



antibiogramDSM

Choosing Antibiotics Based on Local Resistance



A Focus on Outpatient Management

Presenters

- **Benjamin Williamson, BS-Health Sciences, MPH
Candidate**

Des Moines University

- **Andrew Miesner, PharmD, BCPS**

Associate Professor of Pharmacy Practice

Drake University College of Pharmacy & Health Sciences

Clinical Pharmacist

Broadlawns Medical Center

- **Amanda Bushman, PharmD, BCPS-AQ ID, BCIDP**

Infectious Disease Pharmacist

UnityPoint Health - Des Moines

Disclosures

This program is supported by a grant from the Society of Infectious Disease Pharmacists.

Off-label uses of some antibiotics will be discussed during the presentation.

Speaker conflicts of interest

-Ben Williamson: none

-Dr. Miesner: none

-Dr. Bushman: none

Objectives

- Explain how to interpret an antibiogram and its role in empiric antibiotic selection.
- Recall current outpatient treatment recommendations for urinary tract infections, community-acquired pneumonia, sinusitis, and diverticulitis.
- Apply local resistance patterns to a patient case and select appropriate empiric pharmacotherapy.

Antibiograms

- Graphical reports representing the percentage of isolates of various bacteria that are susceptible to different antibiotics over a defined period of time (usually a year)
- Antibiograms serve two main purposes:
 - Guiding clinicians in the selection of empiric antibiotics for suspected bacterial infections
 - Monitoring the development of antibiotic resistance over time
- To aid in consistency and ensure similar reporting standards across institutions, the Clinical Laboratory and Standards Institute (CLSI) has developed standards for antibiogram development and presentation - guidelines known as M39-A4

Antibiogram Standards - Overview

- Only susceptible organisms are reported, not intermediate or resistant organisms
 - Viridans streptococcus against penicillin is an exception
- Only clinical cultures are reported, not surveillance cultures or rapid tests
- Unless specified, it doesn't matter what tissue or site the culture was obtained from
- If duplicate cultures are obtained from the same patient, only the first is included
- Organisms with less than 30 isolates are excluded
 - They may also be included with a footnote to note the low isolate count
- When an organism is reported to be sensitive or resistant, that doesn't mean that all organisms actually underwent testing. Some labs use "cascading" rules. For example, if an E. coli isolate is susceptible to cefazolin, it will also be susceptible to all other cephalosporins, so they will automatically be reported as susceptible at that point.
- Methicillin sensitive and methicillin resistant staphylococcus aureus are to be reported separately

AntibiogramDSM - Navigating an Antibiogram

- To locate the susceptibility for a specific drug-organism combination, find the row representing the organism you are interested in, and the column containing the drug
 - By default, the antibiogram is filtered to the year 2019
 - You can select a different year or multiple years using the filter at the bottom of the page
- In the pictured example, we can see that *E. coli* was susceptible to Ceftriaxone in 94% of 2019 isolates

			Cephalosporins		
			Cefazolin	Ceftriaxone	Cefuroxime
Gram Stain	Genus	Species			
Gram Negative	Enterobact..	cloacae		73%	
	Escherichia	coli	82%	94%	89%
	Klebsiella	pneumoniae	89%	96%	92%
	Proteus	mirabilis	15%	96%	
Gram Positive	Enterococc..	faecalis			
		unspeciated			
	Staphyloco..	aureus (MR..)			
		aureus (MS..)	100%		
	Streptococ..	pneumoniae		100%	

AntibiogramDSM - Things to Note

- Isolate values are not listed aside each organism in AntibiogramDSM because it is a combined community antibiogram, and some isolate totals may differ depending on which susceptibilities hospital systems report
 - Instead, you can find this information by hovering over each cell
- AntibiogramDSM represents four different hospital systems in the Des Moines metro
 - Bacterial resistance may vary from region to region, so this tool's utility may vary outside of central Iowa
- Data included is a mix of inpatient and outpatient data, which may cause some resistances to be overestimated as bacterial resistance can be more problematic in hospital settings

Outpatient Disease States & Our Resistance Patterns

- Infectious diseases make up 15.5 million clinic visits and 4.1 million emergency department (ED) visits per year in the US
- Many outpatient providers are left without adequate decision support when they do not have access to an antibiogram and treatment guidelines are highly reliant on “resistance patterns in the community”
 - Urinary Tract Infections (UTI)
 - Diverticulitis
 - Community-acquired Pneumonia (CAP)
 - Acute Bacterial Sinusitis (ABS)

Urinary Tract Infection : Case Question

A 66 year old female with a history of atrial fibrillation and hypertension comes to your clinic complaining of nausea and flank pain. She has experienced severe dysuria for the past three days.

A urine dipstick test is performed in clinic which is positive for nitrites and leukocyte esterase. A full culture and sensitivity is sent with her urine sample, but you feel that she could be treated on an outpatient basis.

Her medications include sotalol, warfarin, and lisinopril. Which of the following regimens would be best?

- A. Levofloxacin 750mg orally daily for 5 days
- B. Ceftriaxone 1gm intramuscularly now, followed by cephalexin 500mg orally four times daily for 10 days
- C. Ceftriaxone 1gm intramuscularly now, followed by ciprofloxacin 500mg twice daily for 7 days
- D. Trimethoprim/sulfamethoxazole one DS tablet twice daily for 14 days

Urinary Tract Infections

- Most common reason for antimicrobials to be prescribed to women
- Generally categorized into “complicated” and “uncomplicated” cystitis and pyelonephritis
 - Uncomplicated generally includes non-pregnant, premenopausal women
 - Complicated is heterogenous group of those with structural abnormalities (catheterized, strictures, stones), those with limited data (men and children), and pregnancy
- Etiology
 - *E. coli* – 75%
 - *S. saprophyticus* – 6%
 - *K. pneumoniae* – 6%
 - <5% – Group B Streptococcus (*S. agalacticae*), *P. mirabilis*, enterococcus, enterobacter

Urinary Tract Infections

- Guideline recommendations for outpatient pharmacotherapy
 - **Asymptomatic**
 - *SYMPTOM-FREE PEE... LET IT BE.*
 - Exceptions: pregnancy and endoscopic urologic procedures associated with mucosal trauma
 - One generally cannot diagnose based on a urinalysis alone!
 - Mental status changes in absence of urinary symptoms not indicate a UTI.
 - Foul smelling or cloudy urine does not indicate a UTI.

Clin Infect Dis. 2019;68(10):1611–5
<https://www.ammi.ca/?ID=127#Toolkit>

Symptom-Free Pee: LET IT BE

A national initiative to stop inappropriate antibiotic use for asymptomatic bacteriuria in elderly patients.

STOP

STOP treating asymptomatic bacteriuria; it is not an infection
STOP testing foul-smelling, dark, or cloudy urine

WAIT

WAIT and rehydrate patients who develop changes in mental status, behaviour, or function without typical urinary tract infection symptoms

GO

GO to urinalysis and urine culture if typical signs and symptoms of urinary tract infection are present

For more directions and guidance:
www.ammi.ca
#SymptomFreeLetItBe



Urinary Tract Infections

- Guideline recommendations for outpatient pharmacotherapy
 - Uncomplicated Cystitis
 - **Do not use agents empirically if >20% uropathogen resistance (B-III)**
 - TMP/SMX x3 days (A-I)
 - Nitrofurantoin x5 days (A-I)
 - Alternatives
 - Fosfomycin x1 day is an alternative, but may be inferior to other regimens (A-I)
 - Levofloxacin, ciprofloxacin, ofloxacin x3 days have a propensity for collateral damage and should be reserved for important uses other than acute cystitis (A-I)
 - Beta-lactam regimens: amoxicillin/clavulanate, cefdinir, cefaclor, or cephalexin x5-7 days or cefpodoxime x3 days (B-I), may be less effective than above agents but may be useful in situations such as resistance

Urinary Tract Infections

- Guideline recommendations for outpatient pharmacotherapy
 - Uncomplicated Pyelonephritis
 - **Agents should generally have ≤10% uropathogen resistance rate**
 - If treating as an outpatient and selecting an agent with >10% resistance, administer a one-time dose of IV/IM ceftriaxone or gentamicin/tobramycin (B-III)
 - Ciprofloxacin x7 days or Levofloxacin 750mg x5 days (A-I)
 - TMP/SMX x14 days (if organism is known susceptible) (A-I)
 - Recent studies suggest a 7 day course is adequate
 - Beta-lactam regimens are reasonable, but may be less effective as above options (B-III)
 - Usually 2nd/3rd generation cephalosporins

Urinary Tract Infections

- **Antibiogram DSM *E. coli* susceptibility in 2019**

- Nitrofurantoin: **99%**
- Ceftriaxone: **94%**
 - surrogate for cefdinir and cefpodoxime
- Cefazolin: **82%**
 - surrogate for cephalexin
 - Note that urine-only sensitivities are higher than reported on the antibiogram (**approximately 90%**) due to lower breakpoints in uncomplicated cystitis
- Levofloxacin: **81%**
- TMP/SMX: **78%**
- Ciprofloxacin: **75%**



Urinary Tract Infections

- **Local recommendations** for outpatient pharmacotherapy
 - Uncomplicated cystitis (considering the 20% rule)
 - 1st line: Nitrofurantoin x5 days
 - Alternative: Cephalexin x5-7 days, cefdinir x5-7 days, or cefpodoxime x3 days may be reasonable next step due to better susceptibilities than guideline options
 - TMP/SMX should be limited to use when cultures are already available
 - Consider delayed therapy
 - Fosfomycin x1 day is an alternative, but can be costly and local susceptibilities are not known
 - Fluoroquinolones should be avoided due to high resistance rates and potential for collateral damage

Urinary Tract Infections

- Local recommendations for outpatient pharmacotherapy
 - Uncomplicated Pyelonephritis considering the 10% rule
 - 1st Line: Cefdinir or cefpodoxime x10 days
 - High sensitivity, no need for initial parenteral therapy if tolerating oral intake
 - Alternative: *Administer a one-time dose of IV/IM ceftriaxone before below options*
 - Cephalexin 500mg four times daily x10 days
 - Ciprofloxacin x7 days or Levofloxacin 750mg x5 days
 - TMP/SMX x7-14 days (if organism is known susceptible)
 - Will need to obtain culture and follow up if using above options

Urinary Tract Infection : Case Question

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- D. Trimethoprim/sulfamethoxazole one DS tablet twice daily for 14 days

Diverticulitis: Case Question

Which of the following patients with left-sided diverticulitis is **most likely to experience benefit from antibiotics** and can be treated in the outpatient setting?

- A. A 56 year old male with minimal nausea, sigmoid diverticulitis on CT without abscess
- B. A 49 year old female with mild nausea (but tolerating liquids), moderate abdominal tenderness on exam, with CRP = 2mg/dL and a CT showing no abscess
- C. A 67 year old female with a fever, leukocytosis, and confusion, with a CT showing a small intra-abdominal abscess
- D. A 59 year old male with a history of acute diverticulitis two years ago, mild abdominal tenderness and no nausea, CT not obtained

Diverticulitis

- Historically most patients have been admitted to the hospital for diverticulitis
 - 340,000 emergency visits per year in the US
 - Recent studies demonstrate that treatment failure in the outpatient setting for uncomplicated diverticulitis is low (3-5%)
- Outpatient treatment can be considered in patients with mild symptoms, able to maintain oral intake, no signs of peritonitis or abscess, and an adequate support system at home
 - Suggest clear liquid diet, rest, and follow up in 2-3 days
 - Higher outpatient failure for females, free fluid seen on abdominal CT, and significant chronic comorbidities
- What about antibiotics?

Diverticulitis

- Antibiotics are historically standard of therapy for diverticulitis, but multiple studies show no reduction in symptoms, complications, or recurrence for left-sided, uncomplicated diverticulitis
 - More recent studies show that that this finding is also consistent in the outpatient setting
- Guideline recommendations:
 - **American Gastroenterological Association (2015):** Antibiotics should be used selectively, rather than routinely, in patients with acute uncomplicated diverticulitis.
 - **Surgical Infections Society (2017):** Consider deferral of antibiotic therapy in lower-risk patients with uncomplicated acute colonic diverticulitis.
 - **American Society of Colon and Rectal Surgeons (2020):** Selected patients with uncomplicated diverticulitis can be treated without antibiotics. Nonoperative treatment of diverticulitis *may* include antibiotics
- In outpatient settings, limit antibiotics to those patients with moderate symptoms (i.e. poor oral tolerance), persistent symptoms after 3 days, or elevated CRP (>1.7mg/dL)

Diverticulitis

- No standard recommended therapy for outpatient management.
 - Antibiotic coverage should include Gram-negative organisms (esp. *E. coli*) and anaerobes
- Recommended outpatient options:
 - Amoxicillin-clavulanate
 - Moxifloxacin
 - Metronidazole plus one of the following:
 - Levofloxacin or ciprofloxacin
 - Trimethoprim/sulfamethoxazole
 - 1st, 2nd, or 3rd generation cephalosporins
- For intraabdominal infections, if >10-20% resistance to *E. coli* in the community, guidelines recommend culture and sensitivities to be obtained, but not an option in most cases of diverticulitis
- Fluoroquinolones should be avoided if >10% resistance
- Cefoxitin and clindamycin should not be used due to their anaerobic resistance patterns
- Generally uncomplicated diverticulitis is treated for 4-7 days
 - 4 days is as effective as 7 days, but this duration was studied in the inpatient setting with IV agents

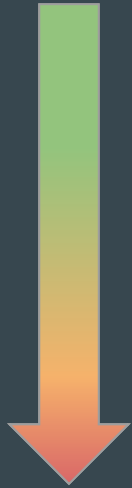
Surg Infect (Larchmt). 2017;18(1):1-76

Clin Infect Dis. 2010; 50:133-64

Int J Colorectal Dis. 2010;25(6):751-9.

Diverticulitis

- Antibiogram DSM *E. coli* susceptibility in 2019:
 - Ceftriaxone: **94%**
 - Surrogate for cefdinir and cefpodoxime
 - Amoxicillin/clavulanate: **88%**
 - Cefazolin: **82%**
 - Surrogate for cephalexin
 - Levofloxacin: **81%**
 - TMP/SMX: **78%**
 - Ciprofloxacin: **75%**



Diverticulitis

- **Local recommendations** for outpatient pharmacotherapy
 - Defer antibiotics until follow up after 2-3 days in mild disease.
 - Consider antibiotics only in failed conservative approach in mild disease or in moderate disease (poor oral intake, elevated CRP)
 - 1st line: Amoxicillin/clavulanate for 4-7 days
 - Alternative Cefdinir or cefpodoxime + metronidazole for 4-7 days

Diverticulitis: Case Question

Which of the following patients with left-sided diverticulitis is **most likely to experience benefit from antibiotics** and can be treated in the outpatient setting?

- A. A 56 year old male with minimal nausea, sigmoid diverticulitis on CT without abscess
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- D. A 59 year old male with a history of acute diverticulitis two years ago, mild abdominal tenderness and no nausea, CT not obtained

Antibiotic Reminders

- A few urinary / GI antibiotic pearls:
 - Nitrofurantoin
 - Package labeling suggests contraindicated if CrCL <60mL/min, but recent evidence suggests efficacy as low as CrCL of 30mL/min
 - Not useful outside of cystitis
 - Often covers ESBL producing *E. coli*
 - Fluoroquinolones
 - Carry FDA BlackBox warning related to severe adverse effects (tendonitis/tendon rupture, neuropathies, central nervous system effects, and myopathies) and **avoidance in uncomplicated cystitis, sinusitis, and bronchitis** unless no other options are available
 - Other major issues: dysglycemia, QTc prolongation, high risk for *C. difficile*
 - Moxifloxacin can NOT be used in UTIs due to poor urinary concentrations, but has expanded anaerobic coverage and can be used monotherapy in diverticulitis
 - TMP/SMX
 - Many under recognized drug interactions: ACE inhibitors / ARBs, warfarin, glyburide

Community-Acquired Pneumonia: Case Question

AB is a 42 y/o female who presents with cough, runny nose and shortness of breath. The patient has nkda and has no significant past medical history. As the provider you determine that the based on the IDSA CAP guidelines and the local DSM antibiogram what treatment option should be prescribed:

- A. Amoxicillin/ Clavulanate 875 mg 1 tablet by mouth daily for 5 days and azithromycin 500 mg by mouth x 1 and then 250 mg po daily x 4 days.
- B. Amoxicillin 1000 mg by mouth three times daily for 5 days
- C. Azithromycin 500 mg by mouth x 1 and then 250 mg po daily x 4 days.

Community-Acquired Pneumonia

- 1.7 million emergency visits per year in United States
- Use of CURB-65 or Pneumonia Severity Index (preferred) plus clinical judgment can assist in identifying outpatient treatment candidates
 - CURB-65 <2 or PSI Class I or II are often good candidates for outpatient treatment
- Bacterial causes vary in the treatment setting:
 - ***Streptococcus pneumoniae* (27%)**
 - *Haemophilus influenzae*
 - *Moraxella catarrhalis*
 - *Mycoplasma pneumoniae*
 - *Chlamydomphila pneumoniae*
 - ***Legionella* species**
 - ***Staphylococcus aureus***

https://www.cdc.gov/nchs/data/nhamcs/web_tables/2016_ed_web_tables.pdf

Clin Infect Dis. 2007; 44:S27–72

Am J Respir Crit Care Med. 2019;200:e45–e67.

Community-Acquired Pneumonia

- Treatment selection dependent on absence/presence of major comorbidities or risks for resistant organisms:
 - Comorbidities include: Chronic heart disease, Chronic lung disease, Chronic renal or liver disease, Diabetes, Alcoholism, Malignancy, Asplenia
 - Pseudomonas or MRSA risks: prior isolation or IV antibiotics in the past 90 days
 - Generally severe infections and less likely to be treated outpatient
- Patient with comorbidities should receive more broad spectrum agents
 - More vulnerable to poor outcomes if initial treatment is inadequate
 - Risk factors for potential antibiotic resistant organisms
- **Healthy Adult Outpatient:** single, narrow spectrum agent
- **Patients with comorbidities:** combination therapy or respiratory fluoroquinolone
 - Should effectively target resistant *s. pneumoniae*, β -lactamase producing *H. influenzae*, Enteric Gram negative bacilli, MSSA, and atypicals (*M. pneumoniae*, *C. pneumoniae*)

Community-Acquired Pneumonia

Guideline Recommendations for Healthy Outpatients

- **Amoxicillin** 1 gram orally three times daily x 5 days (*strong recommendation, moderate quality of evidence*)
 - Included based on studies which showed efficacy of monotherapy in inpatient CAP in low severity patients (CURB-65 = 0-1) despite lack of atypical organism coverage
 - Long track record of safety
 - **Doxycycline** 100 mg orally two times daily x 5 days (*conditional recommendation, low quality evidence*)
 - Limited clinical evidence, but broad spectrum of activity against CAP pathogens
 - **Macrolides**
 - Azithromycin 500 mg orally x 1 then 250 mg daily x 4 additional days or
 - Clarithromycin 500 mg orally two times daily x 5 days or
 - Clarithromycin ER 1000 mg daily x 5 days (*conditional recommendation, moderate quality evidence*)*
- * Macrolides should only be used in areas with pneumococcal resistance < 25%
- Due to resistant *S. pneumoniae* treatment failures, monotherapy is not recommended

Community-Acquired Pneumonia

Guideline Recommendations for Outpatient Adults with Comorbidities:

- Combination Therapy for 5 days: (*conditional recommendation, low quality of evidence*)
 - Amoxicillin/Clavulanate *or*
 - Cefpodoxime *or*
 - Cefuroxime

PLUS

 - Azithromycin *or*
 - Clarithromycin *or*
 - Doxycycline
 - Provides atypical organism coverage, *S. pneumoniae* coverage is inconsequential
- Monotherapy - Respiratory Fluoroquinolone (*Strong recommendation, moderate quality of evidence*)
 - Levofloxacin 750 mg orally daily x 5 days or
 - Moxifloxacin 400 mg orally daily x 5 days or
 - Gemifloxacin 320 mg orally daily x 5 days

Community-Acquired Pneumonia

- Antibiogram DSM *S. pneumoniae* 2019 susceptibility:
 - Ceftriaxone: **100%**
 - Surrogate for cefuroxime and cefpodoxime
 - Levofloxacin: **99%**
 - Penicillin: **93%**
 - Surrogate for amoxicillin
 - Doxycycline: **76%**
 - Azithromycin: **53%** (2018)
 - Erythromycin: **38%**



Community-Acquired Pneumonia

- **Local recommendations** for outpatient pharmacotherapy
 - Healthy Patients
 - Amoxicillin 1gm three times daily for 5 days
 - Alternative: Doxycycline 100mg twice daily for 5 days
 - Patients with comorbidities
 - [Amoxicillin/clavulanate or cefpodoxime] + [azithromycin or doxycycline] for 5 days
 - Levofloxacin 750mg daily or moxifloxacin 400mg daily for 5 days

Community-Acquired Pneumonia: Case Question

AB is a 42 y/o female who presents with cough, runny nose and shortness of breath. The patient has nkda and has no significant past medical history. As the provider you determine that the based on the IDSA CAP guidelines and the local DSM antibiogram what treatment option should be prescribed:

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- B. Amoxicillin 1000 mg by mouth three times daily for 5 days
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Acute Bacterial Sinusitis: Case Question

Which of the following patients with acute bacterial sinusitis should be treated with antibiotics?

- A. A 6-year-old female with headaches and purulent nasal discharge for 3 days
- B. A 46-year-old female with nasal discharge and sinus pressure for 5 days who has had 2 episodes of bacterial sinusitis in the past 18 months
- C. A 25-year-old male with moderate-persistent asthma and seasonal allergies with nasal discharge and pain for 6 days
- D. A 55-year-old male who has been using mometasone for 10 days and has had worsening headaches and purulent nasal discharge

Acute Bacterial Sinusitis

- Acute sinusitis is the 5th most common visit reason to family practice providers
- A majority of sinusitis (67%) is attributable to viruses
- Approximately 64% of patients with acute bacterial sinusitis (ABS) will be cured without antibiotics by 14 days
 - Antibiotics shorten time to cure, but number needed to treat is 19
 - Number needed to harm with antibiotics is 13
- Antibiotics only indicated in **persistent** (10+ days), **severe** (fever + purulent discharge for 3 days), or **worsening** (worse symptoms after clear improvement at 5 days -- “double sickening”)
- Bacteria isolated:
 - *S. pneumoniae* and *H. influenzae* >50% of cases
 - *M. catarrhalis*
 - *S. aureus*
 - Occasionally odontogenic anaerobic bacteria

Cochrane Database Syst Rev. 2018;9:CD006089.

Ann Intern Med. 2016;164(6):425-35.

Clin Infect Dis. 2012;54(8):1041-5.

Acute Bacterial Sinusitis

Symptom Management

- Analgesics, intranasal corticosteroids, and/or nasal saline irrigation may be considered in adjunctive role or during a “watchful waiting” period for mild/moderate disease
 - Offer benefit in both viral and bacterial sinusitis
- Intranasal steroids
 - Mostly studied in conjunction with antibiotics, but recommended as initial monotherapy in some guidelines
 - Mometasone x15 days had greater (but not superior) symptom improvement versus amoxicillin
- Nasal saline
 - Either normal or hypertonic is appropriate
 - Slight decrease in symptoms and decreased need for other decongestants

Otolaryngol Head Neck Surg. 2015;152(2S):S1–S39

Allergy Clin Immunol. 2005;116:1289-95.

Cochrane Database Syst Rev. 2015:CD006821.

Acute Bacterial Sinusitis

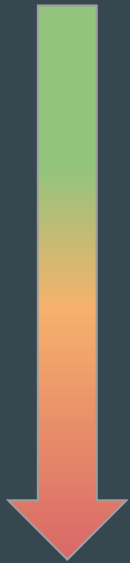
IF antibiotics are indicated (persistent, severe, or worsening)

- 1st Line: Amoxicillin/clavulanate
 - Use “High-dose” (2 g extended release orally twice daily or 90 mg/kg/day orally twice daily) if >10% penicillin resistance in the community or other risks (daycare attendance, >65 or <2 years, hospitalization or antibiotic use in the past month, immunocompromised)
- Penicillin allergy:
 - Doxycycline
 - Fluoroquinolone
 - Note: BlackBox warning from the FDA advising against use of Fluoroquinolones in sinusitis was added after publication of guidelines
 - Cefixime or cefpodoxime + clindamycin
 - Addition of clindamycin suggested due to “variable resistance” patterns in the US
 - Trimethoprim/sulfamethoxazole and macrolides no longer recommended due to resistance

Acute Bacterial Sinusitis

- Antibiogram DSM *S. pneumoniae* 2019 susceptibility:

- Ceftriaxone: **100%**
 - Surrogate for cefuroxime and cefpodoxime
- Levofloxacin: **99%**
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- Trimethoprim/sulfamethoxazole: **59%**
- Azithromycin: **53%** (2018)
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Acute Bacterial Sinusitis

- Local recommendations

- Initial symptomatic therapy with mometasone as this can be helpful in both viral and bacterial sinusitis
 - Use in conjunction with watchful waiting

- IF antibiotics are indicated
 - 1st line: amoxicillin/clavulanate 875mg twice daily
 - Penicillin allergy:
 - Cefpodoxime
 - Clindamycin addition to cephaloporins is advocated in guidelines, but high streptococcal susceptibility eliminates this need
 - Doxycycline

Acute Bacterial Sinusitis: Case Question

Which of the following patients with acute bacterial sinusitis should be treated with antibiotics?

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Antibiotic Reminders

Respiratory Infection Antibiotic Pearls

- Fluoroquinolones
 - Low resistance rates to common CAP pathogens, covers both typical and atypical organisms, but ciprofloxacin should NOT be used
 - Convenience of monotherapy in CAP
 - Black Box warning for adverse events; do not use in sinusitis!
- Cephalosporins
 - Severe penicillin allergy cross reactivity is unlikely with 2nd and 3rd generation cephalosporins
- Macrolides
 - Large amount of streptococcal resistance limits empiric use in respiratory infections as monotherapy, but reliable “add on” for atypical coverage
 - QTc prolongation
 - Drug interactions: erythromycin, clarithromycin >>> azithromycin

Things to think about when developing an outpatient treatment plan

(1) Does my patient have an infection that **REQUIRES** antibiotics?

- ABS and mild diverticulitis may not be improved by antibiotics
- Upper respiratory infections and cystitis may be candidates for delayed therapy

(2) What empiric antibiotic should I select?

- Try to use the narrowest spectrum possible...
 - Why use cefdinir when cephalexin will work?
 - Why use a fluoroquinolone when I don't need anti-pseudomonal activity?
- Try to use agents with lower risk for *C. difficile*
 - Fluoroquinolones, clindamycin, later generation cephalosporins are highest risk
- Does my patient have any drug allergies?
 - What is the allergy? When did the allergy occur? What have they tolerated in the past?
- Will there be any drug- drug interactions with selected antimicrobial agent? Any drug-disease interactions?

Things to think about when developing an outpatient treatment plan

(2) What empiric antibiotic should I select?

- What do I know about my local susceptibilities?
 - Central Iowa major resistance issues
 - *E. coli* versus fluoroquinolones and trimethoprim/sulfamethoxazole
 - *S. pneumoniae* versus macrolides
- What is the cost and availability of the antimicrobial?
 - Many agents presented have high out-of-pocket cost compared to similar class agents or are higher insurance tier
 - Fosfomycin, cefpodoxime, cefixime, moxifloxacin, gemifloxacin

(3) What duration should I select?

- Outpatient disease states rarely need >7 days of antibiotics
- Longer isn't always better and may contribute to antibiotic hoarding and *C. difficile* risk

Questions?