culture (UACRC). Neutropenic and transplant patients may not mount WBC response; appropriate to cover these patients empirically even without positive U/A if presentation suggests pyelonephritis.*

- Ceftriaxone 1 gm IV q24h
- If patient hemodynamically unstable or history MDRO, CHANGE TO: Ertapenem 1g q24h

*Typical Duration: 14 days*

**B. Catheter-associated UTI or Hospital- acquired:**(Resistant Gram-negative rods)

*Diagnosis: In symptomatic pts, obtain specimen from new foley, or from sterilized port on existing foley, not from collection bag or urimeter. Send U/A with reflexive gram stain and culture (UACRC). WBCs and Bacteria on direct stain suggests infection, but colonization also very common.*

- Ceftazidime 2g IV q8h
- If GPC seen on gram stain, add: Vancomycin**
- De-escalate or discontinue coverage if alternate source found for patient symptoms.

*Typical Duration: 7-14 days*

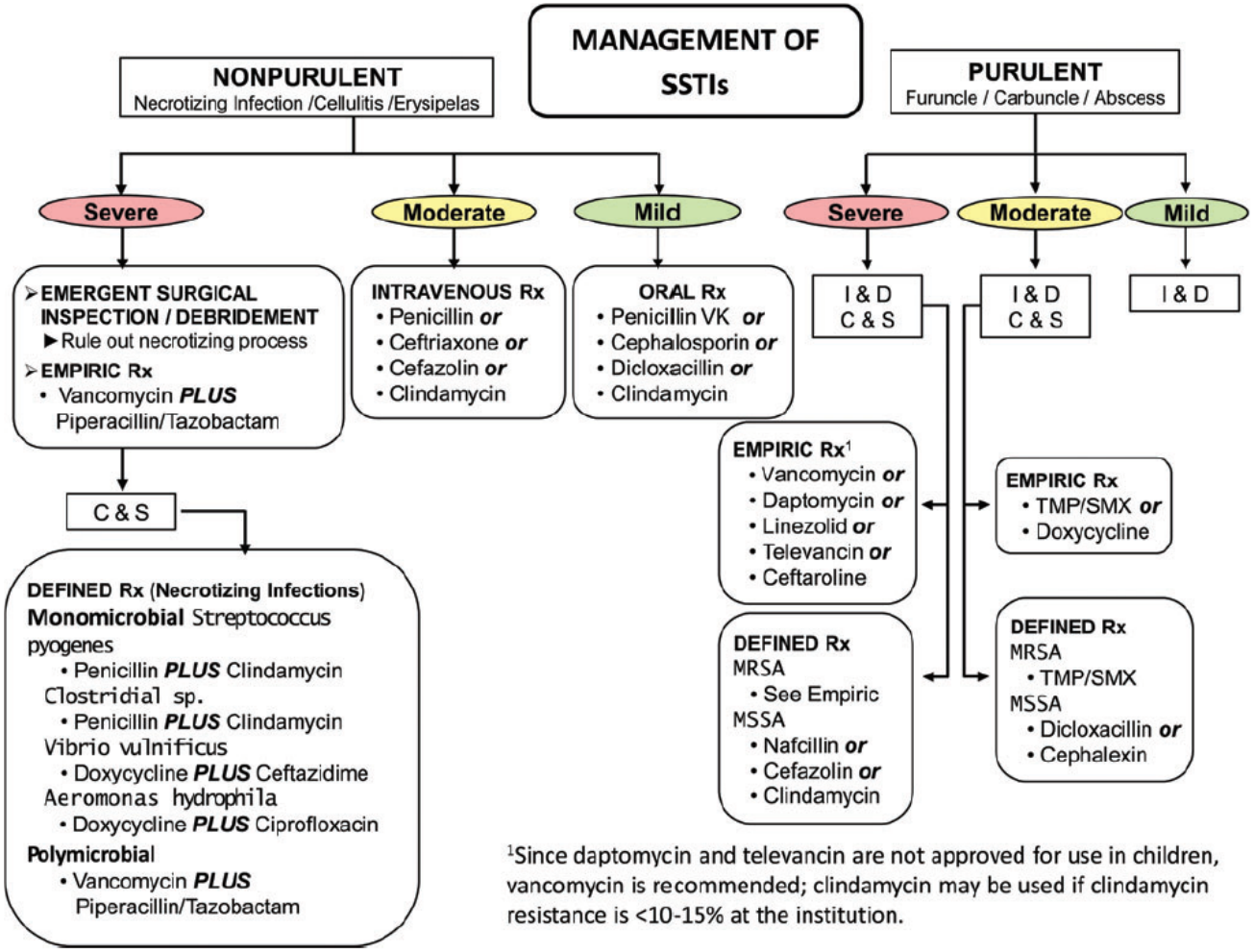
**C. UTIs in abdominal Transplant patients: Same as above and consult Transplant Infectious Diseases**

## CONCERN FOR MULTI-DRUG RESISTANT ORGANISMS (MDRO)

If previous infection or colonization with highly resistant Gram-negative pathogens such as *Acinetobacter, Pseudomonas*, or ESBL, instead of the listed agent, consider: Meropenem 1 gm IV q8h, or 2 gm IV q8h for meningitis *(ID consult required for use beyond 72 hours)*

****Vancomycin Dosing:**
Loading dose IV x1 (2 gm if ≥70 kg, 1.5 gm if <70kg), then 15 mg/kg IV q8-12 hours

# Skin and Skin Structure Infections (IDSA, 2014)




**Most Common Pathogens:**
*Streptococcus* species
*Staphylococus aureus*
Aerobic Gram-negative bacilli (diabetic foot)
Anaerobes (diabetic foot)

Abscess: 5- to 10-day course of an antibiotic active against the pathogen isolated
Erysipelas and cellulitis: 5 days, can extend if infection still present

# Bacterial Vaginosis (CDC 2015 Guidelines)

| Recommended Rx | | Dose/Route | Alternatives | |
|---|---|---|---|---|
| metronidazole oral[1] | OR | 500 mg orally 2x/day for 7 days | tinidazole 2 g orally 1x/day for 2 days | OR |
| metronidazole gel 0.75%[1] | OR | One 5 g applicator intravaginally 1x/day for 5 days | tinidazole 1 g orally 1x/day for 5 days | OR |
| clindamycin cream 2%[1,2] | | One 5 g applicator intravaginally at bedtime for 7 days | clindamycin 300 mg orally 2x/day for 7 days | OR |
| | | | clindamycin ovules 100 mg intravaginally at bedtime for 3 days | |

Superscript:
1. The recommended regimens are equally efficacious.
2. These creams are oil-based and may weaken latex condoms and diaphragms

*Treatment is recommended for all symptomatic pregnant women

Some commonly seen pathogens:

| **Gram Negative** | **Gram Variable** | **Other** |
|---|---|---|
| *Prevotella* species | *Gardnerella vaginalis* | *Ureaplasma urealyticum* |
| *Poryphromonas* species | | *Mobiluncus* species |
| *Bacteroides* species | | |
| *Peptostreptococcus* species | | |

Sources: UpToDate, CDC 2015 STD Guidelines

# *Chlamydia trachomatis* Infections (CDC 2015 Guidelines)

| | Recommended Rx | | Dose/Route | Alternatives | |
|---|---|---|---|---|---|
| Adults and adolescents | azithromycin<br>doxycycline[4] | OR | 1 g orally in a single dose<br>100 mg orally 2x/day for 7 days | erythromycin base[5] 500 mg orally 4x/day for 7 days<br>erythromycin ethylsuccinate[6] 800 mg orally 4x/day for 7 days<br>levofloxacin[7] 500 mg 1x/day orally for 7 days<br>ofloxacin[9] 300 mg orally 2x/day for 7 days | OR<br>OR<br>OR |
| Pregnancy[3] | azithromycin[8] | | 1 g orally in a single dose | ★ amoxicillin 500 mg orally 3x/day for 7 days<br>erythromycin base[5,9] 500 mg orally 4x/day for 7 days<br>erythromycin base 250 mg orally 4x/day for 14 days<br>erythromycin ethylsuccinate 800 mg orally 4x/day for 7 days<br>erythromycin ethylsuccinate 400 mg orally 4x/day for 14 days | OR<br>OR<br>OR<br>OR |
| Infants and Children (<45 kg): urogenital, rectal | erythromycin base[10] ethylsuccinate | OR | 50 mg/kg/day orally (4 divided doses) daily for 14 days | ★ Data are limited on the effectiveness and optimal dose of azithromycin for chlamydial infection in infants and children < 45 kg | |
| Neonates: opthalmia neonatorum, pneumonia | erythromycin base[10] ethylsuccinate | OR | 50 mg/kg/day orally (4 divided doses) daily for 14 days | ★ azithromycin 20 mg/kg/day orally, 1 dose daily for 3 days | |

Superscript numbers in table above:

3. For pregnant women: see complete CDC guidelines
4. Doxycycline should not be administered during pregnancy, lactation, or to children <8 years of age.
5. If patient cannot tolerate high-dose erythromycin base schedules, change to 250 mg 4x/day for 14 days.
6. If patient cannot tolerate high-dose erythromycin ethylsuccinate schedules, change to 400 mg orally 4 times a day for 14 days.
7. Levofloxacin is contraindicated for pregnant or lactating women
8. Azithromycin safe and effective per clinical experience and published studies
9. Erythromycin estolate is contraindicated during pregnancy
10. Effectiveness of erythromycin treatment is approximately 80%; a second course of therapy may be required.

# Gonococcal Infections (CDC 2015 Guidelines)

| | Recommended Rx | | Dose/Route | Alternatives | |
|---|---|---|---|---|---|
| Adults, adolescents: uncomplicated gonococcal infections of the cervix, urethra, and rectum | ceftriaxone | PLUS | 250 mg IM in a single dose | ★ If ceftriaxone is not available:<br>cefixime 400 mg orally in a single dose | PLUS |
| | azithromycin[10] | | 1 g orally in a single dose | azithromycin[8] 1 g orally in a single dose | |
| | | | | ★ If cephalosporin allergy:<br>gemifloxacin 320 mg orally in a single dose | PLUS |
| | | | | azithromycin 2 g orally in a single dose | OR |
| | | | | gentamicin 240 mg IM single dose | PLUS |
| | | | | azithromycin 2 g orally in a single dose | |
| Pharyngeal | ceftriaxone | PLUS | 250 mg IM in a single dose | | |
| | azithromycin[10] | | 1 g orally in a single dose | | |
| Pregnancy[3] | See complete CDC guidelines. | | | | |
| Adults and adolescents: conjunctivitis | ceftriaxone | PLUS | 1 g IM in a single dose | | |
| | azithromycin[10] | | 1 g orally in a single dose | | |
| Children (≤45 kg): urogenital, rectal, pharyngeal | ceftriaxone[18] | | 25-50 mg/kg IV or IM, not to exceed 125 mg IM in a single dose | | |

Superscript numbers in table above:

8. Clinical experience and published studies suggest that azithromycin is safe and effective
10. Effectiveness of erythromycin treatment is approximately 80%; a second course of therapy may be required.

Most common pathogen: *Neisseria gonorrhoeae* (Gram-negative)

# Pelvic Inflammatory Disease (CDC 2015 Guidelines)

| Recommended Rx | | Dose/Route | Alternatives | |
|---|---|---|---|---|
| **Parenteral Regimens** | | | **Parenteral Regimen** | |
| Cefotetan | PLUS | 2 g IV every 12 hours | Ampicillin/Sulbactam 3 g IV every 6 hours | PLUS |
| Doxycycline | OR | 100 mg orally or IV every 12 hours | | |
| Cefoxitin | PLUS | 2 g IV every 6 hours | Doxycycline 100 mg orally or IV every 12 hours | |
| Doxycycline | | 100 mg orally or IV every 12 hours | | |
| **Recommended Intramuscular/Oral Regimens** | | | | |
| Ceftriaxone | PLUS | 250 mg IM in a single dose | | |
| Doxycycline | WITH or WITHOUT | 100 mg orally twice a day for 14 days | | |
| Metronidazole | OR | 500 mg orally twice a day for 14 days | | |
| Cefoxitin | PLUS | 2 g IM in a single dose | | |
| Probenecid | PLUS | 1 g orally administered concurrently in a single dose | | |
| Doxycycline | WITH or WITHOUT | 100 mg orally twice a day for 14 days | | |
| Metronidazole | | 500 mg orally twice a day for 14 days | | |

The complete list of recommended regimens can be found in CDC's 2015 STD Treatment Guidelines.

Some commonly seen pathogens:

**Gram Negatives:**
*Neisseria gonorrhoeae*
*Chlamydia trachomatis*
*Haemophilus influenzae*

**Gram Positive:**
*Streptococcus agalactiae*

**Gram Variable**
*Gardnerella vaginalis*
*Ureaplasma urealyticum*
*Mycoplasma genitalium*

# Syphilis (CDC 2015 Guidelines)

| | Recommended Rx | Dose/Route | Alternatives |
|---|---|---|---|
| Primary, secondary, or early latent <1 year | benzathine penicillin G | 2.4 million units IM in a single dose | doxycycline[7,24] 100 mg 2x/day for 14 days OR tetracycline[7,24] 500 mg orally 4x/day for 14 days |
| Latent >1 year, latent of unknown duration | benzathine penicillin G | 2.4 million units IM in 3 doses each at 1 week intervals (7.2 million units total) | doxycycline[7,24] 100 mg 2x/day for 28 days OR tetracycline[7,24] 500 mg orally 4x/day for 28 days |
| Pregnancy[3] | See complete CDC guidelines. | | |
| Neurosyphilis | aqueous crystalline penicillin G | 18–24 million units per day, administered as 3–4 million units IV every 4 hours or continuous infusion, for 10–14 days | procaine penicillin G 2.4 MU IM 1x daily PLUS probenecid 500 mg orally 4x/day, both for 10-14 days. |
| ★ Congenital syphilis | See complete CDC guidelines. | | |
| Children: Primary, secondary, or early latent <1 year | benzathine penicillin G | 50,000 units/kg IM in a single dose (maximum 2.4 million units) | |
| Children: Latent >1 year, latent of unknown duration | benzathine penicillin G | 50,000 units/kg IM for 3 doses at 1 week intervals (maximum total 7.2 million units) | |
| See CDC STD Treatment guidelines for discussion of alternative therapy in patients with penicillin allergy. | | | |

Superscript numbers in table above:

3. For pregnant women: see complete CDC guidelines
7. Doxycycline, tetracycline contraindicated for pregnant women
24. Pregnant patients allergic to penicillin should be treated with penicillin after desensitization.

# Asymptomatic Bacteriuria (IDSA, 2005)

**Table 2. Prevalence of asymptomatic bacteriuria in selected populations.**

| Population | Prevalence, % | Reference |
|---|---|---|
| Healthy, premenopausal women | 1.0–5.0 | [31] |
| Pregnant women | 1.9–9.5 | [31] |
| Postmenopausal women aged 50–70 years | 2.8–8.6 | [31] |
| Diabetic patients | | |
| Women | 9.0–27 | [32] |
| Men | 0.7–11 | [32] |
| Elderly persons in the community[a] | | |
| Women | 10.8–16 | [31] |
| Men | 3.6–19 | [31] |
| Elderly persons in a long-term care facility | | |
| Women | 25–50 | [27] |
| Men | 15–40 | [27] |
| Patients with spinal cord injuries | | |
| Intermittent catheter use | 23–89 | [33] |
| Sphincterotomy and condom catheter in place | 57 | [34] |
| Patients undergoing hemodialysis | 28 | [28] |
| Patients with indwelling catheter use | | |
| Short-term | 9–23 | [35] |
| Long-term | 100 | [22] |

[a] Age, ≥70 years.

**Most Common Pathogens:**

- *Escherichia coli* (more so in women)
- *Proteus mirabilis* (more so in men)
- *Enterococcus* species
- *Klebsiella pneumoniae*

Catheters are a risk factor for **polymicrobial** bacteriuria in men and women. Cultures may grow:

- *Pseudomonas aeruginosa*
- *Providencia stuartii*
- *Morganella morgannii*

**Does the patient have a long-term, indwelling catheter?**

- Consider if this is colonization vs acute infection
- Pyruria = not indication for treatment IF accompanied by asymptomatic bacteriuria

# Uncomplicated Cystitis and Pyelonephritis in Women (IDSA, 2010)

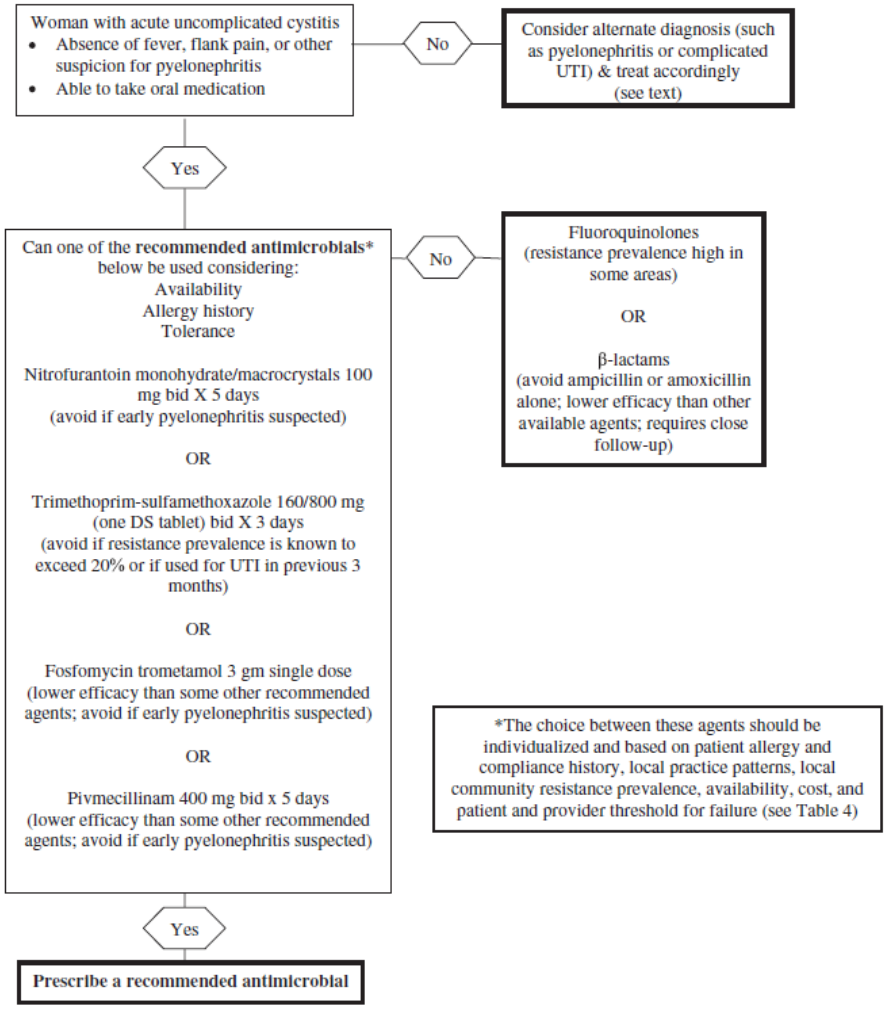



**Figure 1.** Approach to choosing an optimal antimicrobial agent for empirical treatment of acute uncomplicated cystitis. DS, double-strength; UTI,

**Nitrofurantoin**: avoid in 65 or greater and those with CrCl < 30 mls/min

**Pivmecillinam:** not approved in USA

**Fluoroquinolones:** Rare chance of CNS side effects in elderly

**Treat UTIs for 3-7 days depending on drug chosen**

IDSA, Lexicomp