

Community Antibiotic Stewardship



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Antibiotic Stewardship programs exist frequently in hospitals and health management organizations in order to optimize patient health outcomes, control costs, ensure correct utilization, and, most importantly, minimize the emergence of bacterial resistance to preserve the effectiveness of current antibiotic medications.¹ There are few established antibiotic stewardship programs that formally exist in community pharmacy despite the fact that up to 50 percent of all antibiotics are dispensed through community pharmacies.² Among that percentage, it is estimated that a significant portion of those antibiotics were prescribed

inappropriately to treat symptoms of viral infection rather than a true bacterial infection. As a result, populations and individual patients who use the same antibiotic, or class of antibiotic, repeatedly are more likely to develop resistance.³ Community pharmacists are the most frequently seen health care provider and the final check in the delivery-of-care line. The regular correspondence that community pharmacists have with patients, as well as the training and knowledge they possess, creates a tremendous opportunity to perform interventions for patients in order to slow resistance, verify appropriate usage, recommend alternative over-the-counter (OTC)

medications, and educate physicians and patients.

The purpose of this article is to offer a program to provide recommendations for how community pharmacists can act as antibiotic stewardship proponents. This program offers an evidence-based formulary, accredited organizational-based practice guidelines, and relevant clinical pearls for continued education and awareness. It is composed of program principles (Table 1), a formulary (Table 2), and guidelines for treatment (Table 3). While there is no consensus to implementing a community-based antibiotic stewardship program, we propose the following (further detailed in Table 1):

Table 1. Community-Based Antibiotic Stewardship Program & Principles

Strategy	Implementation
Increase pharmacist's awareness of regional antibiotic resistance patterns	Contacting the CDC or WHO to obtain information and resources regarding current high-risk organisms and antibiotic resistance trends. A list of such organisms and antibiotics should be compiled by the pharmacist in charge or a designated team member, and all team members should be educated for what drugs and organisms to look out for. The list should be updated regularly, i.e., yearly or seasonally. Pharmacists should also be aware of the most common misdiagnoses, such as pharyngitis, common cold, bronchitis, sinusitis, etc.
Increase pharmacist's knowledge of treatment guidelines for diseases/infections for which antibiotic therapy is appropriate and ensure sufficient coverage and duration of therapy	Provide quick-reference brochures for commonly dispensed antibiotics and indications. These brochures should be easy to refer to and contain information such as diagnosis, appropriate antibiotics and alternatives, recommended length of therapy, and adjunct drugs necessary. The quick-reference guides should include the most commonly outpatient diagnoses: pharyngitis, sinusitis, bronchitis, upper respiratory tract exacerbation, urinary tract infection, non-tuberculosis mycobacterium, and organisms such as <i>S. pneumoniae</i> , <i>H. influenzae</i> , and <i>M. catarrhalis</i> .
Community pharmacies should limit and adjust their inventory of antibiotics to minimize overuse of broad-spectrum antibiotics and maximize usage of narrow-spectrum antibiotics	Pharmacy should carry limited supplies of the broadest spectrum antibiotics to discourage overutilization or flag such antibiotics as high-alert medications for dispensing pharmacist to verify appropriateness of usage. Narrow-spectrum antibiotic inventory should be maintained as appropriate for patient population served by the pharmacy, seasonal infection patterns by year, and resistance trends by pharmacy region. High-resistance risk/alert antibiotics should typically include: azithromycin, cephalosporins, and high-dose amoxicillin-clavulanate.

<p>Antibiotic-stewardship-focused prospective and retrospective drug utilization review</p>	<p>Pharmacists should ask patients or physicians what the antibiotic is for if the drug prescribed is a broad-spectrum antibiotic and verify if the information is missing or unclear in order to ensure completeness and appropriateness of the prescription. Any refills for antibiotics should be verified for appropriate continuation of the medication for a treatment regimen. Pharmacist should periodically review patient profiles for antibiotics that are being refilled or new but repeat orders of the same antibiotic or class. Pharmacists should also schedule follow-up calls for patients during or after their antibiotic course to ensure successful completion and better patient compliance, and to monitor for adverse drug events, sudden discontinuation, or physician revisit for new antibiotics. The pharmacy should also run reports that find physician antibiotic prescribing patterns to determine whether there are any physicians who may be overprescribing inappropriate broad-spectrum antibiotics who could benefit from a pharmacist intervention or educational reminder call.</p>
<p>Pharmacists should prioritize and promote immunizations</p>	<p>Train and certify that all pharmacists are capable of administering immunizations. Pharmacists should be up to date on their own immunizations. Ensure that pharmacy is stocked with correct inventory of immunizations and that they are the current batch for the year. Vaccines stocked and administered should include: Annual influenza, pneumococcal, hepatitis A/B, chickenpox, meningitis, measles, mumps, rubella, shingles-herpes zoster, tetanus Td, and Tdap. An increased number of vaccinations in the community will increase herd immunity, decrease physician visits, and lower the likelihood of developing symptoms that result in antibiotics prescribed for viral causes.</p>
<p>Mandatory counseling and counseling guidelines for all antibiotics by pharmacists</p>	<p>All antibiotics including new prescriptions and refills (only for appropriate long-term continuation therapy) must be dispensed with a pharmacist counseling of what the medication is for, how long to take the medication, what side effects to look out for, and clinical pearls such as to take all pills until finished. Pharmacists must also clarify the difference between a side effect, adverse reaction, or drug allergy and firmly instruct patient to continue taking antibiotic to completion even if they start feeling better. Antibiotic counseling should be prioritized especially during cold and flu season.</p>
<p>Pharmacists should recommend OTC products to treat symptoms first before referring patient to a physician for antibiotic; actively educate patients on viral vs. bacterial infections and the dangers of antibiotic overuse and resistance.</p>	<p>For patients with the following symptoms, recommend that they try these OTC products first before going to physician for an antibiotic: Sore throat: throat spray and lozenges Ear pain: warm moist cloth over ear or acetaminophen (APAP) Runny nose: decongestant, saline spray Sinus pain/pressure: warm compress, decongestant, nasal spray, steam Cough: humidifier, rest, fluids Note: APAP formulations specific for children under 6 months only</p> <p>Community pharmacists should look for the following symptoms in adult patients as appropriate to refer to physician: extreme lethargy, stiff neck, difficulty breathing, high fever, and seizures. Remind pharmacists to look for and educate patients who may have viral infections and should try an OTC product first.</p> <p>Be able to distinguish between appropriate OTC drugs for pregnancy, infants, children, hypertensive, diabetic, etc.</p> <p>Recommend community hygiene practices such as washing hands correctly before handling food and after using the bathroom; practices such as covering one's mouth when sneezing, and using a face mask to minimize spread to others in confined areas.</p>
<p>Pharmacists should educate physicians and bring awareness to antibiotic resistance from inappropriate expectations from patients</p>	<p>Physicians commonly cite patient expectations and demands as reasons for prescribing antibiotics in the ambulatory setting.</p> <p>Educate patients that antibiotics have no benefit if for the wrong organism and are likely to wipe out natural healthy protective bacteria and give patients side effects such as diarrhea and secondary infections.</p> <p>Identify particular local physicians with prescribing habits that demonstrate overuse of broad-spectrum antibiotics and/or inappropriate use of antibiotics, and create list with which to perform interventions and antibiotic switching to narrower spectrum when appropriate by pharmacist judgment. Inform physicians of local antibiotic resistance trends and ask if their facility has policies and procedures in place for antibiotic stewardship.</p>
<p>Pharmacists should ensure that all patient profiles accurately contain true patient drug allergies; pharmacists should counsel patients on true drug allergies vs. adverse events or side effects</p>	<p>Patient profiles should contain up-to-date and accurate patient information on true allergies to antibiotics, especially beta lactams and sulfas. True drug allergic reactions will involve skin rashes, hives, breathing problems, edema, swelling, changes in blood pressure.</p> <p>Anaphylaxis occurs quickly after taking medication and causes responses such as severe swelling, bronchoconstriction and difficulty breathing, nausea/vomiting, sudden drop in blood pressure, loss of consciousness, and possible shock and organ damage.</p> <p>Pharmacists should use their clinical judgment to determine whether a patient has a true allergy and is prescribed a related antibiotic to the stated allergy. Policies and procedures should be in place in the event of an antibiotic drug allergy event. These policies and procedures will be outlined in a way to cover actions such as informing the physician, providing supportive and reversal agents to an allergic reaction, and providing appropriate alternative antibiotic in a timely manner.</p>

Table 2. Antibiotic Formulary Focused on Indications

Drugs	Indication	Guidelines for Use	Quantity Limits / Step Therapy / Concurrent Therapy	Resistance Patterns
Cefdinir	Bronchitis: S. pneumoniae, H. influenzae, M. catarrhalis Pneumonia Pharyngitis Sinusitis	300mg PO Q12H for 5-10 days	20	3rd gen cep resistance: E. coli 3.94% US-West 2010
Cephalexin	Dental infection: Streptococci, anaerobes Otitis Media Streptococcal Pharyngitis UTI	500mg PO Q6H	40	
Amoxicillin / Clavulanate	Pneumonia: S. pneumoniae, Mycoplasma pneumoniae, H. influenzae, Bacteroides, Peptostreptococcus, fusobacterium Dental infection: beta-lactamase producing organisms Sinusitis (symptoms < 14 days) S. pneumoniae, H. influenzae, M. catarrhalis, Group A strep, anaerobes Bronchitis: S. pneumoniae, H. influenzae, M. catarrhalis	875mg PO BID or 500mg PO TID for 10 days 875mg PO BID or 500mg TID for 10-14 days (prefer over amoxicillin mono for children) 875mg PO BID or 500mg PO TID for 7 days	42	PCN resistant S. pneumoniae 5.90% 2010 US-West
Amoxicillin	Dental infection: Streptococci, anaerobes Bronchitis: S. pneumoniae, H. influenzae, M. catarrhalis	250-500mg PO Q6-8h 500mg PO TID for 5-14 days		Aminopenicillin resistance: E. coli 41.26% 2010 US West
Ampicillin	Respiratory Tract Infection GI Tract Infection Genitourinary Infection	250mg PO Q6H for 10-14 days 500mg PO Q6H		
Dicloxacillin	Infection due to S. aureus	125-500mg Q6H	Max 2g/day	
Penicillin VK	Pharyngitis: Strep (pyogenes, group C and G), A. hemolyticum, C. diphtheriae Respiratory Tract Infection	250-500mg PO Q6H for 10 days	40	PCN resistant S. pneumoniae 48.59%
Azithromycin	Pneumonia: S. pneumoniae, Mycoplasma pneumoniae, H. influenzae Sinusitis + penicillin allergy (symptoms < 14 days) S. pneumoniae, H. influenzae, M. catarrhalis, Group A strep, anaerobes Bronchitis: S. pneumoniae, H. influenzae, M. catarrhalis	500mg PO on day 1 then 250mg daily on days 2-5 or 2g for 1 dose 500mg PO on day 1 then 250mg PO daily for 4 days	6	Macrolide resistant S. pneumoniae 29.63% 2010 US-West
Erythromycin	Pneumonia: S. pneumoniae, Mycoplasma pneumoniae, H. influenzae Dental infections: Streptococci, anaerobes	250mg PO Q6H OR 500mg PO Q12H 250mg PO Q6H or 500mg PO Q12H	Max 4g/day	Macrolide resistant S. pneumoniae 29.63% 2010 US-West

Clarithromycin	Pneumonia: S. pneumoniae, Mycoplasma pneumoniae, H. influenzae Pharyngitis: Strep (pyogenes, group C and G), A. hemolyticum, C. diphtheriae Sinusitis + penicillin allergy (symptoms < 14 days) S. pneumoniae, H. influenzae, M. catarrhalis, Group A strep, anaerobes Bronchitis: S. pneumoniae, H. influenzae, M. catarrhalis	500mg PO BID for 7 days 250mg PO BID for 10 days 500mg PO BID for 10-14 days 500mg PO Q12H for 3-10 days	56	Macrolide resistant S. pneumoniae 29.63% 2010 US-West
Doxycycline	Urethritis Bronchitis: S. pneumoniae, H. influenzae, M. catarrhalis Rocky Mountain Spotted Fever	100mg PO BID for 7 days 100mg PO BID for 5-14 days 100mg PO BID for 7 days	28	TCN resistance: Coag neg. Staph 13.49% 2010 US-West
Tetracycline	H. pylori	500mg QID for 10-14 days plus bismuth, metronidazole, PPI	Use for high resistance risk or patient who tried/failed prior triple course	TCN resistance: Coag neg. Staph 13.49% 2010 US-West
Ciprofloxacin	Bronchitis: S. pneumoniae, H. influenzae, M. catarrhalis Lower respiratory tract infection	500-750mg PO Q12H for 7-14 days	28	FQN resistant K. pneumoniae 4.68%, P. aeruginosa 29.28%, P. mirabilis 10.24%, Coag neg. Step 48.25%
Levofloxacin	Pneumonia: S. pneumoniae, Mycoplasma pneumoniae, H. influenzae Sinusitis + penicillin allergy (symptoms < 14 days) S. pneumoniae, H. influenzae, M. catarrhalis, Group A strep, anaerobes UTI: Enterobacteriaceae (includes E. coli, serratia, klebsiella, enterobacter, citrobacter), S. saprophyticus, enterococci Bronchitis: S. pneumoniae, H. influenzae, M. catarrhalis	750mg PO daily for 5 days 750mg PO daily for 7-10 days for resistant S. pneumoniae 250mg PO daily for 3 days 500mg PO daily for 5 days	10	FQN resistant E. coli 17.34% 2010 US-West FQN resistant K. pneumoniae 4.68%, P. aeruginosa 29.28%, P. mirabilis 10.24%, Coag Neg Step 48.25%
Moxifloxacin	Pneumonia: S. pneumoniae, Mycoplasma pneumoniae, H. influenzae Bronchitis: S. pneumoniae, H. influenzae, M. catarrhalis	400mg po daily for 7-10 days 400mg PO daily for 5 days	10	FQN resistant E. coli 17.34% 2010 US-West FQN resistant K. pneumoniae 4.68%, P. aeruginosa 29.28%, P. mirabilis 10.24%, Coag Neg Step 48.25%
Nitrofurantoin	UTI: Enterobacteriaceae (includes E. coli, serratia, klebsiella, enterobacter, citrobacter), S. saprophyticus, enterococci	100mg PO BID for 5 days	10	
Metronidazole	Bacterial vaginosis Trichomoniasis H. pylori infection	500 mg PO BID for 7 days 2g PO as single dose or 500 mg PO BID/ 250 mg PO TID for 7 days See Table 3	21	

Trimethoprim	Sinusitis (symptoms < 14 days) S. pneumoniae, H. influenzae, M. catarrhalis, Group A strep, anaerobes UTI: Enterobacteriaceae (includes E. coli, serratia, klebsiella, enterobacter, citrobacter), S. saprophyticus, enterococci Bronchitis: S. pneumoniae, H. influenzae, M. catarrhalis	800 mg PO BID for 10-14 days 800 mg PO BID for 3 days + phenazopyridine 200 mg PO TID for 2 days 800 mg PO BID for 5 days	28	Sulfa-TMP resistant P. mirabilis 14.34%, E. coli 18.16%,
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Table 3. Guideline-Based Treatment Options

Infection Type	Organisms	When to initiate therapy	Treatment Options
Rhinosinusitis	S. pneumoniae, H. influenzae, M. catarrhalis, S. pyogenes, S. aureus, Enterobacteriaceae, Bacteroides, Fusobacterium, Peptostreptococcus	Persistent symptoms > 10 days without improvement Severe symptom onset with fever > 102° F, nasal discharge, and facial pain for 3-4 days Onset with worsening symptoms following viral infection for 5-6 days that was improving	Amoxicillin Amoxicillin-clavulanate Respiratory FQN-Levofloxacin, Moxifloxacin Clindamycin Doxycycline as alternative to amoxicillin-clavulanate Duration: 5-7 days adults, 10-14 children Macrolides (not recommended due to S. pneumoniae resistance) Bactrim (not recommended due to S. pneumoniae and H. influenzae resistance) Cephalosporins not recommended
Pharyngitis	Group A Streptococcus S. pyogenes Group C Strep	Throat swab + Rapid Antigen Detection Test Clinical features alone do not distinguish between bacterial and viral infection	For at least 10 days Penicillin 250mg 3-4x daily for 10 days or 500mg bid for 10 days Amoxicillin 50mg/kg daily for 10 days Clindamycin 7mg/kg tid for 10 days (PCN allergy patients) Cephalexin 20mg/kg bid for 10 days Clarithromycin for 10 days Azithromycin for 5 days
Community-Acquired Pneumonia (Outpatient)	S. pneumoniae, Mycoplasma pneumoniae, H. influenzae, Chlamydia pneumoniae	Clinical features Physical exam Pulse oximetry Chest radiography Recent travel history Sputum sample	Previously healthy + no risk factors for S. pneumoniae resistance Macrolide-azithromycin, clarithromycin, erythromycin Doxycycline Comorbidities (heart, lung, liver, renal, DM, asplenia, immune) or prior use of antibiotics within prior 3 months FQN-Levofloxacin, Moxifloxacin B-lactam + macrolide: amoxicillin, amoxicillin-clavulanate preferred, or cephalosporin or doxycycline Consider patterns of resistance to S. pneumoniae

Acute uncomplicated cystitis (UTI)	E. coli, Proteus mirabilis, Klebsiella pneumonia, S. aureus	Absence of fever, flank pain, and other suspicion for pyelonephritis	Nitrofurantoin 100mg bid x 5 days (avoid if pyelonephritis suspected) Sulfamethoxazole-Trimethoprim 800/160mg bid x 3 days (avoid if resistance >20% and used for UTI in prior 3 months) FQN: ciprofloxacin 250 mg bid x 3 days, levofloxacin 250mg x 3 days Beta Lactams: amoxicillin-clavulanate, cefdinir, cefaclor for 3-7 days Avoid amoxicillin and ampicillin
Bronchitis	Most cases due to virus S. pneumonia, H. influenza, S. aureus, M. catarrhalis, Mycoplasma pneumonia, Chlamydia pneumonia, Bordetella pertussis	Studies indicate most patients with acute bronchitis do not have significant benefit with antibiotic therapy	
Nontuberculosis Mycobacterium	Mycobacterium avium, Complex	Pulmonary symptoms Nodes on CT or radiograph Positive cultures Biopsy AIDS/HIV immunocompromised	Clarithromycin 1000mg TIW or Azithromycin 500mg TIW PLUS Rifampin 600mg TIW PLUS Ethambutol 25mg/kg TIW until sputum cultures negative for 1 year
H. pylori Infection	H. pylori infection	Endoscopy: biopsy urease, histology, bacteria culture	Low resistance- Triple therapy clarithromycin 500mg + amoxicillin 1000mg + PPI bid for 10-14 days OR clarithromycin 500mg + metronidazole 500mg + PPI bid for 10-14 days High resistance/failed prior triple course- Quad therapy: Bismuth 525mg + metronidazole 250mg + TCN 500mg QID + PPI bid for 10-14 days Urea breath or stool test 4 weeks after therapy to confirm eradication
Acute Otitis Media		Infants < 6 months 6 months-2 years if severe illness or positive diagnosis > 2 years if severe illness or observe	Amoxicillin 90mg/kg/day divided Q12 or Q8H Amoxicillin-clavulanate 90mg/kg/day divided Q12H Clarithromycin 15mg/kg/day divided Q12H Sulfa-TMP 6-10mg/kg/day divided Q12H for 10 days if severe/<2 years age for 5-7 days if >2 years old and mild-moderate

DISSEMINATE: Dissemination of the program with all three tables to pharmacy staff and prescribers

DISPLAY: Posting the tables in the pharmacy and in the provider exam rooms

PORTABLE: Lamination of the tables for ease of transport by prescribers and pharmacists in their lab coats

CLINICAL PEARLS: Regular and continuing educational interactions between prescribers and pharmacists based on clinical pearls drawn from the three program tables

EDUCATION: Short educational articles for dissemination to patients and interested organizations

LABELS: Include treatment guidelines for specific therapies in computer labels and ancillary Web-based communications

REVIEWS: Monthly review of antibiotic and corollary prescriptions (e.g. cough and cold medications, antihistamines, analgesics, etc.) with a pharmacist follow-up to prescribers focusing on improvement of appropriate antibiotic prescribing habits.

FEEDBACK ON PERFORMANCE: Announce to prescribers, pharmacy staff, and patients successes and improvements to the program

There is a critical need for improving antibiotic prescribing. It is the authors' hope that this program can

provide guidance for community pharmacists and managers to address this problem at the site of the largest volume of prescriptions. We would be very interested in feedback provided from local programs and their successes.

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