Antimicrobial Stewardship in Ambulatory Health-System Pharmacy and Long-Term Care Pharmacy

Mark Dewey, Pharm.D., CGP
NDSU/LRH/ Consultant Pharmacist Inc.
Mark.Dewey@ndsu.edu 218-736-8057

Objectives

1. Develop an understanding of why antibiotic stewardship is important in outpatient settings for Health-System Pharmacists and encourage pharmacist involvement in these areas.

2. Gain insight on interventions to decrease the use antibiotics in the LTC setting.

3. Discover ways to promote prudent use of antibiotics in your surrounding LTC facilities.

4. Describe the impact of an Antimicrobial Stewardship Program in an outpatient community health-system

What is Antibiotic Stewardship

- Stewardship is an ethic that embodies the responsible planning and management of resources.
- Antibiotic Stewardship: A system of informatics, data collection, personnel, and policy/procedures which promotes the optimal selection, dosing, and duration of therapy for antimicrobial agents throughout the course of their use
- Pertinent in all healthcare settings and practiced at system and individual level
- Collaborative expertise from clinicians, pharmacists, microbiologists, infection control, and informatics technologists

Why Antibiotic Stewardship

- 90 yo female with Alzheimer's disease and severe knee arthritis, which prevents her from walking
- Also, depression and advanced glaucoma.
- Staff contact the on-call physician on the weekend after noting the resident's urine is dark and concentrated and slightly more confused. Afebrile and no urinary catheter. Staff asked for "UA/UC".
- On call provider orders the UA/UC and no antibiotic started. Two days later the primary provider is called with urine results that show pyuria and 1+ nitrates. The culture grows 100,000 CFU of gram(-) rod and antibiotic is ordered. In the mean time, the resident has been stable, is afebrile and shows no urinary symptoms.

Why Antibiotic Stewardship

- The Washington Post (1/29/15, Paquette) reports that according to the CDC, 80% of American are issued prescription antibiotics every year, and “up to half of the estimated 258 million prescriptions are unnecessary.” Jesse Goodman, director of Georgetown University’s Center on Medical Product Access, Safety and Stewardship and a former FDA chief scientist, says this is a “culture” problem and advises that “patient and doctor must understand these drugs are precious resources. The more we use them, and the more unwisely, the more resistance” will be built up against them. President Obama announced a plan this week “to nearly double the amount of federal funding dedicated to fighting antibiotic-resistant bacteria,” which the CDC says is responsible for an estimated two million illnesses and 23,000 deaths each year.

Why Antibiotic Stewardship

- The goal of the Obama Administration National Action Plan for Combating Antibiotic-Resistant Bacteria is to reduce inappropriate antibiotic use by 50% in outpatient settings by 2020

Why Antibiotic Stewardship

- An estimated 1.6-3.8 million LTC residents are treated for infections annually, and approximately 400,000 infection-related deaths
- Antibiotics constitute up to 40% of all prescribed medications in LTC, with as many as 70% of residents having at least one antibiotic Rx in any given year.
- According to various studies, 25-75% of the antibiotic use in LTC is inappropriate
- Infection risk is highest in those with greatest functional disability and requirement for direct care
- Risk of morbidity and mortality increased in LTC with infection due to physiological changes, more chance of underlying diseases, invasive devices, and polypharmacy.

Why Antibiotic Stewardship

- Antimicrobial use in the LTC setting is typically empiric, broad spectrum, and frequently initiated without diagnostic tests.
- Antibiotic use can cause adverse drug reactions and can lead to resistance and increase C. diff.
- Often in LTC, viral respiratory infections and asymptomatic bacteriuria are treated with antibiotics
- Under federal regulations, nursing facilities must have an infection control program that “investigates, controls, and prevents infections in the facility.”

Case

- Resident is a 65 yo female at a LTC facility the with painful lesions on the right side of her scalp and complains that the pain is radiating to the right side of her neck and ear. It is itchy and bleeds because the patient picks at it. A wound culture was ordered and she was prescribed Levofloxacin 750 mg by mouth daily for two weeks. Patient was diagnosed with seborrheic dermatitis and the culture was positive for light growth of staphylococcus and no antibiotic changes were made.
- NKDA
- Wt 125.5 kg
- Ht 67 in
- AST 39
- ALT 61
- Scr 1.1
- CrCl 56.2 ml/min

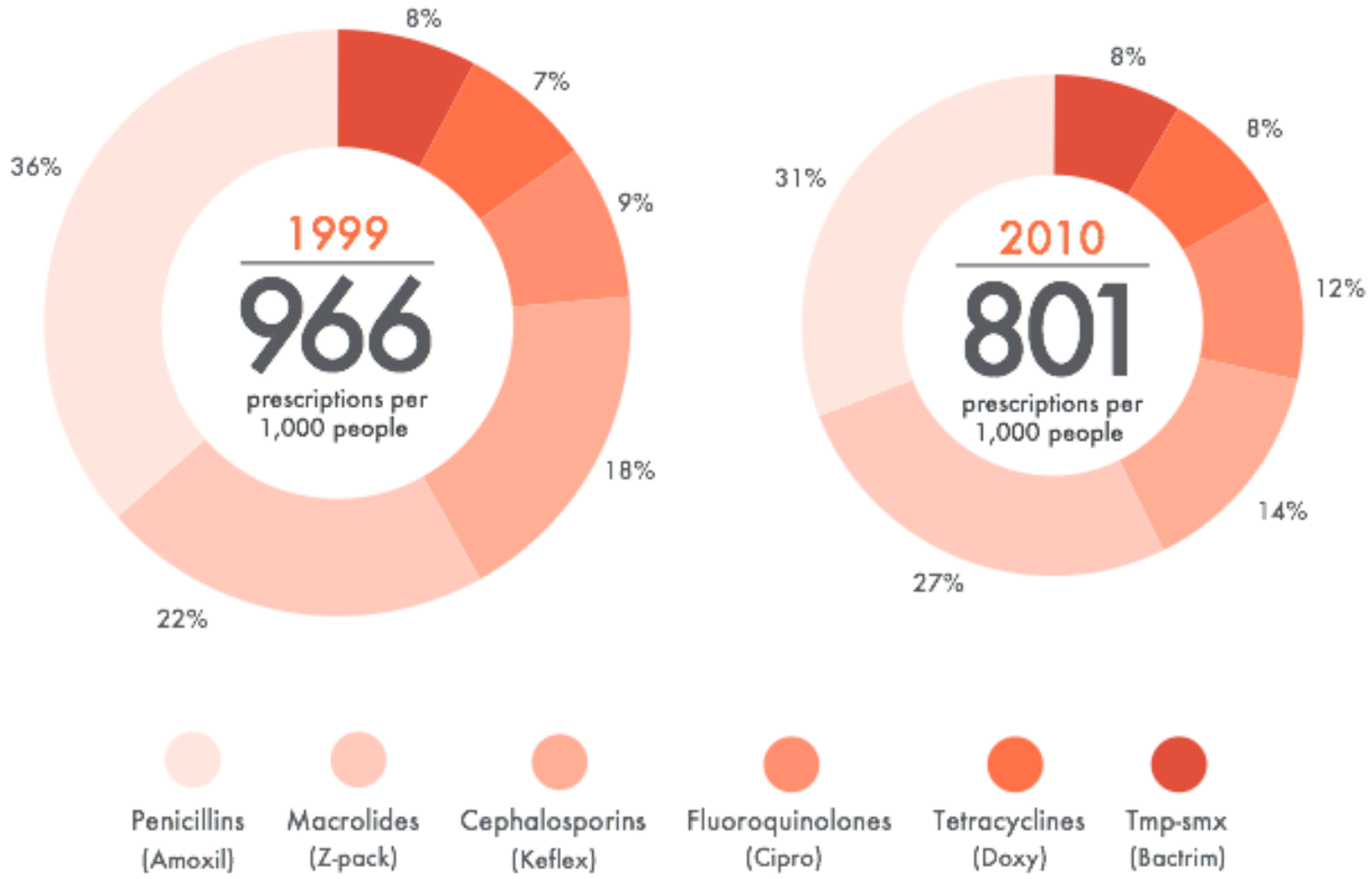
Case

Amox/K Clav	Sensitive	<=1	Clindamycin	Sensitive	<=0.5
Tetracycline	Sensitive	<=4	Ceftriaxone	Sensitive	<=1
Ciprofloxacin	Sensitive	<=1	Daptomycin	Sensitive	1
Gentamicin	Sensitive	<=4	Levofloxacin	Sensitive	<=1
Oxacillin	Sensitive	<=1	Penicillin	Sensitive	<=1
Cephalexin	Sensitive	<=1	Trimeth/Sulfa	Sensitive	<=0.5/9.5

- Possible recommendations: De-escalate Levofloxacin (broad-spectrum) to Cephalexin 500mg TID or QID for treatment of non-resistant staph aureus.

THE COMPOSITION OF ANTIBIOTIC USE IS CHANGING

Although the number of prescriptions per capita decreased, there has been a shift towards newer, more powerful antibiotic classes.



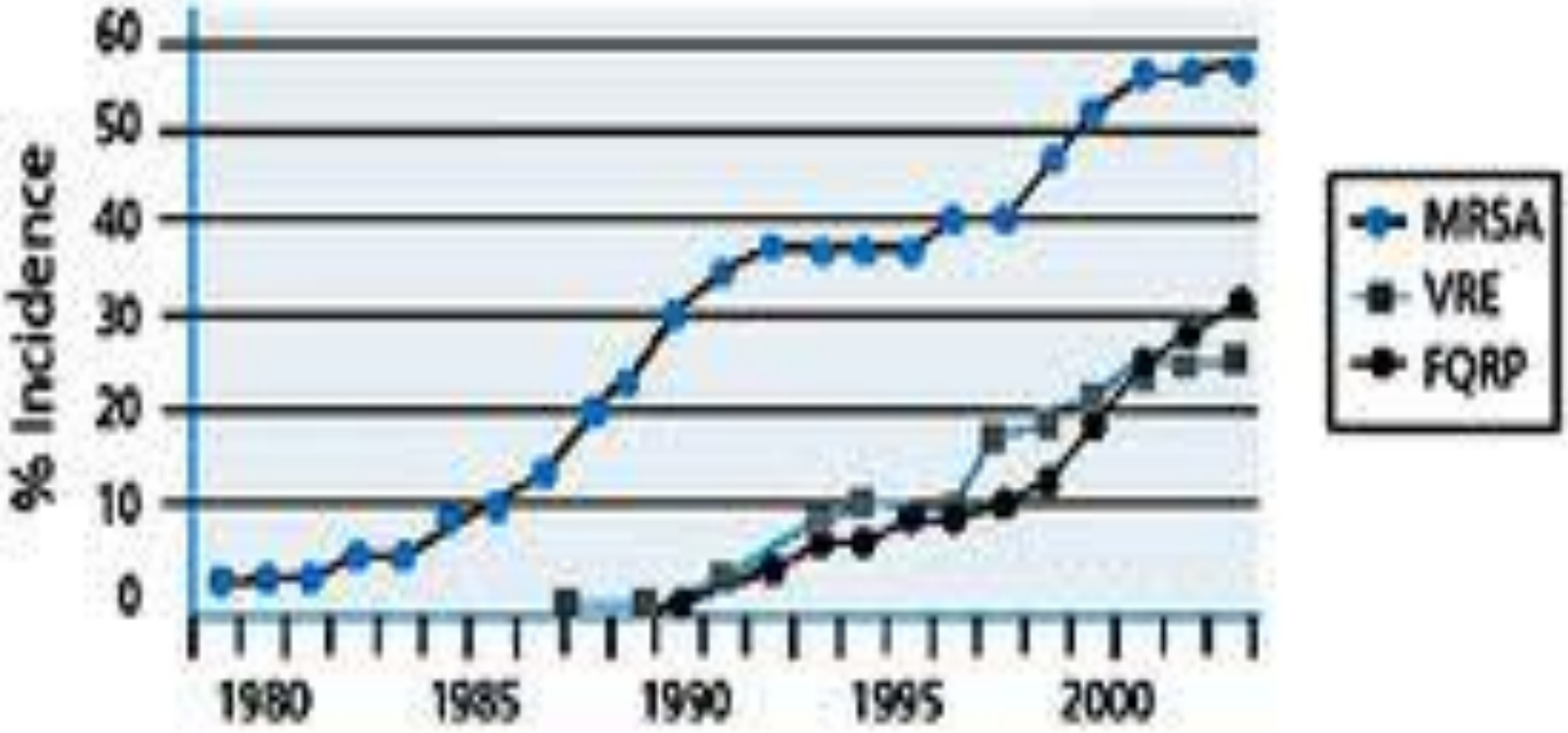
The relative increase in the use of antibiotics with a broader spectrum such as fluoroquinolones or macrolides is troubling because it accelerates the rise of bacterial resistance.

Taken from CDDEP Resistance Map

Why Antibiotic Stewardship

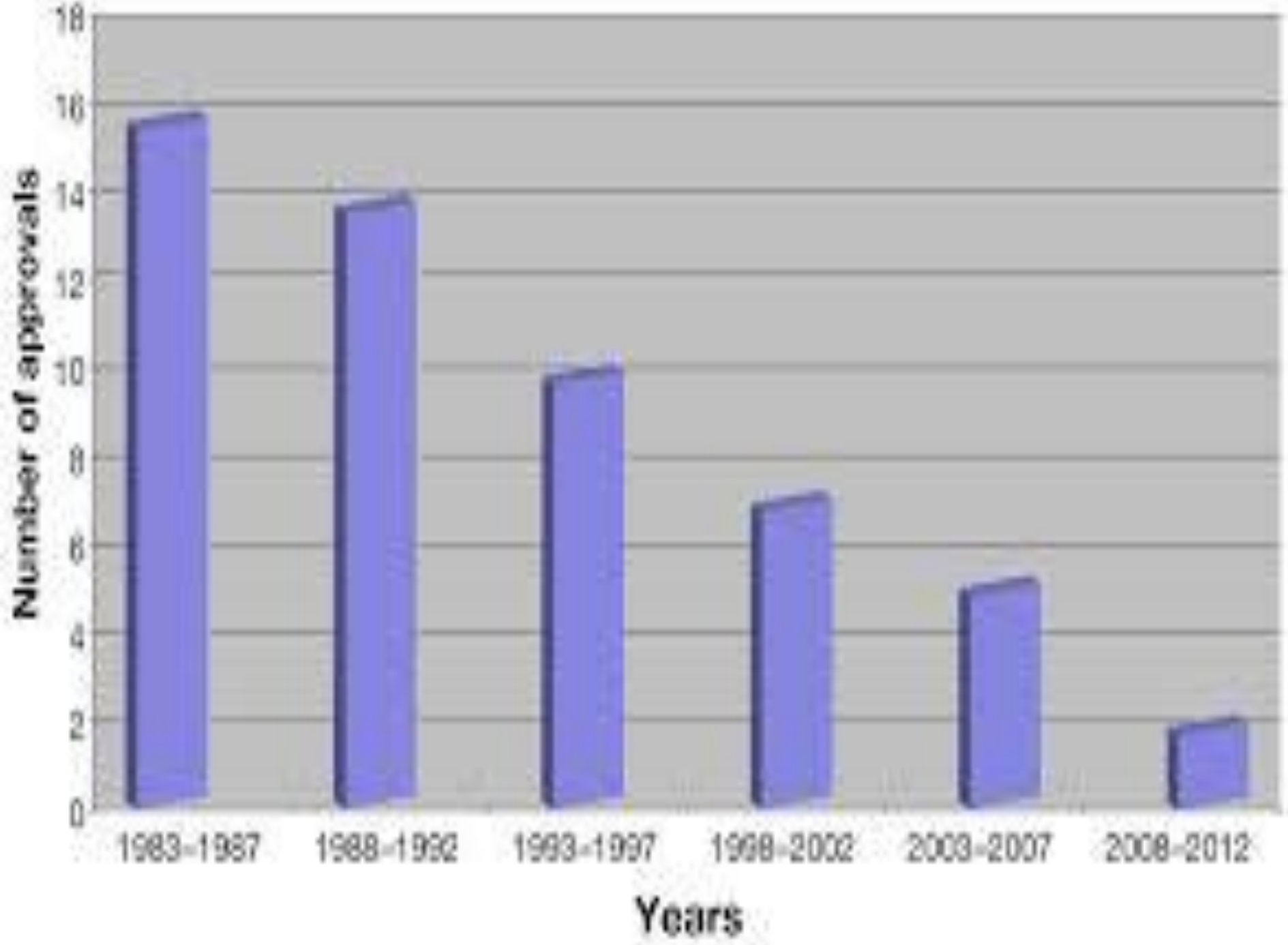
- Many kinds of bacteria are continuing to develop resistance to the available antibiotics
- Multidrug-resistant organisms (prior antibiotic use and invasive devices are biggest risk factors) coupled with antibiotic misuse at LTC facilities contribute to a vicious cycle in which antibiotic resistance spreads quickly in the community and in LTC settings.
- CDC reports that carbapenem-resistant Enterobacteriaceae (CRE) and Clostridium difficile are urgent threats to public health
- C. Difficile infection develops due to:
  - Overprescribing of antibiotics
  - Improper cleaning of the surrounding environment
  - Infection via healthcare worker transfer

Resistant Strains Spread Rapidly



Source: Centers for Disease Control and Prevention

MRSA = Methicillin-resistant *Staphylococcus Aureus*
VRE = Vancomycin-resistantant Enterococci
FQRP = Floroquinolone-resistant *Pseudomonas aeruginosa*


Number of approvals
18
16
14
12
10
8
6
4
2
0
1983-1987
1988-1992
1993-1997
1998-2002
2003-2007
2008-2012
Years

Case

- Resident is a 67 yo male with BPH and urinary obstruction, presenting for uroflow and bladder scan. His urine was malodorous, cloudy and UA was positive. UC was ordered and the resident was started on ciprofloxacin 500 mg by mouth BID for 7 days. The culture came back positive for Enterococcus faecalis that was resistant to ciprofloxacin.
- Complicated UTI: male, DM
- NKDA
- Wt 127.3 kg
- Ht NA
- AST 23
- ALT 28
- Scr 1.7
- CrCl 75.9 ml/min

Case

Daptomycin	**Sensitive**	**1**	**Gent Synergy**	**Resistant**	**>500**
Linezolid	Sensitive	2	Ampicillin	Sensitive	<=2
Ciprofloxacin	Resistant	>2			
Tetracycline	Resistant	>8	Levofloxacin	Resistant	>4
Penicillin	Sensitive	8	Nitrofurantoin	Sensitive	<=32
Rifampin	Sensitive	<=1	Vancomycin	Sensitive	2

Case

- The resident's empiric medication was not changed. In 2 weeks he continued to have symptoms so another UA/UC and more antibiotics. At this visit he was started on levofloxacin empirically which also came back resistant to the still existing Enerococcus faecalis. At this time the resident's antibiotics were finally changed to something sensitive.

- Possible recommendations: Look at the cultures thoroughly, as it is unfortunate this patient was left on a resistant antibiotic with his complicated UTI. Consider using an antibiotic based on the sensitivity profile.

Why Antibiotic Stewardship

- American Academy of Pediatrics
- American Society of Health-System Pharmacists
- Infectious Diseases Society for Obstetrics and Gynecology
- Society for Hospital Medicine
- Society of Infectious Diseases Pharmacists
- Society for Healthcare Epidemiology of America
- Infectious Diseases Society of America
- Centers for Disease Control and Prevention

Core Elements of ASP

- Leadership Commitment
  - Communicate formal statements from the facility supporting improved use of antibiotics and monitoring
  - Include stewardship-related tasks in job descriptions and performance reviews
  - Support training and education
  - Ensure staff have time to contribute to stewardship activities
- Accountability
  - Identify leaders responsible for the program
- Expertise
  - Identify nurses, pharmacists, clinicians, QI staff, laboratory staff, IT staff

Core Elements of ASP

- Action
  - Implement policies to document dose, duration, and indication of antibiotics
  - Develop and implement facility-specific recommendations for common infections (UTI's, pneumonia, etc.)
  - Implement interventions based on the needs and available resources of the facility (infection and syndrome-specific interventions)
- Tracking and Reporting
  - Perform periodic assessments of the use of antibiotics
  - Provide feedback to members of the program and document responses
  - Establish "benchmarking" by measuring antibiotic use in days of therapy or defined daily dose
  - Track clinical outcomes to impact of interventions
  - Report resistance trends in facility antibiotics

Core Elements of ASP

- Education
  - Provide regular updates to staff about antibiotic prescribing, resistance, and ID management that address local & national issues
  - Share facility-specific antibiotic information with others
  - Review cases in which changes in antibiotic therapy could have been made
  - Seek out web-based education resources for developing educational content for staff (ex. www.leadstewardship.org, www.shea-online.org)

Based on information provided by CDC
http://bit.ly/CDC_AntibioticStewardship

Gram-Positive Cocci (% Susceptible)							Gram-Negative Bacilli (% Susceptible)								
	Entero.	Staph	MRSA	Staph	Strep.	Strep.	Citrob.	Entrob.	E.	H.	K.	Kleb.	Prot.	Pseudom	Enterobact.
	faecalis	aureus		epi.	pneumo.	agalactiae B	freundi	cloacae	coli	influenzae	oxytoca	pneumonia	miralibis	aeruginosa	aerogenes
Total Isolates	91	61	52	31	6	43	14	26	264	7	14	60	15	39	5
Amp/Sulbactam		100	0	32			64	19	63	86	73	92	100		80
Amikacin							100	96	100		100	98	93	90	100
Ampicillin	100	0	0	0		100	29	12	62	86	14	7	80		0
Amox/clav		100	0	32	100 (NU)		7	4	84	100	93	95	100		0
Azithromycin			0 (NU)		60 (NU)	33 (NU)									
Aztreonam							79	77	100	100	100	100	100	72	100
Ceftriaxone		98	0	32	100 (NU)	100	86	77	99	100	100	100	100	64	100
Ceftazidime							86	85	99		100	100	100	87	100
Cefotaxime					100 (NU)	100	86	85	99		100	100	100	36	100
Cefazolin							0	4	91		36	97	100		0
Cefepime					100 (NU)	100	100	100	100		100	100	100	79	100
Cefuroxime					80 (NU)		71	27	96		86	93	100		80
Cefotetan							86	54	99		100	100	100		80
Ciprofloxacin	63	89	15	35			100	85	86		100	98	73	77	100
Clindamycin		80 (NU)	33	75 (NU)	100 (NU)	33 (NU)									
Erythromycin	5 (NU)	69 (NU)	7 (NU)	33 (NU)	60 (NU)	33 (NU)									
Ertapenem							100	96	99	100	100	100	100		100
Gentamicin		100	98	87			100	100	93		100	98	100	72	100
Imipenem/Cilast					.		100	100	100		100	100	93	90	100
Levofloxacin	70	90	15	35	100 (NU)	98	100	85	87	100	100	98	73	46	100
Linezolid	100	100	100	100											
Meropenem					100 (NU)		100	100	100	100	100	100	100	90	100
Moxifloxacin		90 (NU)	34	16			100 (NU)	100 (NU)	22 (NU)		100 (NU)	100 (NU)	27		100 (NU)
Nitrofurantoin	100 (U)	100 (U)	100 (U)	100 (U)			91 (U)	11 (U)	99 (U)		82	58 (U)	0 (U)		0 (U)
Oxacillin		100	0	32											
Penicillin	100	33	0	6	60 (NU)	100									
Piper/Tazo		**100**					86	85	99		100	100	100	90	100
Rifampin	32	100	100	97											
Synercid	0	100	100	100		100 (U)									
TMP/SMX		98	96	45	80 (NU)	92 (U)	100	96	85	43	100	95	80		100
Tetracycline	24	95	96	71	100 (NU)	33	93	92	86		100	85	0		100
Ticarcillin/Clav							86	77	88		93	98	100	87	60
Tobramycin							94	100	94		100	100	93	92	100
Vancomycin	99	100	100	100	100 (NU)	100									

Antibiotic Stewardship

- Interventions that work to improve and measure appropriate antimicrobial use
  - Promote the selection of optimal drug regimen, dose, duration, and route of administration
  - Achieve optimal clinical outcomes, minimize toxicity, reduce costs, and limit resistance.
- Antibiotic overuse stimulates the spread of antimicrobial resistance
- Already utilized and shown to be effective in the inpatient setting
  - Often involves audit and feedback of antibiotic prescribing
  - Meetings between infectious disease physicians and clinical pharmacists

Factors to Consider When Selecting an Antibiotic

1. Coverage of antibiotic
2. Patterns of resistance
3. Evidence or track record for the specified infection
4. Achievable serum, tissue, or body fluid concentration (e.g. cerebrospinal fluid, urine)
5. Allergy
6. Toxicity
7. Formulation (IV vs. PO); if PO assess bioavailability
8. Adherence/convenience (e.g. 2x/day vs. 6x/day)
9. Cost

Case

- Resident is a 76 yo female living at an LTC facility. She is seen with urinary discomfort (malodorous urine, cloudy, pink tinged, urinary frequency), but with no lower back pain, no flank pain, no nausea/vomiting and no fever. UA/UC was ordered and she was started on Macrobid 100 mg by mouth BID for 7 days empirically. Her culture came back positive for ESBL E. coli, sensitive to the Macrobid. Her antibiotic regimen was not changed.
- Complicated UTI due to DM
- Allergies: cephalexin/sulfa
- Wt 85.5 kg
- Ht 63 in
- AST 18
- ALT 16
- Scr 1.7
- CrCl 29 ml/min

Case

Amox/K Clav	Sensitive	<=8/4	Ampicillin	Resistant	>16
Cefazolin	Resistant	>16	Cefepime	Resistant	>16
Cefoxitin	Sensitive	<=8	Ceftriaxone	Resistant	>32
Ciprofloxacin	Resistant	>2	Ertapenem	Sensitive	<=2
Gentamicin	Sensitive	<=4	Levofloxacin	Resistant	>4
Meropenem	Sensitve	<=4	Nitrofurantoin	Sensitive	<=32
Pip/Tazo	Sensitive	<=16	Trimeth/Sulfa	Resistant	>2/38

Case

- Macrobid is contraindicated in patients with CrCl <60 ml/min and is not recommended in patients greater than 65 yo. However, this is a difficult patient due to allergies and drug resistance.

- Possible recommendations: Augmentin 875 by mouth every 12 hours for 5 days; ertapenem 1 gram IV/IM once daily for 10-14 days

Risk factors for colonization or infection with antimicrobial-resistant organisms in long-term care facilities.

- Aging and higher intrinsic risk of infection
- Malnutrition and poor oral intake
- Chronic disease and medications
- Increasing device utilization rate
- Frequent inappropriate use of antibiotics
- Often-subtle symptoms and signs of infection
- Semi closed setting
- Increasing number of step-down units after hospitalization
- Frequent transfer of residents among long-term care and acute care facilities
- Diagnostic testing not readily available
- Physician visits infrequent/lack of coordinated medical care
- Frequent turnover of long-term care facility staff and broad variation in educational level
- Unfavorable nurse: resident ratios

Risk factors for colonization or infection with antimicrobial-resistant organisms in long-term care facilities.

- ***Resident factors***
- Prior antibiotic treatment
- Presence of invasive devices (e.g., urinary catheters or feeding tubes)
- Lower functional status
- Presence of decubitus ulcers, wounds, urinary incontinence, comorbidities or fecal incontinence
- Prior hospitalization
- Prior colonization by antibiotic-resistant organisms
- Prolonged duration of stay in long-term care facilities
- Male sex
- Higher age
- Higher intensity of nursing care
- Lower cognitive status

Risk factors for colonization or infection with antimicrobial-resistant organisms in long-term care facilities.

- ***Facility factors***
  - Lack of infection-control policy (e.g., lack of hygienic measures)
  - Staffing (i.e., higher patient: staff ratio, frequent staff turnover and staffing by nonprofessional personnel)
  - Increased number of residents per bedroom
  - Increased resident-to-resident contact
  - Increased facility size
  - Limited facilities for hand washing

Barriers

- Antibiotic prescribing is a complex process
  - Provider factors
  - Other healthcare-team member factors
  - Patient factors
- Cultures not done or followed up on
- Patients/Families have come to expect antibiotics
- Thin line between bacterial/viral

Physicians/Providers

- Rate of antibiotic prescribing varies greatly among providers

- 4 Ideas to explain the differences
  - Lack of knowledge
  - Length of time in practice
    - Veteran, staff physicians more likely to prescribe antibiotics inappropriately compared to interns and residents.
  - Provider Training Environment
  - Avoidance of time-consuming patient education
    - Patient load
      - Providers with higher practice volumes more likely to prescribe antibiotics inappropriately.

What has been tried

- Provider education
  - Printed educational materials, Emails, Lectures
  - Interactive meetings, Educational outreach visits
- Audits/Feedback
- Delayed Antibiotic Prescription
  - Prescriber writes for antibiotic few days after office visit
  - If viral, will clear up or improve within that time
- Algorithms
  - “Clinical Pathways”

What seems to work best?

- Hard to determine which intervention works best
  - Physician differences
  - Site differences
  - Hard to measure clinical outcomes, cost-effectiveness of interventions, impact on antimicrobial resistance
- Interactive meetings worked better than lectures
- Multi-faceted interventions most successful
  - Using many methods together worked better than using one method alone

Prevention and control of antimicrobial resistance in long-term care facilities

Prevent infection

Step 1. Vaccinate

- Give influenza and pneumococcal vaccinations to residents
- Promote vaccination among all staff

Step 2. Prevent conditions that lead to infection

- Prevent aspiration
- Prevent pressure ulcers
- Maintain hydration

Step 3. Remove unnecessary devices

- Insert catheters and devices only when essential and minimize duration of exposure
- Use proper insertion and catheter-care protocols
- Reassess catheters regularly
- Remove catheters and other devices when no longer essential

Prevention and control of antimicrobial resistance in long-term care facilities

Diagnose and treat infections effectively

Step 4. Use established criteria for diagnosis of infection

- Target empiric therapy to likely pathogens
- Target definitive therapy to known pathogens
- Obtain appropriate cultures and interpret results with care
- Consider *Clostridium difficile* in patients with diarrhea and antibiotic exposure

Step 5. Use local resources

- Consult infectious disease experts for complicated infections and potential outbreaks
- Know your local and/or regional data
- Obtain previous microbiology data for transfer residents
- Use antimicrobials wisely

Treat Bacterial Infection, not Colonization

- $\geq 10^5$ colony forming units is often used as a diagnostic criteria for a positive urine culture
- It does NOT prove infection; it is just a number to state that the culture is <u>unlikely</u> due to contamination
- Pyuria also is not predictive on its own
- It is the presence of **<u>symptoms</u>** AND pyuria AND bacteruria that denotes infection

Treatment of Asymptomatic Bacteriuria in LTC Residents

- No improvement in “mental status”
- No difference in the number of symptomatic UTIs
- No improvement in chronic urinary incontinence
- No improvement in survival

Summary of Asymptomatic Bacteriuria Treatment

- Treat symptomatic patients with pyuria and bacteriuria
- Don’t treat asymptomatic patients with pyuria and/or bacteriuria
- Define the symptomatic infection anatomically
- Dysuria and frequency without fever equals cystitis
- Dysuria and frequency with fever, flank pain, and/or nausea and vomiting equals pyelonephritis
- Remember prostatitis in the male with cystitis symptoms

Resident_____ DOB_____Date:_____

Allergies_____Provider_____

Without Catheter: (3 of the following)

- ☐ Fever (increase in temperature of >2 degrees F or rectal temperature >99.5 degrees F or single measurement of temperature >100 degrees F);
- ☐ New or increased burning pain on urination, frequency or urgency;
- ☐ New flank or suprapubic pain or tenderness;
- ☐ Change in character of urine (e.g., new bloody urine, foul smell, or amount of sediment) or as reported by the laboratory (new pyuria or microscopic hematuria); and/or
- ☐ Worsening of mental or functional status (e.g., confusion, decreased appetite, unexplained falls, incontinence of recent onset, lethargy, decreased activity).

OR

With Catheter: (2 of the following)

- ☐ Fever or chills;
- ☐ New flank pain or suprapubic pain or tenderness;
- ☐ Change in character of urine (e.g., new bloody urine, foul smell, or amount of sediment) or as reported by the laboratory (new pyuria or microscopic hematuria);
- ☐ Worsening of mental or functional status. Local findings such as obstruction, leakage, or mucosal trauma (hematuria) may also be present

Additional Comments:

_____

_____

_____

_____

If treatment warranted via clinical judgment, but insufficient signs/symptoms exist, please document rationale for treatment (eg history of UTI resulting in sepsis, severely immunocompromised, frequent serious hospitalizations due to UTI's, etc.):

_____

_____

_____

Physician response: ☐ **UA/UC**

_____

_____

_____

Signature: **Date:**

Prevention and control of antimicrobial resistance in long-term care facilities

Step 6. Know when to say 'no'

- Minimize use of broad-spectrum antibiotics
- Avoid chronic or long-term antimicrobial prophylaxis
- Develop a system to monitor antibiotic use and provide feedback to appropriate personnel

Step 7. Treat infection, not colonization or contamination

- Perform proper antisepsis with culture collection
- Re-evaluate the need for continued therapy after 48-72 h
- Do not treat asymptomatic bacteriuria

Step 8. Stop antimicrobial treatment

- Stop antimicrobial treatment when cultures are negative and infection is unlikely
- Stop antimicrobial treatment when infection has resolved

10 Clinical Situations in LTC when Antibiotics should be questioned

1. UTIs
2. Positive Urine Culture in an Asymptomatic Patient
3. UA/UC for cludy or malodorous urine
4. Nonspecific symptoms or signs not referable to a UTI
5. Respiratory conditions
6. URI's
7. Bronchitis absent COPD
8. Suspected or Proven Influenza without a secondary infection
9. Skin wounds without cellulitis, sepsis, osteomyelitis
10. Decubitus Ulcer in a terminal patient

Observation Order Example

- ☐ Obtain vital signs (BP, Pulse, Resp Rate, Temp, Pulse Ox) every ____ hours for ____ days.
- ☐ Record fluid intake each shift for _____ days.
- ☐ Notify physician if fluid intake is less than _____ cc daily.
- ☐ Offer resident _____ ounces of water / juice every _____ hours.
- ☐ Notify physician, NP, or PA if condition worsens, or if no improvement in _____ hours.
- ☐ Obtain the following blood work _____ .
- ☐ Consult pharmacist to review medication regimen.
- ☐ Contact the physician, NP, PA with an update on the resident's condition on _____.

Prevention and control of antimicrobial resistance in long-term care facilities

Prevent transmission

Step 9. Isolate the pathogen

- Use standard precautions
- Contain infectious body fluids (use approved droplet and contact isolation precautions)

Step 10. Break the chain of contagion

- Follow CDC recommendations for work restrictions and stay home when sick
- Cover your mouth when you cough or sneeze
- Educate staff, residents and families
- Promote wellness in staff and residents

Prevention and control of antimicrobial resistance in long-term care facilities

Step 11. Perform hand hygiene

- Use alcohol-based handrubs or wash your hands
- Encourage staff and visitors to follow hand hygiene protocols

Step 12. Identify residents with MDROs

- Identify both new admissions and existing residents with MDROs
- Follow standard recommendations for MDRO case management

Promote prudent antibiotic use

- Prospective audit of antibiotic use with direct intervention and feedback to prescribers
- Formulary restriction and preauthorization
- Education
- Guidelines and clinical pathways
- Evaluating the impact of the program
- Both process measures (did the intervention result in the expected change in antimicrobial use?) and outcome measures (have resistance or other unintended consequences been reduced or prevented?) are useful

Effectiveness of ASP in LTC

- Very few studies on the cost of ASP specifically in LTC. Even though national groups recommend the use of antimicrobial stewardship, there is no consensus on the specific components of stewardship programs or resources which need to be applied in LTC
- Several hospital-based studies that have shown savings
- The studies that have show effectiveness (via different modalities) in LTC have shown reduction of inappropriately prescribed antibiotics, decreases in C. difficile

ASP Effectiveness in LTC

1. Four teaching sessions over 18 months including all 20 full time staff internists; groups of 3-7.
2. Published guidelines on LTC infections and results of local audit discussed; interactive discussion of local cases.
3. Evidence-based algorithms and guidelines developed with internists.
4. Pocket booklet with optimal management of LTC infection syndromes.

Pre/post analysis of 100 random charts pre intervention and during 5 months after the last session:

A. Antimicrobial courses met guideline for diagnostic criteria: 32% vs 62%, p=0.006
B. Initial antimicrobial therapy met guidelines: 11% vs 39%, p=0.001
C. Antimicrobial days fell 29.7%, starts fell 25.9%- improvements sustained 2 yr post-intervention

Interventions for experimental group:

1. Mailing antibiotic guide and individual prescribing profile past 3 months to 36 physicians. Antibiotic courses given by physician characterized as adherent or non-adherent.
2. Repeat second mailing 4 months later.
3. Experimental vs control homes at trial end:

A. Nonadherent prescriptions: 20.5% vs 5.1%
B. Likelihood of prescription of nonadherent antibiotics:
   a. Post-intervention one: OR 0.47
   b. Post-intervention tow: OR 0.36
   c. 15 months follow-up: OR 0.48

ASP Effectiveness in LTC

1. Local physician, nurse, developed guidelines in focus groups. Evaluation of guidelines in pilot study with revision.
2. Small educational sessions- physicians, nurses.
3. Feedback on prescribing and references to available guidelines; discussion of structural, organizational, social barriers to change.

- Effect of intervention (95% CI) at 2 years (differences):
- Primary outcome: Floroquinolones for UTI: 0.028 (-0.193, 0.249)
- Secondary outcomes: UtIs/residents: 0.04 (-0.01, 0.09) All infections: Antibiotics -0.12 (-0.23, -0.02)

"Wait and see" 0.143 (0.047, 0.240)

ID consultation service team (ID physician and nurse practitioner) once weekly on site and available by phone contact 24/7.

36 months pre compared with 18 months post: reduction in

- total antibiotics, 30.1%, $p<0.001$
- oral antibiotics, 31.6% $p<0.001$
- IV antibiotics, 24%, p=000.1
- Positive C. difficile/1,000 days decreased, p=0.04

ASP Effectiveness in LTC

1. Small group consensus process for guideline development with physician/nurse practitioners.
2. Nurses: 1 hour training session on guidelines.
3. Laminated pocket cards summarizing guidelines.
4. Laminated posters with guidelines by telephone

A. No differences in antimicrobial use consistent with guidelines between two randomized groups.
B. In a pre/post analysis
   a. Pre/post IV antibiotics meeting guidelines 50% vs 81.8% (p=0.06) for multi-disciplinary group and 65vs 69% (p=0.73) for physician/practitioners.
   b. No change in 30 day mortality or hospitalization.

1. Optimized immunization, diagnostic testing at facility level.
2. Interactive educational sessions for NH staff to improve vaccination rates and nursing assessment skills
3. Study liaison nurse to facilitate change.
4. Academic detailing to physicians

A. Optimal antibiotic use pre/post: intervention 60% vs 66%, control =32% vs 39% (NS).
B. Duration of antibiotics, no difference.
C. Antibiotics within 4 hours 75% vs 38%

ASP Effectiveness in LTC

1. Diagnostic & treatment algorithm for UTI
2. Small group interactive sessions for nurses using case scenarios- video-tapes of sessions, written material, continuing outreach visits.
3. One on one interviews with physicians.

A. Pocket cards and posters with algorithms.
B. Antimicrobial courses for suspected urinary infection: 1.17 vs 1.59/1,000 resident days- difference- 0.49 (-0.93, -0.06)
C. Total antimicrobial use: 3.52 vs 3.93/1,000 days difference -0.37 (-1.1, 0.44)

1. Education of nursing staff to discourage urine cultures in absence of symptoms. Pocket cards with criteria for cultures.
2. Education of physicians/nurse practitioners re current guidelines not to treat ASB and adverse effects of antibiotics. Pocket cards for diagnosis and treatment of symptomatic urinary infection.
3. Posters at computer stations used by nurses/primary care physicians.
4. Follow-up educational sessions semi-annually by infection control nurse with case based feedback of inappropriate practices

In 6 months after intervention:

A. Inappropriate urine cultures: 2.6 down to 0.9/1000 ($p<0.04$)
B. Treatment of ASB: 167.1 down to 117.4/1000 patient days ($p=0.0017$)
C. Total antimicrobial days: 167.7 down to 117.4/1,000 pt days ($p<0.001$). Reductions maintained for 7-30 months while intervention continued.

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Outpatient Antimicrobial Stewardship in a Community Health-System

Margo Christopher, Pharm D

PGY-1 Pharmacy Practice Resident

Lake Region Healthcare

North Dakota State University

Lake Region HEALTHCARE

May 7th, 2015

Co-Investigators

- Mark Dewey, Pharm D, CGP
- Dan Friesner, PhD

Objectives

- Primary Objectives
  - Describe the impact of an Antimicrobial Stewardship Program in an outpatient community health-system
  - Identify the significance of pharmacists' involvement in outpatient antibiotic prescribing

Objectives

- Secondary Objective
  - Assess the acceptance of an Antimicrobial Stewardship Program in an outpatient community health-system by providers

Project Rational

- Lake Region Healthcare pharmacists and providers discovered hospitalizations where non-optimal antibiotic treatment in the outpatient setting may have contributed
- Improve patient care
- Reduce antibiotic resistance

Project Sites

- Lake Region Healthcare Main Clinic

Lake Region HEALTHCARE

- Family Medicine
- Internal Medicine
- Obstetrics/Gynecology
- Oncology
- Orthopedics
- Podiatry
- Urology

Project Sites

- Lake Region Healthcare Walk-in Clinic
  - Fergus Falls, MN

Project Sites

- Lake Region Healthcare
  - Battle Lake Clinic
    - Family Medicine

Project Design: Pre-Intervention

- Pre-intervention data collection
  - 4 months
  - 108 patients
- Randomized patient's cultures and sensitivities were selected for review retrospectively
- Providers were NOT contacted about changes that needed to be made

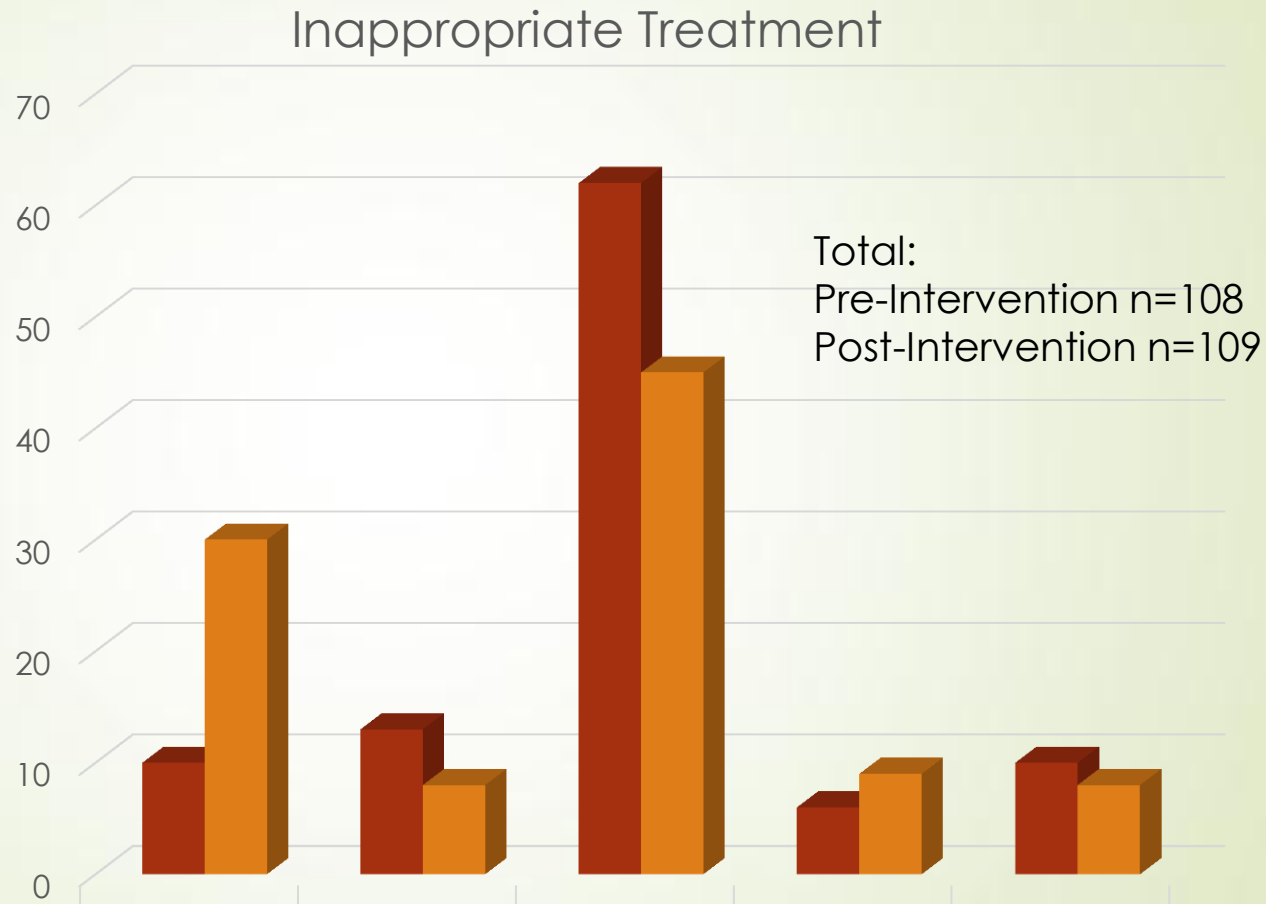
Project Design: Post-Intervention

- Post-Intervention data collection
  - 3 months
  - 109 patients
- Infection algorithms were distributed to providers at all three clinics
- Randomized patient's cultures and sensitivities were selected for review on a daily basis
- Providers WERE contacted about changes that needed to be made

Data Analysis

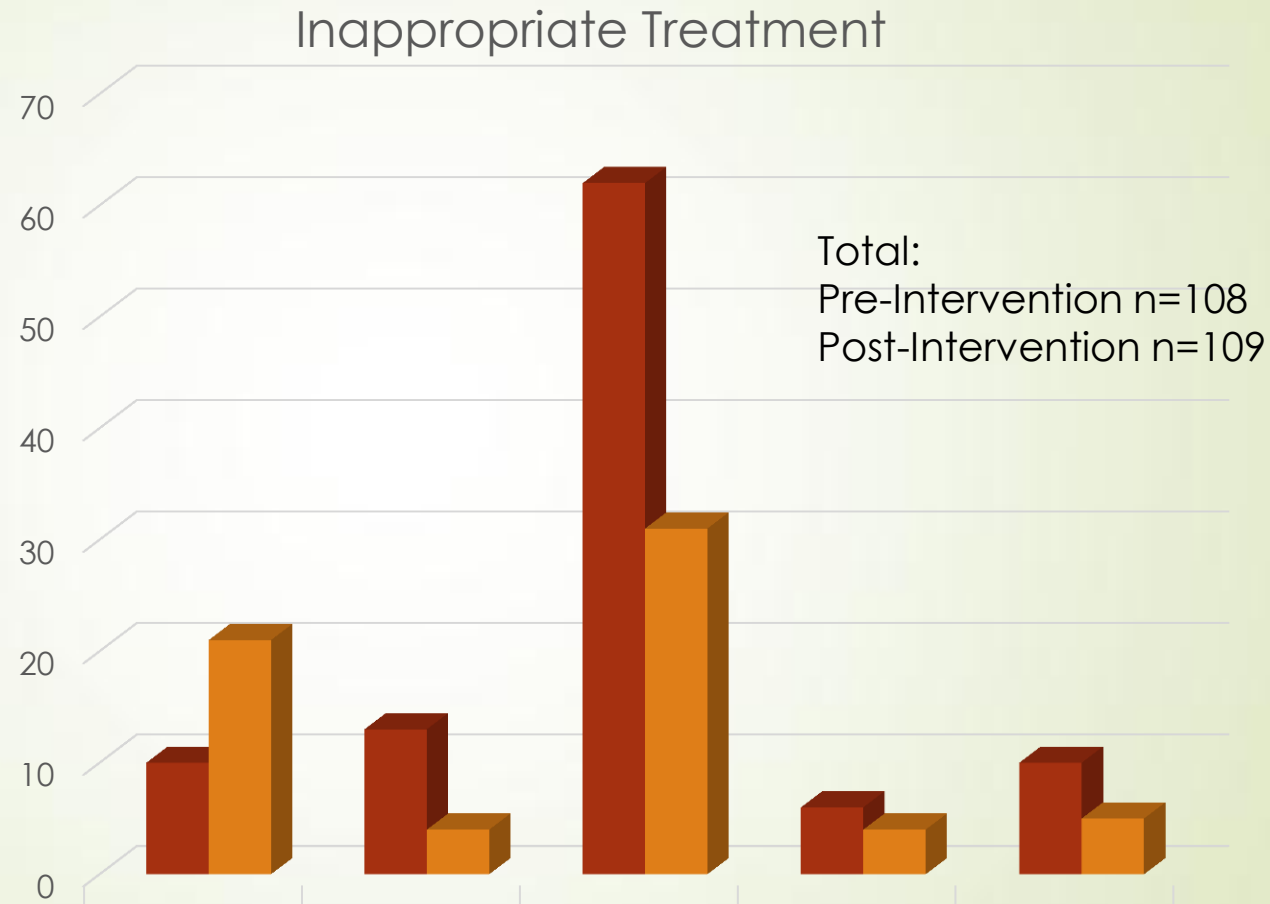
- Pre-intervention data
  - 60.2% inappropriate
    - 9.3% Dose
    - 12% Age
    - 57.4% Duration
    - 5.6% Resistant
    - 9.3% Renal

Data Analysis- without pharmacy interventions



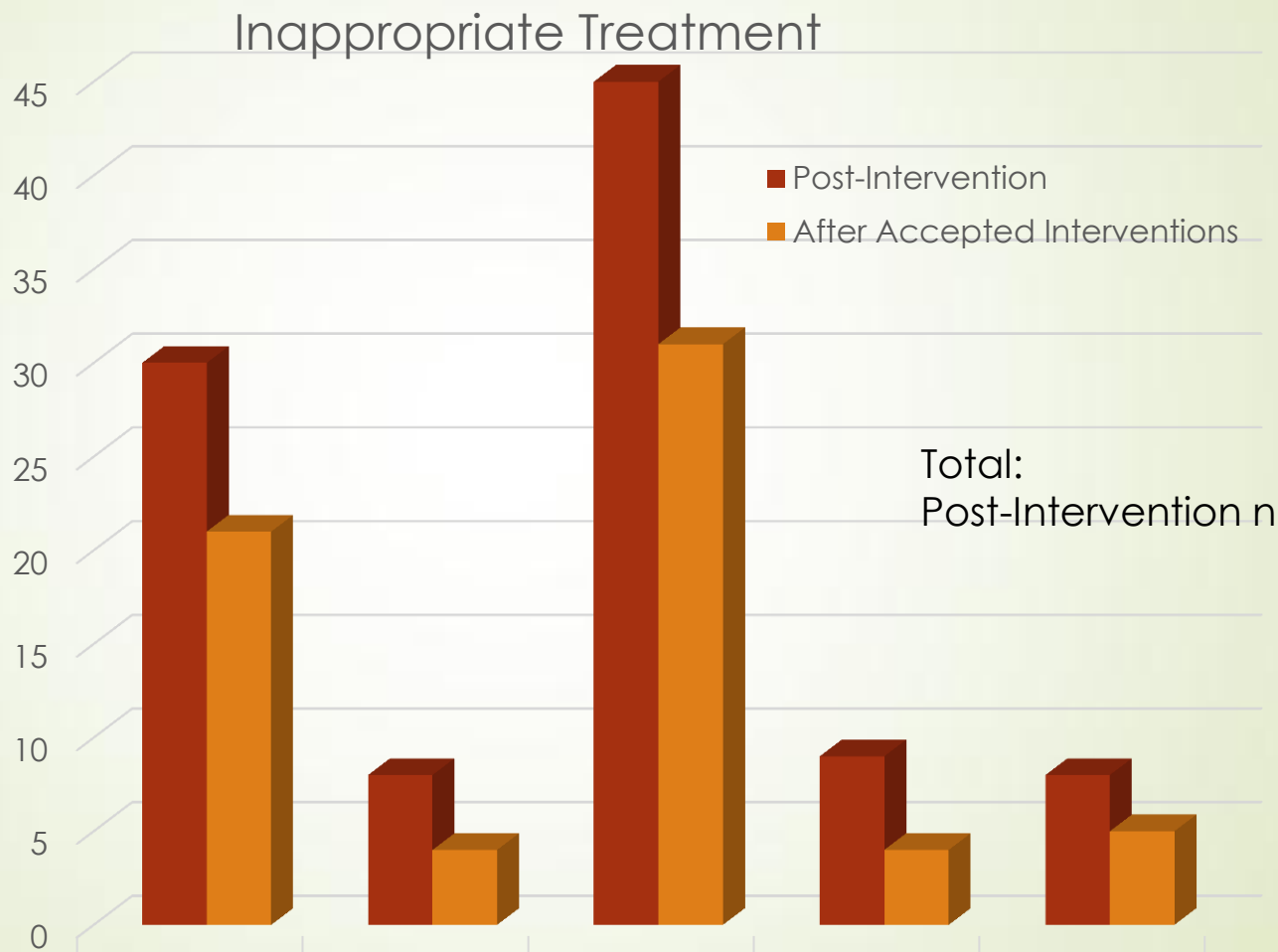
	Dose	Age	Duration	Resistant	Renal
Pre-Intervention	10	13	62	6	10
Post-Intervention	30	8	45	9	8
	p=0.001	**p=0.242**	**p=0.018**	**p=0.119**	**p=0.608**

Data Analysis- with pharmacy interventions



	Dose	Age	Duration	Resistant	Renal
Pre-Intervention	10	13	62	6	10
Post-Intervention	21	4	31	4	5

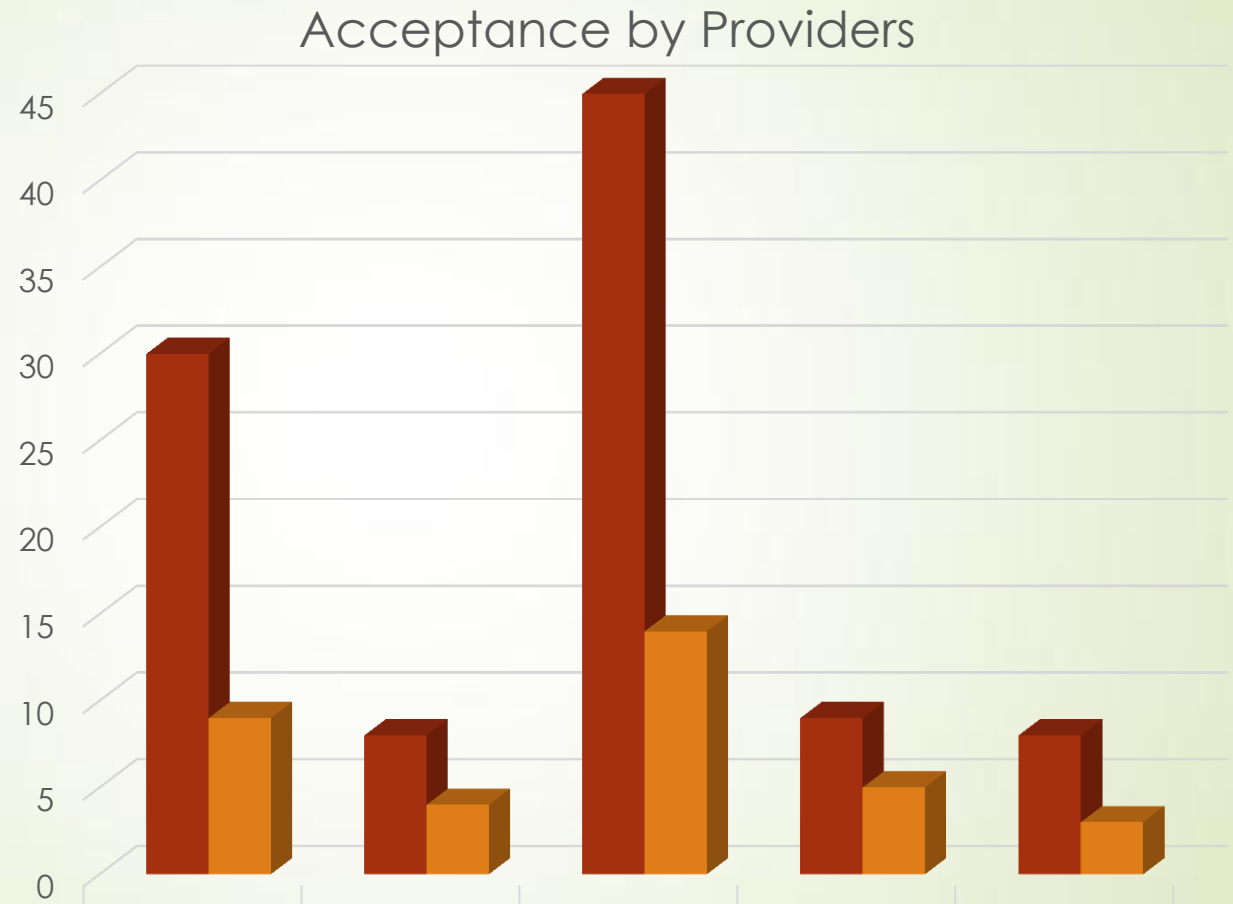
Data Analysis



Total:
Post-Intervention n=109

	Dose	Age	Duration	Resistant	Renal
Post-Intervention	30	8	45	9	8
After Accepted Interventions	21	4	31	4	5

Data Analysis



	Dose	Age	Duration	Resistant	Renal
MD Contacted	30	8	45	9	8
Changed	9	4	14	5	3

Data Analysis

- Overall
  - Most common infection
    - UTI
  - Site with most inappropriate treatments
    - Main Clinic

Limitations/Challenges

- Unfamiliarity with technology for contacting physicians
- No documentation in EHR
  - No initial treatment documented
  - No change in treatment documented
  - No response from provider
- Only able to review antibiotic treatment with cultures and sensitivities
- Limited amount of time
  - 4 months pre-intervention
  - 3 months post-intervention

Conclusion

- Implementing an Antimicrobial Stewardship Program in an outpatient community health-system was beneficial
- Pharmacists provide a significant impact on outpatient antibiotic prescribing
- It may take some time to get provider acceptance
- Plan to use data to learn how to move forward with this project

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- Images
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Acute Bronchitis in Children, Adolescents, and Adults

Key points
- More than 90% of acute cough illnesses are non-bacterial
- Multiple studies show that patients with acute bronchitis do not benefit from antibiotic therapy
- Symptoms may last up to 3 weeks
- Evaluation should focus on excluding pneumonia or other severe disease
- Purulent green or yellow sputum alone is not predictive of bacterial infection

Possible signs and symptoms of acute bronchitis ("chest cold"):
- Productive cough (may be dry the first few days)
- Chest soreness
- Wheezing
- Fatigue
- Mild headache
- Mild body aches
- Low-grade fever (less than 102°F)

Acute exacerbation of COPD not covered in this guideline

Differential diagnosis:
- Non-specific URI
- Asthma
- Community-acquired pneumonia
- Acute exacerbation of COPD
- Post-nasal drip

Clinical picture consistent with acute bronchitis

Any of the following present? (may suggest pneumonia)
- Ill-appearing
- High fever or other constitutional symptoms
- Tachypnea
- Tachycardia
- Evidence of lung consolidation on physical exam

Yes

Chest X-ray (if available)

Infiltrate

Refer to guideline for community-acquired pneumonia

No infiltrate

No

Uncomplicated acute bronchitis likely*

Antibiotic therapy not indicated*

Recommend specific symptomatic therapy:

Children
- Encourage fluids
- Fever control (acetaminophen or NSAIDs)

Adults
- Bronchodilator (β-agonist) therapy shortens the duration of cough
- Dextromethorphan or codeine for cough
- Acetaminophen or NSAIDs for fever/pain

Implement communication tips from page 1

Nonspecific Upper Respiratory Tract Infection in Children, Adolescents, and Adults

Key points
- Nonspecific upper respiratory tract infection (URI), or the "common cold," is caused by viral pathogens
- Symptoms may last up to 10-14 days
- Treatment with an antibiotic does not shorten duration of illness or prevent bacterial sinusitis
- Purulent green or yellow secretions alone are not predictive of bacterial infection

Possible signs and symptoms of nonspecific URI or the "common cold":
- Sore throat
- Nasal congestion or discharge
- Cough
- Sneezing
- Sore throat
- Headache
- Malaise
- Low-grade fever

→ **Differential diagnosis:**
- Acute bronchitis
- Acute rhinosinusitis
- Acute pharyngitis
- Allergic rhinitis
- Pertussis*
- Influenza*

↓ Clinical picture consistent with nonspecific URI

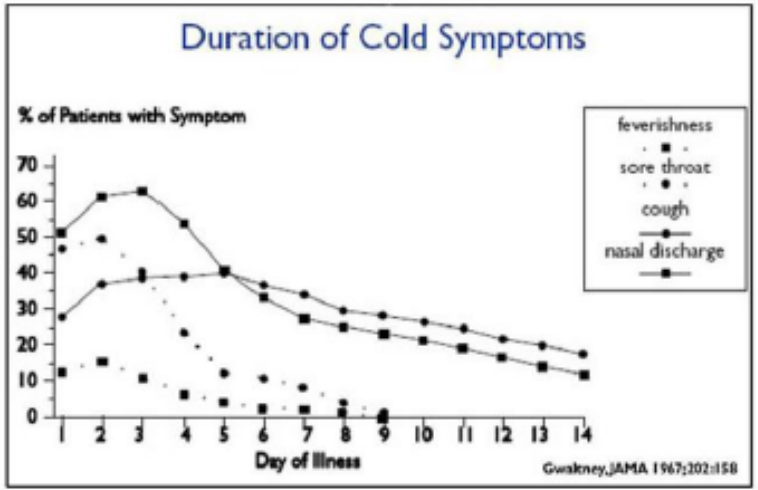
Antibiotic therapy not indicated*

Recommend specific symptomatic therapy:

Children
- Encourage fluids
- Fever control (acetaminophen or NSAIDs)

Adults
- Dextromethorphan or codeine for cough
- Acetaminophen or NSAIDs for fever/pain
- Consider decongestant

Implement communication tips from page 1



Acute Rhinosinusitis in Non-Pregnant Adults

Key points
- Most cases of acute rhinosinusitis are due to viral infections
- Purulent yellow or green nasal discharge alone is not predictive of bacterial infection
- Antibiotic therapy for acute viral sinusitis will not shorten duration of illness or prevent bacterial infection
- Use the strict criteria below for diagnosis of bacterial sinusitis

Possible signs and symptoms of acute rhinosinusitis (present <4 weeks):

1)	Nasal discharge	5)	Fever
2)	Nasal congestion	6)	Cough
3)	Facial pressure/pain	7)	Ear pressure or fullness
4)	Maxillary dental pain	8)	Anosmia

Clinical picture suggestive of acute rhinosinusitis? (clinical diagnosis – radiographs are not necessary)

Yes → Present for more than 7-10 days and not improving
OR
Worsening after initial improvement
OR
Severe symptoms (moderate-severe pain or temperature >/= 38.3 C or 101 F)

No → Consider alternative etiologies

No → **Likely viral etiology, antibiotic therapy not indicated**

→ Start therapy to relieve obstruction and alleviate symptoms

- NSAIDs or acetaminophen for pain
- Nasal saline washes

Consider:
- Topical glucocorticoid (nasal)
- Decongestants (nasal or systemic)

→ Duration more than 10 days
OR
Worsening symptoms*

→ **Bacterial etiology more likely, initiate antibiotic therapy**

→ Antibiotic treatment within last 4-6 weeks?

Yes →
1st line:
Amoxicillin-clavulanate 875mg BID for **7-10 days**
OR
Levofloxacin 500mg QDay for **7-10 days**

No →
1st line:
Amoxicillin 500mg TID for **7-10 days**

Alternatives (7-10 days):
Doxycycline 100mg BID or TMP-SMX 1DS BID

→ Absence of clinical response within 7 days

→ Consider drug-resistant infection, alternative etiologies, or complications*

→ **Change antibiotic therapy if drug-resistant infection suspected**

Acute Pharyngitis in Children >5 years, Adolescents, and Adults

Key points
- Group A streptococci cause 15%–30% of cases of acute pharyngitis in pediatric patients, but only 5%–10% of such illnesses in adults
- Diagnosis of Group A streptococcal pharyngitis requires diagnostic testing as clinical assessment alone is not sufficiently accurate
- Limit antibiotic therapy to patients with a positive test for Group A streptococcus
- Penicillin is the preferred therapy

Suspected uncomplicated acute pharyngitis

Any factors associated with Group A streptococcal pharyngitis present?
- Fever (>38 C or 100.3 F)
- Tonsillar swelling or exudates
- Tender anterior cervical lymph nodes
- Absence of a cough, coryza, conjunctivitis, diarrhea
- Palatine petechiae

Yes → Possible Group A streptococcal pharyngitis → Perform rapid antigen detection test, if available

- Positive → **Initiate antibiotic therapy**
- Negative → Perform throat culture
  - Positive → **Initiate antibiotic therapy**
  - Negative → **Antibiotic therapy not indicated**

No → Viral etiology likely** → **Antibiotic therapy not indicated**

Antibiotic therapy not indicated

Recommend specific symptomatic therapy:
- Acetaminophen or NSAIDS for fever/pain

Implement communication tips from page 1

****Other etiologies of acute pharyngitis to consider:**
- *F. necrophorum*
- *C. diphtheriae*
- *M. pneumoniae*
- *N. gonorrhea*
- Infectious mononucleosis
- Primary HIV infection
- HSV
- Influenza

Initiate antibiotic therapy

	Antibiotic	Adults/Adolescents >60lbs	Children <60lbs
1st line:	**Penicillin V**	**500mg TID**	**50mg/kg divided BID or TID** (max 500mg/dose)
or	Amoxicillin	500mg TID	50mg/kg divided BID or TID (max 1gm BID)
or	Benzathine PCN G	1.2 million units IM once	600,000 units IM once
Alternatives:	Cephalexin	500mg BID	25-50mg/kg divided BID (max 500mg/dose)
	Azithromycin†	500mg x 1, then 250mg QDay	12mg/kg QDay (max 500mg/day)

Recommended duration of oral therapy: 10 days†

Urinary Tract Infection in Non-Pregnant Adults

Key points
- *E.coli* remains the most common cause of both simple cystitis and complicated urinary tract infection
- Heavy fluoroquinolone use has led to widespread emergence of quinolone-resistant *E. coli* at DH
- Screen for risk factors for fluoroquinolone resistance when considering their use

Possible signs and symptoms of urinary tract infection:
1) Urinary frequency
2) Urgency
3) Dysuria
4) Suprapubic pain
5) Hematuria

Clinical picture suggestive of urinary tract infection?

No → Consider alternative etiologies

Yes →

Any complicating factors present? (associated with broader spectrum of bacteria and/or increased risk of complications)

Male gender	Immunosuppression	Renal insufficiency
Systemic symptoms	Nephrolithiasis	Urinary catheter
Symptoms >7 days	Urinary obstruction	Recent treatment failure
Diabetes mellitus	Anatomical GU abnormality	Recent hospitalization
Evidence of pyelonephritis	Recent GU instrumentation	

No → **Simple cystitis**

Urine culture generally not indicated[†]

1st line:
Nitrofurantoin[‡] 100mg PO BID for **5 days***

Alternatives:
Ciprofloxacin 250mg PO BID for 3 days

Trimethoprim-sulfamethoxazole DS 1 tab PO BID for 3 days (if *E.coli* resistance rate<15%)

Yes → **Complicated infection**

- Obtain urinalysis and culture
- Blood cultures if systemic signs/symptoms

Clinical evidence of pyelonephritis?
- Fever
- Nausea/vomiting
- Leukocytosis
- Flank pain
- CVA tenderness

No → **Complicated UTI**

Yes → **Pyelonephritis**

Risk factors for fluoroquinolone (FQ) resistance present?[b]:
1) Hospitalization in previous 12 months OR
2) Fluoroquinolone use in previous 12 months OR
3) Prior documented FQ-resistant organism

Yes → **Moderate to severe illness**

If appropriate for outpatient therapy:
Ceftriaxone 1gm IV or IM daily **OR**
Amikacin 10mg/kg IV or IM daily if *Pseudomonas* likely or if serious cephalosporin allergy

Yes → **Mild illness**

No →

Levofloxacin 500mg PO daily (use 750mg if risk for FQ resistance) OR
Ciprofloxacin 500mg PO BID (use 750mg BID if risk for FQ resistance)

Adjust antibiotics based on cultured organism and susceptibilities

If quinolone-resistant **AND** ceftriaxone-susceptible organism:
Cefixime 400mg PO daily
*not for empiric use for *suspected* quinolone resistance

Treatment duration varies by clinical scenario: 5-14 days*

Skin and Soft Tissue Infection in Non-Pregnant Adults

Key points
- Beta-hemolytic streptococci are the most common cause of cellulitis without abscess
- MRSA is the most common cause of simple abscess
- Drainage is the primary therapy for simple abscess; several studies show that antibiotic therapy does not add benefit to drainage alone
- Short-course antibiotic therapy has been shown to be as effective as longer courses

Possible signs and symptoms of skin and soft tissue infection (SSTI):

1) Cutaneous erythema
2) Cutaneous warmth
3) Swelling
4) Pain
5) Tenderness to palpation
6) Fever

Clinical picture consistent with SSTI?

- Yes → Severe infection or systemic illness?
  - Yes → Hospital admission
  - No → Fluctuant mass consistent with **cutaneous abscess?**
- No → Consider alternative etiologies

Fluctuant mass consistent with **cutaneous abscess?**

- Yes → **Simple abscess** (MRSA most common pathogen) → Incision and drainage → If antibiotics to be initiated, send purulent material for gram stain/bacterial culture → Extensive surrounding cellulitis; Inadequate drainage; Diabetes mellitus; Valvular heart disease; Immunosuppressing condition or medication
  - Yes → 1st line: **Clindamycin** 300-450mg PO TID OR **Doxycycline** 100mg PO BID* OR **TMP-SMX** DS 1-2 tabs PO BID*
  - No → **Antibiotic therapy not indicated†**
- No → Purulent drainage?
  - Yes → **Purulent SSTI** (MRSA common) → 1st line: **Clindamycin** 300-450mg PO TID OR **Doxycycline** 100mg PO BID* OR **TMP-SMX** DS 1-2 tabs PO BID*
  - No → **Simple cellulitis** (Streptococci most common) → β-lactam allergy OR Recent treatment with recurrence
    - Yes → 1st line: **Clindamycin** 300-450mg PO TID OR **Doxycycline** 100mg PO BID* OR **TMP-SMX** DS 1-2 tabs PO BID*
    - No → 1st line: **Dicloxacillin** 500mg PO 4x/daily OR **Cephalexin** 500mg PO 4x/daily

Duration of antibiotic therapy: 5 days**

Encourage adjunctive therapies:
1) **Elevate affected area**
2) **Ibuprofen 600mg PO Q8hrs** if no contraindication to NSAIDs

Community-Acquired Pneumonia in Non-Pregnant Adults

Key points
- Avoid diagnosing CAP without radiographic evidence of pneumonia
- Multiple studies suggest short-course antibiotic therapy is as effective as longer courses

Possible signs and symptoms of community-acquired pneumonia (CAP):

1) Cough
2) Shortness of breath
3) Fever
4) Sputum production
5) Pleuritic chest pain
6) Tachycardia
7) Tachypnea
8) Rales, egophany, or fremitus

Clinical picture suggestive of CAP

Yes → Obtain chest radiograph (CXR) Consider complete blood count

No → Consider alternative etiologies

Infiltrate present on CXR

No infiltrate on CXR* → **Does not meet criteria for CAP*** → Consider alternative etiologies

2 or more *CURB-65* criteria?
- Confusion – new onset disorientation to person, place, or time
- Uremia – BUN >20
- Respiratory rate >30
- Blood pressure – systolic <90 OR diastolic <60
- 65 – age >65

Yes → **Consider hospital admission**

No → Appropriate for outpatient therapy based on other medical and social needs?

No → **Consider hospital admission**

Yes → **Any risk factors for drug-resistant *S. pneumoniae*?†**
- Use of antibiotics within 3 months
- Uncontrolled diabetes mellitus
- Chronic medical condition with frequent health care contact
- Alcoholism
- Asplenia
- Immunosuppressing conditions or medications

Yes

1st line: Levofloxacin 750mg QDay for 5 days**

Alternative: Amoxicillin 1gm TID *plus* Doxycycline 100mg BID for 7 days

No

1st line: Doxycycline 100mg BID for 7 days

Alternative: Azithromycin 500mg QDay for 3 days