MANAGING COMMON INFECTIONS IN OLDER ADULTS

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Objectives

1. Review the common infection syndromes in the nursing home population
2. Discuss when antibiotic treatment is necessary
3. Evaluate examples for assessing the appropriateness of antibiotic treatment
Impact of Infections in Nursing Homes

• Estimated prevalence of infections: 5.3%
• Incidence rates: 3.6-5.2/1,000 resident days
• Infections are associated with
  • High mortality and morbidity
  • Re-hospitalization
  • Extended hospital stay and substantial healthcare expenditures

Risk of Infections in the Older Adults

- Impairment in immunity
- Functional impairment
- Multiple comorbidities
- Presence of indwelling devices
- Recent admission to an acute care facility
MS is an 89 year old male, long term resident of a nursing home

- Hx of diabetes, renal insufficiency, mild dementia, no history of COPD
- He has peripheral vascular disease and a chronic ulcer over the right lateral malleolus, previous culture from the ulcer grew methicillin resistant *Staphylococcus aureus* (MRSA)
- The CNA notices that he is coughing up yellow phlegm and asks the resident if he is feeling OK.
- Mr. MS reports some headache, chills and he does not feel hungry for dinner
• The nurse assesses the resident

• His temperature is 99°F, HR 90/min, RR 22/min, BP: 156/90, pulse oximetry 98% on room air

• Mr. MS looks fatigued and very weak. His chest exam is negative, he has no abdominal or CVA tenderness, his chronic ankle ulcer has minimal yellow material at the base. The nurse notices that urine (in his urinal) is foul smelling

• A physician is covering for the night and does not know Mr. MS or the nurse. He orders over the phone a urinalysis and culture, CBC, Cr, CXR. To “be safe” he orders ciprofloxacin for a urinary tract infection (UTI), TPM/SMX for a possible MRSA ulcer infection and azithromycin for his cough

• The nurse failed to tell the doctor that there are other residents with similar symptoms of cough on the unit
• The consultant pharmacist is reviewing record on the unit 2 days later and he is asked by his nurse to review his antibiotics, she said “they are too many”
• The pharmacist reviews the labs and cultures and CXR results:
  • CBC: WBC 10,000, Hct 35, Plts 110K, creatinine: 1.5 mg/dl, creatinine clearance: 36.4 ml/min
  • Urinalysis: cloudy, 1+ Leukocyte esterase, negative nitrites, WBC 45/HPF
  • Urine culture grew: 100,000 E coli resistant to ciprofloxacin, TMP/SMX but sensitive to nitrofurantoin
  • The ulcer grew MRSA sensitive to vancomycin, TMP/SMX, linezolid, tetracycline
  • The CXR is normal
• Does the resident have:
  • UTI?
  • Bronchitis?
  • Infected leg ulcer?

Does he needs any antibiotics?
Antimicrobial Use In Nursing Homes

• Pooled mean 4.8 courses/1,000 resident days, range 0.4-23.5)

• Primary indications for antibiotics:
  1. Urinary tract infections
  2. Respiratory tract infections
  3. Skin and soft tissue infections

• Fluoroquinolones use is common

• 25%-75% of antibiotic use deemed inappropriate

Benoit et al. JAGS 2008; 56: 2039-2044
10 most Common Situations Where Antibiotics are Used and Rarely Necessary

**UTI**
1. Positive urine culture in asymptomatic patient
2. U/A and culture for cloudy or malodorous urine
3. Non specific symptoms or signs not referable to the urinary tract

**Respiratory Conditions**
4. Upper respiratory infections
5. Bronchitis without COPD
6. Suspected or proven influenza with no secondary infection
7. Respiratory symptoms in a terminal patient with dementia

**Skin Wounds**
8. Skin wound without cellulitis, sepsis or osteomyelitis
9. Small localized abscess without significant cellulitis
10. Decubitus ulcer in a terminal patient

http://www.annalsoflongtermcare.com/article/ten-clinical-situations-long-term-care-which-antibiotics-are-often-prescribed
Many Challenges in Clinical Decision to Initiate Antibiotics In the Nursing Homes

- Clinical features of infections are poor
- Difficulty in obtaining a history due to cognitive, hearing and speech impairments
- Medical staff not available to perform an evaluation of the resident
- Low nurse to patient ratio and poor communication
- Diagnostic tests less readily available
- Colonization is common

Lead to diagnostic errors and overtreatment
Conceptual Model Related to Prescribing Decisions in Nursing Homes

Overuse of Antibiotics

**Adverse drug effects**
- Antibiotic related side effects
- Interaction with other drugs

**Antibiotic resistance**
- Increase opportunities for transmission to other patients

**C. difficile infections**
- Older adults are at higher risk of infections
Treatment with antibiotics with narrow spectrum and lower *C. difficile* infection risk is preferred

<table>
<thead>
<tr>
<th>Frequent associated</th>
<th>Occasionally associated</th>
<th>Rarely associated</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fluoroquinolones</td>
<td>macrolides</td>
<td>Aminoglycosies</td>
</tr>
<tr>
<td>Clindamycin</td>
<td>TMP/SMX</td>
<td>Tetracylines</td>
</tr>
<tr>
<td>Cephalosporins (broad spectrum)</td>
<td></td>
<td>Metronidazole</td>
</tr>
<tr>
<td>Penicillins</td>
<td></td>
<td>Vancomycin</td>
</tr>
</tbody>
</table>
Revised Surveillance Definitions of Infections for Nursing Homes
Algorithms for Treatment of Common Infections in LTCF

In the Trenches

Algorithms Promoting Antimicrobial Stewardship in Long-Term Care

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Carrie Allen PharmD, CGP, BCPS, BCPP, FASCP\textsuperscript{a}, Eric Tangalos MD\textsuperscript{b},
Joseph G. Ouslander MD\textsuperscript{c}

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\textsuperscript{b} Mayo Clinic, Rochester, MN
\textsuperscript{c} Department of Integrated Medical Sciences, Charles E. Schmidt College of Medicine, Florida Atlantic University, Boca Raton, FL

Zarowitz, BJ et al. JAMDA 2016: 173-178
MANAGEMENT OF UTI
Urinary Tract Infections in Nursing Homes

• Incidence 0.1-2.4 cases per 1000 residents days

• Most common indication for antibiotics:
  • 32-66% of prescriptions

• Most common condition associated with inappropriate treatment
  • Residents are often treated for asymptomatic bacteriuria
Asymptomatic Bacteriuria Is Common

<table>
<thead>
<tr>
<th></th>
<th>Asymptomatic bacteriuria</th>
</tr>
</thead>
<tbody>
<tr>
<td>Women less than 60 years</td>
<td>3-5%</td>
</tr>
<tr>
<td>Elderly in Community</td>
<td></td>
</tr>
<tr>
<td>Women</td>
<td>11-16%</td>
</tr>
<tr>
<td>men</td>
<td>15-40%</td>
</tr>
<tr>
<td>Elderly in Nursing Homes</td>
<td></td>
</tr>
<tr>
<td>women</td>
<td>25-50%</td>
</tr>
<tr>
<td>men</td>
<td>15-40%</td>
</tr>
<tr>
<td>Patient with indwelling catheter</td>
<td>100%</td>
</tr>
</tbody>
</table>

Nicolle LE, Clinical Infectious Diseases 2005;40(5): 643–54
Treatment of Asymptomatic Bacteriuria

Not recommend except for 2 conditions:

- Pregnant women
- Prior to a urologic procedure

Treatment does not:

- Prevent symptomatic UTI
- Death

Treatment leads to more adverse effects

Nicolle LE, Clinical Infectious Diseases 2005;40(5): 643–54
Zalmnovici TA et al, Cochrane Database Syst Rev, 2015
UTI vs. Asymptomatic Bacteriuria

Bacteria in Urine

Urinary Tract Symptoms

Asymptomatic Bacteriuria (ASB)

Urinary Tract Infection (UTI)
## Specific Urinary Tract Symptoms

<table>
<thead>
<tr>
<th>Symptoms</th>
<th>NOT Symptoms</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dysuria</td>
<td>New Onset Delirium*</td>
</tr>
<tr>
<td>Urgency</td>
<td>Mental Status Changes*</td>
</tr>
<tr>
<td>Flank Pain</td>
<td>“Acting Funny”</td>
</tr>
<tr>
<td>Incontinence</td>
<td>Weakness</td>
</tr>
<tr>
<td>Frequency</td>
<td>Fatigue</td>
</tr>
<tr>
<td>Hematuria</td>
<td>Decrease oral intake</td>
</tr>
<tr>
<td>Suprapubic Pain</td>
<td>Falls or gait instability</td>
</tr>
<tr>
<td></td>
<td>Foul smelling or cloudy urine</td>
</tr>
</tbody>
</table>

* For resident without an indwelling urinary catheter
Pyuria and Asymptomatic Bacteriuria

- Pyuria (>10 WBC/High power filed) is evidence of inflammation in the genitourinary tract.
- Pyuria has no apparent clinical relevance in those with asymptomatic bacteriuria, and should not influence decisions about antimicrobial therapy.
- 90% of elderly residents have pyuria with asymptomatic bacteriuria.
- The absence of pyuria rules out UTI.
  - Negative predictive value of 95%.
- Initiation of antibiotics based on a urinalysis, results in a misdiagnosis of a UTI in 20-40% of patients.

The Diagnosis of UTI in Residents with Advanced Dementia is Challenging

Table 2. Characteristics of Suspected Urinary Tract Infection Episodes in Nursing Home Residents with Advanced Dementia

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>All Episodes, N = 131</th>
<th>Episodes in Residents with a Foley Catheter, n = 15</th>
<th>Episodes in Residents without a Foley Catheter, n = 116</th>
</tr>
</thead>
<tbody>
<tr>
<td>Symptoms or signs</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fever</td>
<td>27 (20.6%)</td>
<td>5 (33.3%)</td>
<td>22 (19.0%)</td>
</tr>
<tr>
<td>Dysuria</td>
<td>5 (3.8%)</td>
<td>1 (6.7%)</td>
<td>4 (3.4%)</td>
</tr>
<tr>
<td>Frequency</td>
<td>2 (1.5%)</td>
<td>0 (0%)</td>
<td>2 (1.7%)</td>
</tr>
<tr>
<td>Urgency</td>
<td>0 (0%)</td>
<td>0 (0%)</td>
<td>0 (0%)</td>
</tr>
<tr>
<td>Hematuria</td>
<td>9 (6.9%)</td>
<td>3 (13.3%)</td>
<td>6 (5.2%)</td>
</tr>
<tr>
<td>Costovertebral tenderness</td>
<td>3 (2.3%)</td>
<td>1 (6.7%)</td>
<td>2 (1.7%)</td>
</tr>
<tr>
<td>Suprapubic pain</td>
<td>0 (0%)</td>
<td>0 (0%)</td>
<td>0 (0%)</td>
</tr>
<tr>
<td>Mental status change</td>
<td>58 (44.3%)</td>
<td>3 (13.3%)</td>
<td>56 (48.3%)</td>
</tr>
<tr>
<td>Rigors</td>
<td>2 (1.5%)</td>
<td>1 (6.7%)</td>
<td>1 (0.9%)</td>
</tr>
<tr>
<td>Minimum symptoms and signs to support antimicrobial initiation</td>
<td>21 (16.0%)</td>
<td>6 (40.0%)</td>
<td>15 (12.9%)</td>
</tr>
</tbody>
</table>
Survival After Suspected Urinary Tract Infection in Individuals with Advanced Dementia

A patient with advanced dementia may be unable to report urinary symptoms, in this situation, it is reasonable to obtain a urine culture if there are signs of systemic infection such as fever, (increase in temperature ≥ 2°C from baseline), leukocytosis, or a left shift or chills, in the absence of additional symptoms (e.g. new cough) to suggest an alternative source of infection.
## When to Treat for UTI

<table>
<thead>
<tr>
<th>Microbiologic criteria</th>
<th>Symptom criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>No indwelling catheter</strong></td>
<td>Acute dysuria</td>
</tr>
<tr>
<td>Positive urinalysis (WBC ≥ 10/HPF) and Positive urine culture (≥10^5 cfu/mL in voided specimen ≥ 10^2 cfu/ml if in and out cath)</td>
<td>--OR-- Fever* + at least 1 of following (new or worsening):* If no fever, 2 of the following (new or worsening)</td>
</tr>
<tr>
<td><em>Urinary urgency</em></td>
<td>• Urinary urgency</td>
</tr>
<tr>
<td><em>Frequency</em></td>
<td>• Frequency</td>
</tr>
<tr>
<td><em>Suprapubic pain</em></td>
<td>• Suprapubic pain</td>
</tr>
<tr>
<td><em>Gross hematuria</em></td>
<td>• Gross hematuria</td>
</tr>
<tr>
<td><em>Costovertebral angle tenderness</em></td>
<td>• Costovertebral angle tenderness</td>
</tr>
<tr>
<td><em>Urinary incontinence</em></td>
<td></td>
</tr>
<tr>
<td><strong>Indwelling catheter</strong></td>
<td>At least 1 of the following (new or worsening):</td>
</tr>
<tr>
<td>Positive urinalysis (WBC ≥ 10/HPF) and Positive urine culture (≥10^3 cfu/mL)</td>
<td>• Fever*</td>
</tr>
<tr>
<td></td>
<td>• Costovertebral angle (CVA) tenderness</td>
</tr>
<tr>
<td></td>
<td>• Rigors (shaking chills)</td>
</tr>
<tr>
<td></td>
<td>• Delirium</td>
</tr>
<tr>
<td></td>
<td>• Flank pain (back, side pain)</td>
</tr>
<tr>
<td></td>
<td>• pelvic discomfort</td>
</tr>
<tr>
<td></td>
<td>• Acute hematuria</td>
</tr>
</tbody>
</table>

*Fever: A single oral temperature 100°F (37.8°C); or repeated oral t ≥ 99°F (37.2°C); or Persistent rectal t ≥ 99.5°F (37.5°C); or an increase in t of > 2°F (1.1°C) over the baseline temperature

Modified from Loeb M. BMJ 2005;331:669
What is the Appropriate Treatment?

- Consult your facility antibiogram
  - If antibiogram not available tools are available for generating an antibiogram and instruction on how to use it:
- Review previous urine culture data
- Urine culture is necessary to tailor treatment due to increasing antibiotic resistance
- Take into consideration renal function and potential interaction with other medications
## Antibiogram

(Data Collected 7/1/2013 - 6/30/2014)

Percent of Non-Duplicate Patient Isolates Susceptible to Achievable Serum Levels

| ORGANISM             | No. of Isolates | Amikacin | Gentamicin | Tobramycin | Ampicillin | Ampicillin-Clavulanate | Ampicillin-Sulbactam | Penicillin | Piperacillin/Tazobactam | Oxacillin | Imipenem | Meropenem | Ertapenem | Aztreonam | Cefazolin | Cefepime | Ceftriaxone | Vancomycin | Erythromycin | Clindamycin | TMP-SMZ | Ciprofloxacin | Levofoxacin | Moxifloxacin | Nitrofurantoin | Tetracycline | Tigecycline |
|----------------------|-----------------|----------|------------|------------|------------|------------------------|-----------------------|------------|-------------------------|-----------|----------|-----------|-----------|-----------|-----------|----------|------------|-----------|-------------|-------------|-----------|---------------|-------------|-----------|---------------|-------------|-----------|--------------|-------------|-----------|
| E. coli              | 143             | 100      | 82         | 96         | 39         | 65                     | 99                    | 100        | 100                     | 99        | 88        | 81        | 89        | 85        | 76        | 52       | 90         | 74        | 73          | 75          | 73        | 90            | 65          | 100       |
| Klebsiella pneumoniae| 63              | 100      | 91         | 98         | 0          | 87                     | 95                    | 100        | 100                     | 100       | 74        | 73        | 75        | 73        | 90        | 88       | 90         | 90        | 90          | 88          | 85        | 90            | 65          | 100       |
| Proteus mirabilis    | 88              | 100      | 100        | 100        | 71         | 90                     | 100                   | 100        | 100                     | 100       | 95        | 100       | 100       | 100       | 93        | 85       | 93         | 93        | 93          | 85          | 85        | 93            | 65          | 100       |
| Ps. aeruginosa       | 34              | 100      | 97         | 97         | 100        | 100                    | 93                     | 86         | 100                     | 100       | 100       | 18        | 39        | 97        | 10        | 100      | 100        | 100        | 97          | 10          | 100       | 10            | 10          | 100       |
| Staph aureus         | 38              | 97       | 31         | 7          | 31         | 31                     | 31                    | 100        | 100                     | 18        | 39        | 97        | 10        | 100       | 100       | 93       | 98         | 47        | 91          | 32          | 32        | 91            | 32          | 100       |
| Enterococcus         | 73              | 67\(^b\) | 90         | 90         |            |                        |                       |            |                         |           |           |           |           |           |           |           |            |           |             |             |           |               |             |           |               |             |           |               |             |           |

\(^a\)Susceptible to achievable levels in urine only

\(^b\)Susceptible to high level gentamicin
UTI Definitions

- **Uncomplicated UTI** – infection in a structurally/functionally normal urinary tract. Includes women post menopausal and with controlled diabetes.

- **Complicated UTI** – patients with a structural or functional abnormality of the urinary tract. Includes men and any patient with structural urinary abnormalities.

- **Lower UTI** – UTI without involvement of the kidneys (whether complicated or uncomplicated).

- **Upper UTI/pyelonephritis** – infection of the kidney.
Optimal management of urinary tract infections in older people

Abstract: Urinary tract infections (UTI) occur frequently in older people. Unfortunately, UTI is commonly overlooked and over-treated on the basis of nonspecific clinical signs and symptoms. The diagnosis of a UTI in an older person requires the presence of new urinary symptoms, with or without systemic symptoms. Urinalysis is commonly used to diagnose infection in this population, however, the evidence for its use is limited. There is overwhelming evidence that asymptomatic bacteriuria should not be treated. Collecrter associated urinary tract infection accounts for a significant amount of hospital-associated infection. Indwelling urinary catheters should be avoided where possible and alternatives sought. The use of narrow spectrum antimicrobial agents for urinary tract infection is advocated. Local guidelines are now widely used to reflect local resistance patterns and available agents. Guidelines need to be updated to reflect changes in antimicrobial prescribing and a move from broad to narrow spectrum antimicrobials.

Keywords: urinary tract infection, elderly, review
<table>
<thead>
<tr>
<th>Cystitis*/Lower UTI (complicated or uncomplicated)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Agent</strong></td>
</tr>
</tbody>
</table>
| Nitrofurantoin | • Most active agent against E. coli  
• Avoid if CrCl < 30 mL/min  
• Avoid if systemic signs of infection/suspicion of pyelonephritis or prostatitis  
• Does not cover Proteus |
| TMP-SMX* | • Drug-drug interactions with warfarin  
• Monitor potassium level if concomitant use of spironolactone, angiotensin-converting enzyme inhibitors (ACEIs), angiotensin receptor blockers (ARBs)  
• Renal dose adjustments, avoid if CrCl < 15 mL/min |
| Cephalexin | • Active against E. coli, Proteus, and Klebsiella |
| Fosfomycin | • Active against E. coli, Enterococcus. Is also active against ESBL positive E. coli. Fosfomycin susceptibility tests recommended. |

* TMP/SMX: Modify according to your facility’s antibiogram, increasing resistance reported
Fosfomycin

### Percent of *E. coli* (N=50) from Nursing Home Patients Susceptible to Antibiotics

<table>
<thead>
<tr>
<th></th>
<th>Amox/clav</th>
<th>Cefaz</th>
<th>Cipro</th>
<th>Doxy</th>
<th>Fosfo</th>
<th>Nitro</th>
<th>Tmp/Smz</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>S</strong></td>
<td>66</td>
<td>84</td>
<td>70</td>
<td>74</td>
<td><strong>100</strong></td>
<td>96</td>
<td>68</td>
</tr>
<tr>
<td><strong>I</strong></td>
<td>24</td>
<td>0</td>
<td>0</td>
<td>6</td>
<td>0</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td><strong>R</strong></td>
<td>10</td>
<td>16</td>
<td>30</td>
<td>20</td>
<td>0</td>
<td>2</td>
<td>28</td>
</tr>
<tr>
<td><strong>Sum</strong></td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>98</td>
</tr>
</tbody>
</table>

### Percent of Enterococcus faecalis (N=20) from Nursing Home Patients Susceptible to Antibiotics

<table>
<thead>
<tr>
<th></th>
<th>Amox/clav</th>
<th>Cefaz</th>
<th>Cipro</th>
<th>Doxy</th>
<th>Fosfo</th>
<th>Nitro</th>
<th>Tmp/Smz</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>S</strong></td>
<td>Pending</td>
<td>ND</td>
<td>25</td>
<td>40</td>
<td><strong>90</strong></td>
<td>90</td>
<td>ND</td>
</tr>
<tr>
<td><strong>I</strong></td>
<td>Pending</td>
<td>ND</td>
<td>45</td>
<td>55</td>
<td>10</td>
<td>10</td>
<td>ND</td>
</tr>
<tr>
<td><strong>R</strong></td>
<td>Pending</td>
<td>ND</td>
<td>30</td>
<td>5</td>
<td>0</td>
<td>0</td>
<td>ND</td>
</tr>
<tr>
<td><strong>Sum</strong></td>
<td>Pending</td>
<td>ND</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>ND</td>
</tr>
</tbody>
</table>

Fosfomycin sensitivity performed by Dr. Dwight Hardy at the University of Rochester Microbiology Lab.
<table>
<thead>
<tr>
<th>Line</th>
<th>Agent</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>1&lt;sup&gt;st&lt;/sup&gt; line</td>
<td>TMP-SMX</td>
<td>- Patient should receive 1 dose of IV/IM ceftriaxone prior to starting oral therapy</td>
</tr>
<tr>
<td>2&lt;sup&gt;nd&lt;/sup&gt; line</td>
<td>Ciprofloxacin</td>
<td>- If patient unable to tolerate TMP/SMX</td>
</tr>
</tbody>
</table>
| 3<sup>rd</sup> line | Beta-lactams | - Data suggests that oral beta-lactams are inferior to TMP/SMX or fluoroquinolones for pyelonephritis  
- Initial dose of IV/IM ceftriaxone and longer treatment duration of 10-14 days are recommended |
| 1\textsuperscript{st} line | Ceftriaxone | Can be used safely in patients with mild penicillin allergy (i.e. rash), cross-reactivity very low |
| 2\textsuperscript{nd} line | Gentamicin | ONLY in patients who need parenteral therapy and have severe IgE mediated penicillin allergy |
|  |  | • Significant nephrotoxicity/ototoxicity concerns |
## UTI Treatment Duration

<table>
<thead>
<tr>
<th>UTI Location</th>
<th>Agent</th>
<th>Duration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Uncomplicated UTI</td>
<td>TMP/SMX</td>
<td>3 days</td>
</tr>
<tr>
<td></td>
<td>quinolones</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Nitrofurantoin, β lactam</td>
<td>5 days</td>
</tr>
<tr>
<td>Complicated UTI</td>
<td>Any agent</td>
<td>7 days if rapid improvement</td>
</tr>
<tr>
<td></td>
<td></td>
<td>10-14 days for delayed response</td>
</tr>
<tr>
<td>Pyelonephritis</td>
<td>quinolones</td>
<td>5-7 days</td>
</tr>
<tr>
<td></td>
<td>TMP/SMX</td>
<td>10-14 days</td>
</tr>
<tr>
<td></td>
<td>β lactam</td>
<td></td>
</tr>
<tr>
<td>Catheter related UTI</td>
<td></td>
<td>7 days if rapid improvement</td>
</tr>
<tr>
<td></td>
<td></td>
<td>10-14 days if delayed response</td>
</tr>
</tbody>
</table>

Gupta et al. Clinical Infectious Diseases 2011;52(5):e103–e120
Grigoryan L, et al. JAMA 2014;312(16):1677-1684
## Respiratory Tract Infections

<table>
<thead>
<tr>
<th></th>
<th>Signs and symptoms</th>
<th>Antibiotics</th>
</tr>
</thead>
</table>
| **Upper Respiratory Tract infection (URTI)** | Runny nose  
Sore throat  
cervical lymphadenopathy  
Dry cough | ✗           |
| **Influenza like illness** | Fever with increased cough, headache, myalgia, sore throat                           | ✗           |
| **Bronchitis No COPD**    | New or worsening cough  
Sputum production                                                                      | ✗           |
| **COPD exacerbation**     | New or worsening cough and sputum production                                         | ✗ ✗         |
| **Pneumonia (bacterial)** | New or worsening cough, sputum production, shortness of breath  
pleuritic chest pain, HR > 125/min  
RR> 24/min, fever, O2 saturation <94%  
and + CXR                      | ✗ ✗         |
Nursing Home Pneumonia

- Represents 13–48% of all infections
- Incidence: 0.6-2.6 per 100 residents days
- Leading cause of mortality
- Primary reason for resident transfer to the hospital
- Manifestation is atypical
- Aspiration pneumonia is common

El-Solh A. Current Medical Research and Opinion, 2010; 26: 2707–2714
Healthcare Associated Pneumonia (HCAP)

HCAP: is defined as pneumonia that occurs in a nonhospitalized patient with extensive healthcare contact, as defined by one or more of the following:

1. Intravenous therapy, wound care, or intravenous chemotherapy within the prior 30 days
2. **Residence in a nursing home or other long-term care facility**
3. Hospitalization in an acute care hospital for two or more days within the prior 90 days
4. Attendance at a hospital or hemodialysis clinic within the prior 30 days

Survival and Comfort After Treatment of Pneumonia in Advanced Dementia

Survival after suspected pneumonia episode, by treatment: no antimicrobial agents, oral antimicrobial agents, intramuscular antimicrobial agents, and intravenous antimicrobial agents or hospitalization. Adjusted for age, sex, race, functional status (Bedford Alzheimer Nursing Severity Subscale), suspected aspiration, congestive heart failure, hospice referral, chest radiograph obtained, do-not-hospitalize order, and unstable vital signs.

Figure Legend:

Controversy Regarding Optimal Treatment for Nursing Home Acquired Pneumonia (NHAP)

• 2005 American Thoracic Society (ATS)/IDSA guidelines placed NHAP in the healthcare associated category and recommending triple regimens

• New studies suggest that organisms more typical of Community Acquired Pneumonia pathogens

• Treatment should be based on risks for Multidrug Resistant organisms (MDRO):
  • Recent hospitalization
  • Colonization with MDRO
  • Very low functional status
  • High prevalence of MDRO in facility

Pneumonia Treatment (2 Rochester NH)
## Suggested Pneumonia Treatment

**No Risk for MDRO**

<table>
<thead>
<tr>
<th></th>
<th>Agents</th>
<th>Dosing</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1st line</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mild</td>
<td>Azithromycin or Doxycycline</td>
<td>500mg PO for 3 days</td>
</tr>
<tr>
<td>Moderate*</td>
<td>Amoxicillin</td>
<td>1 gm PO 3 times a day x 7d</td>
</tr>
<tr>
<td></td>
<td>Cefuroxime</td>
<td>500mg PO twice daily x 7d</td>
</tr>
<tr>
<td></td>
<td>Cefpodoxime</td>
<td>200mg or 400mg PO BID x 7d</td>
</tr>
<tr>
<td></td>
<td>Amoxicillin/Clavulanate</td>
<td>2 gm twice daily x 7d</td>
</tr>
<tr>
<td>Moderate to severe*</td>
<td>Ceftriaxone</td>
<td>1gm IM q day (switch to oral when improved, afebrile, can take oral meds)</td>
</tr>
<tr>
<td><strong>2nd line</strong></td>
<td>Levofloxacin</td>
<td>500- 750mg PO Q24H x 7d</td>
</tr>
<tr>
<td></td>
<td>Moxifloxacin</td>
<td>400mg PO Q24H x 7d</td>
</tr>
</tbody>
</table>

*Consider combination with azithromycin or doxycycline*

SKIN INFECTIONS AND MRSA
Suspected Skin and Soft Tissue Infection

• New or increasing purulent drainage at a wound, skin, or soft-tissue site

or

• At least 2 of the following:
  • Fever (>37.9°C [100°F] or a 1.5°C [2.4°F] increase above baseline temperature)
  • Redness
  • Tenderness
  • Warmth
  • New or increasing swelling
Colonization vs Infection

Important to differentiate between Colonization and Infection:

• **Colonization**: When an organism lives on your skin but not causing disease

• **Infection**: When the organisms on your skin invade though a break in your skin, multiply and **cause disease**
Differentiate Between Cellulitis and Non-Infectious Reasons for Red Leg

Images [http://www.consultantlive.com](http://www.consultantlive.com)  

Stasis dermatitis  
Cellulitis
Purulent and Non Purulent Cellulitis

Photo Credit: Major Kirk Waibel, MD

MRSA skin abscess
Practice Guidelines for the Diagnosis and Management of Skin and Soft Tissue Infections: 2014 Update by the Infectious Diseases Society of America

Dennis L. Stevens,1 Alan L. Bisno,2 Henry F. Chambers,3 E. Patchen Dellinger,4 Ellie J. C. Goldstein,5 Sherwood L. Gorbach,6 Jan V. Hirschmann,7 Sheldon L. Kaplan,8 Jose G. Montoya,9 and James C. Wade10

1Division of Infectious Diseases, Department of Veterans Affairs, Boise, Idaho; 2Medical Service, Miami Veterans Affairs Health Care System, Florida; 3San Francisco General Hospital, University of California; 4Division of General Surgery, University of Washington, Seattle; 5University of California, Los Angeles, School of Medicine, and R. M. Alden Research Laboratory, Santa Monica, California; 6Department of Community Health, Tufts University, Boston, Massachusetts; 7Medical Service, Puget Sound Veterans Affairs Medical Center, Seattle, Washington; 8Department of Pediatrics, Baylor College of Medicine, Houston, Texas; 9Department of Medicine, Stanford University, California; and 10Geisinger Health System, Geisinger Cancer Institute, Danville, Pennsylvania

A panel of national experts was convened by the Infectious Diseases Society of America (IDSA) to update the 2005 guidelines for the treatment of skin and soft tissue infections (SSTIs). The panel’s recommendations were developed to be concordant with the recently published IDSA guidelines for the treatment of methicillin-resistant Staphylococcus aureus infections. The focus of this guideline is the diagnosis and appropriate treatment of diverse SSTIs ranging from minor superficial infections to life-threatening infections such as necrotizing fasciitis. In addition, because of an increasing number of immunocompromised hosts worldwide, the guideline addresses the wide array of SSTIs that occur in this population. These guidelines emphasize the importance of clinical skills in promptly diagnosing SSTIs, identifying the pathogen, and administering effective treatments in a timely fashion.
Purulent skin and soft tissue infections (SSTIs).

**MANAGEMENT OF SSTIs**

- **NONPURULENT**
  - Necrotizing Infection / Cellulitis / Erysipelas
    - Severe
    - Moderate
    - Mild
    - **EMERGENT SURGICAL INSPECTION / DEBRIDEMENT**
    - Rule out necrotizing process
    - **EMPIRIC Rx**
      - Vancomycin PLUS Piperacillin/Tazobactam
    - C & S

- **PURULENT**
  - Furuncle / Carbuncle / Abscess
    - Severe
    - Moderate
    - Mild
    - **EMPIRIC Rx**
      - Vancomycin or Daptomycin or Linezolid or Televancin or Ceftaroline
    - C & S

**DEFINED Rx (Necrotizing Infections)**

- **Monomicrobial** Streptococcus pyogenes
  - Penicillin PLUS Clindamycin
  - Clostridial sp.
  - Penicillin PLUS Clindamycin
  - Vibrio vulnificus
    - Doxycycline PLUS Ceftazidime
  - Aeromonas hydrophila
    - Doxycycline PLUS Ciprofloxacin

- **Polymicrobial**
  - Vancomycin PLUS Piperacillin/Tazobactam

**EMPIRIC Rx**

- Vancomycin or Daptomycin or Linezolid or Televancin or Ceftaroline

**DEFINED Rx**

- MRSA
  - See Empiric MSSA
  - Nafcillin or Cefazolin or Clindamycin
- MSSA
  - TMP/SMX or Doxycycline
  - Dicloxacillin or Cephalexin

1 Since daptomycin and televancin are not approved for use in children, vancomycin is recommended; clindamycin may be used if clindamycin resistance is <10-15% at the institution.

# Treatment for Cellulitis

<table>
<thead>
<tr>
<th>Drug</th>
<th>Regimen</th>
<th>Indication</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Amoxicillin</strong></td>
<td>500mg PO TID  &lt;br&gt; <strong>Dose Adjustment:</strong>  &lt;br&gt; CrCl 10-30 = 500mg BID  &lt;br&gt; CrCl &lt;10 = 500mg Q Day</td>
<td>Use for <strong>Strep</strong> Infections</td>
</tr>
<tr>
<td><strong>Dicloxacillin</strong></td>
<td>500mg PO q6h  &lt;br&gt; <strong>Dose Adjustment:</strong> None</td>
<td>Good for <strong>Strep</strong> or <strong>MSSA</strong></td>
</tr>
<tr>
<td><strong>Cephalexin</strong></td>
<td>500mg PO q6h  &lt;br&gt; <strong>Dose Adjustment:</strong>  &lt;br&gt; CrCl 10-50 = 500mg q8-12h  &lt;br&gt; CrCl &lt;10 = 250mg – 500mg q12-24h</td>
<td>Can use to treat <strong>Strep</strong> or <strong>MSSA</strong></td>
</tr>
<tr>
<td><strong>TMX/SMX</strong></td>
<td>1-2 DS tab PO BID  &lt;br&gt; <strong>Dose Adjustment:</strong>  &lt;br&gt; CrCl 15-30 = 50% of dose  &lt;br&gt; CrCl &lt;15 = do not use</td>
<td>Use for <strong>MRSA (if susceptible)</strong>  &lt;br&gt; <strong>Not a good option for Strep infections!</strong></td>
</tr>
<tr>
<td><strong>Clindamycin</strong></td>
<td>450mg PO TID</td>
<td>Use for <strong>Strep</strong> or <strong>MRSA</strong>  &lt;br&gt; <strong>Caution:</strong> High risk of C. Diff. Only use if not other options available</td>
</tr>
</tbody>
</table>
HOW TO USE GUIDELINES TO ASSESS ANTIBIOTIC TREATMENT APPROPRIATENESS
**Antimicrobial Appropriateness**

<table>
<thead>
<tr>
<th>Assessment</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Appropriate diagnosis</strong></td>
<td></td>
</tr>
<tr>
<td>1. Treatment of asymptomatic bacteriuria</td>
<td></td>
</tr>
<tr>
<td><strong>Appropriate antibiotic prescription</strong></td>
<td></td>
</tr>
<tr>
<td>2. Empiric choice according to guidelines</td>
<td>Consider of previous cultures, allergies and renal function</td>
</tr>
<tr>
<td>3. Appropriate dose</td>
<td>Adjusted for renal function</td>
</tr>
<tr>
<td>4. Appropriate duration</td>
<td>According to site of infection and clinical response</td>
</tr>
<tr>
<td>5. Antibiotic adjusted according to culture result and antibiotic sensitivity</td>
<td></td>
</tr>
</tbody>
</table>
### Resident without indwelling catheter*

- Acute dysuria alone OR
- Fever + at least one of the symptoms below (new or increased) OR
- If no fever, at least two of the symptoms below (new or increased) OR
  - Urgency
  - Frequency
  - Suprapubic pain
  - Gross hematuria
  - Costovertebral angle tenderness
  - New urinary incontinence

*Mental status changes alone are not specific enough to identify symptomatic urinary tract infection.

### Resident with indwelling catheter

- At least one of the symptoms below (new or increased)
  - Fever
  - Costovertebral angle (CVA) tenderness
  - Rigors (shaking chills)
  - Delirium
  - Flank pain (back, side pain)
  - Pelvic discomfort
  - Acute hematuria
  - Malaise or lethargy with no other cause

### Treated at time of culture (empiric)

- Name of empiric antibiotic

- If an organism was isolated by culture, was it susceptible to the prescribed empiric antibiotic? (PLEASE CHECK ANTIBiotic SUSCEPTIBILITY REPORT) __Yes__ __No__ __Unknown__

- If NO, was the antibiotic changed? __Yes__ __No__ __Unknown__ __N/A__

- Name of antibiotic

- Was empiric antibiotic stopped if no organism was isolated by culture? __Yes__ __No__ __Unknown__ __N/A__

- Was the antibiotic used changed to a narrow therapeutic medication? __Yes__ __No__ __Unknown__ __N/A__

### Treated at time of culture (targeted)

- Name of targeted antibiotic

- Is the organism isolated by culture susceptible to the prescribed targeted antibiotic? (PLEASE CHECK ANTIBiotic SUSCEPTIBILITY REPORT) __Yes__ __No__ __Unknown__ __N/A__

- Was the antibiotic used a quinolone? __Yes__ __No__

- If yes, were there other options on the sensitivities report? __Yes__ __No__

- Was resident evaluated for continued symptoms prior to starting antibiotics? __Yes__ __No__ __Unknown__ __N/A__

### Was the duration of therapy appropriate? __Yes__ __No__ __Unknown__

**Suggestions:**

________________________

Thank You, ___________________ Signature of Pharmacist

Please contact me in the Pharmacy (ext 6108) if additional information is required on the matter.

**RESPONSE:** The above comments or suggestions were reviewed by me and my response is:

________Agree and have taken follow-up action. _______Don’t Agree _______Will Review and Respond. _______See following comments: ________________

________________________

Signature of Physician/NP/PA

**PLEASE RETURN TO THE PHARMACY WHEN COMPLETED**
## Example of a tracking sheet of UTI treatment

<table>
<thead>
<tr>
<th>Name</th>
<th>Antibiotic</th>
<th>Duration</th>
<th>Dose</th>
<th>Min symptoms criteria met</th>
<th>Warning signs</th>
<th>Pyuria present</th>
<th>Culture result</th>
<th>Treatment according to guidelines</th>
<th>Recommendation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mary Jones</td>
<td>Ciprofloxacin</td>
<td>10</td>
<td>500 mg</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
<td>50,000 Proteus</td>
<td>No</td>
<td>Stop antibiotic</td>
</tr>
<tr>
<td>John Rogers</td>
<td>nitrofurantoin</td>
<td>5</td>
<td>100 mg</td>
<td>yes</td>
<td>no</td>
<td>Yes</td>
<td>&gt;100,000 E. coli</td>
<td>yes</td>
<td>none</td>
</tr>
</tbody>
</table>
QUESTIONS