Antibiotic Stewardship Beyond Hospital Walls

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OBJECTIVES

1. Review what Antibiotic Stewardship is for all transitions of care.

2. Review national mandates and guidelines.

3. Review new rapid diagnostic testing available to help with antibiotic stewardship.

4. Discuss how to reduce community Clostridium difficile with appropriate antibiotic stewardship principles.

5. Discuss how to educate other healthcare providers and patients on antibiotic stewardship principles.
Antibiotics are a shared resource and becoming a scarce resource.

30-50% of antibiotic use in hospitals is unnecessary or inappropriate.

Antibiotic overuse contributes to the growing problems of Clostridium difficile infection and antibiotic resistance in healthcare facilities.
Fast Facts

- Reducing unnecessary antibiotic use can decrease antibiotic resistance, *Clostridium difficile* infections, and healthcare costs, and improve patient outcomes.

- Interventions to improve antibiotic use can be implemented in any healthcare setting—from the smallest to the largest.

- Improving antibiotic use is a medication-safety and patient-safety issue.

http://www.cdc.gov/getsmart/healthcare/evidence.html
Antibiotic Resistance of *Escherichia coli*

% Resistant (invasive isolates)

<table>
<thead>
<tr>
<th>Country</th>
<th>Aminoglycosides</th>
<th>Aminopenicillins</th>
<th>Amoxicillin–clavulanate</th>
<th>Carbapenems</th>
<th>Cephalosporins (3rd gen)</th>
<th>Fluoroquinolones</th>
<th>Piperacillin–tazobactam</th>
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Center for Disease Dynamics, Economics & Policy (cddep.org)
Antibiotic Resistance of *Escherichia coli*
Clostridium Difficile On The Rise

Figure 1. Rates of discharges from US short-term stay hospitals of patients with *Clostridium difficile*–associated disease listed as any diagnosis, by age [5].
DEADLY DIARRHEA:
C. DIFFICILE CAUSES IMMENSE SUFFERING, DEATH

IMPACT

500,000
Caused close to half a million illnesses in one year.

C. difficile comes back at least once in about 1 in 5 patients who get C. difficile.

Caused 15,000 deaths in one year. 1 in 11 people 65 and older died within a month of C. difficile infection diagnosis.

RISK

People on antibiotics are 7-10 times more likely to get C. difficile while on the drugs and during the month after.

Being in healthcare settings, especially hospitals, or nursing homes.

More than 80% of C. difficile deaths occurred in people 65 and older.

SPREAD

Touching unclean surfaces, especially those in healthcare settings, contaminated with feces from an infected person.

Dirty hands.

Failing to cross-contaminate other healthcare facilities when patients with C. difficile transfer from one facility to another.

PREVENT

Improve prescribing of antibiotics.

Use best tests for accurate results to prevent spread.

Rapidly identify and isolate patients with C. difficile. Wipe gloves and gowns when transferring patients with C. difficile. Remind that hand sanitizer doesn’t kill C. difficile.

Cleanf rom of face with EPA-approved, spore-killing disinfectant (such as bleach), which C. difficile patients are infected.

http://www.cdc.gov/HAI/organisms/cdiff/Cdiff_infect.html

www.cdc.gov/media
What Is Antibiotic Stewardship?

• Program which promotes and monitors appropriate selection, dosing, route and duration of antimicrobial therapy.

• Primary Goals
  • Optimized clinical outcomes
  • Minimize unattended consequences of antimicrobial use
    • Toxicity
    • Selection of pathogenic organisms
      • (Clostridium difficile)
    • Emergence of resistance
Endorsed By Multiple National Organizations

- Infectious Disease Society of America
- Society of Healthcare Epidemiology of America
- American Society of Health-Systems Pharmacists
- American Academy of Pediatrics
- Society for Hospital Medicine
- Pediatric Infectious Disease Society
- Society of Infectious Disease Pharmacist
- Infectious Disease Society for Obstetrics and Gynecology
- Center of Disease Control
- Institute of HealthCare Improvement
NATIONAL STRATEGY
FOR COMBATING ANTIBIOTIC-RESISTANT BACTERIA

Vision: The United States will work domestically and internationally to prevent, detect, and control illness and death related to infections caused by antibiotic-resistant bacteria by implementing measures to mitigate the emergence and spread of antibiotic resistance and ensuring the continued availability of therapeutics for the treatment of bacterial infections.

September 2014
Goals

• Slow the Development of Resistant Bacteria and Prevent the Spread of Resistant Infections

• Strengthen National One-Health Surveillance Efforts to Combat Resistance

• Advance Development and Use of Rapid and Innovative Diagnostic Tests for Identification and Characterization of Resistant Bacteria

• Accelerate Basic and Applied Research and Development for New Antibiotics, Other Therapeutics, and Vaccines

• Improve International Collaboration and Capacities for Antibiotic Resistance Prevention, Surveillance, Control, and Antibiotic Research and Development
CDC CORE ELEMENTS FOR ANTIBIOTIC STEWARDSHIP

Outpatient

- **Commitment:** Demonstrate dedication to and accountability for optimizing antibiotic prescribing and patient safety.

- **Action for policy and practice:** Implement at least one policy or practice to improve antibiotic prescribing, assess whether it is working, and modify as needed.

- **Tracking and reporting:** Monitor antibiotic prescribing practices and offer regular feedback to clinicians, or have clinicians assess their own antibiotic prescribing practices themselves.

- **Education and expertise:** Provide educational resources to clinicians and patients on antibiotic prescribing, and ensure access to needed expertise on optimizing antibiotic prescribing.

Hospital

- **Leadership Commitment:** Dedicating necessary human, financial and information technology resources.

- **Accountability:** Appointing a single leader responsible for program outcomes. Experience with successful programs show that a physician leader is effective.

- **Drug Expertise:** Appointing a single pharmacist leader responsible for working to improve antibiotic use.

- **Action:** Implementing at least one recommended action, such as systemic evaluation of ongoing treatment need after a set period of initial treatment (i.e. “antibiotic time out” after 48 hours).

- **Tracking:** Monitoring antibiotic prescribing and resistance patterns.

- **Reporting:** Regular reporting information on antibiotic use and resistance to doctors, nurses and relevant staff.

- **Education:** Educating clinicians about resistance and optimal prescribing.

Long Term Care (Nursing Homes)

- **Leadership commitment:** Demonstrate support and commitment to safe and appropriate antibiotic use in your facility

- **Accountability:** Identify physician, nursing and pharmacy leads responsible for promoting and overseeing antibiotic stewardship activities in your facility

- **Drug expertise:** Establish access to consultant pharmacists or other individuals with experience or training in antibiotic stewardship for your facility

- **Action:** Implement at least one policy or practice to improve antibiotic use

- **Tracking:** Monitor at least one process measure of antibiotic use and at least one outcome from antibiotic use in your facility

- **Reporting:** Provide regular feedback on antibiotic use and resistance to prescribing clinicians, nursing staff and other relevant staff

- **Education:** Provide resources to clinicians, nursing staff, residents and families about antibiotic resistance and opportunities for improving antibiotic use
antibiotic stewardship efforts. Fill research gaps around effective interventions for improving prescribing habits, and help our members use antibiotics appropriately in outpatient settings. These coordinated efforts will help preserve these life-saving therapies for the good of all of our patients.

4. This goal specifically targets a reduction in unnecessary antibiotic prescribing, and does not include goals aimed at improving antibiotic selection. Ensuring the appropriate antibiotic is chosen for a particular condition is another critical aspect of antibiotic stewardship.
Nationally, 48.1% of all hospitals have stewardship programs (2,199 of 4,549); the national goal is 100% of hospitals by 2020.

* A hospital stewardship program is defined as a program following all 7 of CDC’s Core Elements of Hospital Antibiotic Stewardship Programs.

Source: CDC’s National Healthcare Safety Network (NHSN) Survey
Community Antibiotic Prescriptions per 1,000 Population by State — 2014

At least 30% of antibiotics prescribed in doctors’ offices, emergency departments and hospital clinics are unnecessary.*

Data source: IMS Health Xponent 2014.

Kansas

Acute Care Hospitals

Healthcare-associated infections (HAIs) are infections patients can get while receiving medical treatment in a healthcare facility. Working toward the elimination of HAIs is a CDC priority. The standardized infection ratio (SIR) is a summary statistic that can be used to track HAI prevention progress over time; lower SIRs are better. The infection data are reported to CDC’s National Healthcare Safety Network (NHSN). HAI data for nearly all U.S. hospitals are published on the Hospital Compare website. This report is based on 2014 data, published in 2016.

CLABSIs

Central Line-Associated Bloodstream Infections

When a tube is placed in a large vein and not put in correctly or kept clean, it can become a way for germs to enter the body and cause deadly infections in the blood.

- Kansas hospitals reported no significant change in CLABSIs between 2013 and 2014.
- Among the 21 hospitals in Kansas with enough data to calculate an SIR, 11% had an SIR significantly higher (worse) than 0.50, the value of the national SIR.

CAUTIs

Catheter-Associated Urinary Tract Infections

When a urinary catheter is not put in correctly, not kept clean, or left in a patient for too long, germs can travel through the catheter and infect the bladder and kidneys.

- Kansas hospitals reported no significant change in CAUTIs between 2013 and 2014.
- Among the 31 hospitals in Kansas with enough data to calculate an SIR, 6% had an SIR significantly higher (worse) than 1.00, the value of the national SIR.

MRSA Bacteremia

Laboratory Identified Hospital-Onset Bloodstream Infections

Methicillin-resistant Staphylococcus aureus (MRSA) is bacteria usually spread by contaminated hands. In a healthcare setting, such as a hospital, MRSA can cause serious bloodstream infections.

- Kansas hospitals reported no significant change in MRSA bacteremia between 2013 and 2014.
- Among the 14 hospitals in Kansas with enough data to calculate an SIR, 0% had an SIR significantly higher (worse) than 0.87, the value of the national SIR.

SSIs

Surgical Site Infections

When germs get into an area where surgery is or was performed, patients can get a surgical site infection. Sometimes these infections involve only the skin. Other SSIs can involve tissues under the skin, organs, or implanted material.

SSI: Abdominal Hysterectomy

- Kansas hospitals reported no significant change in SSIs related to abdominal hysterectomy surgery between 2013 and 2014.
- Not enough data to report how many hospitals had an SIR significantly higher (worse) than 0.83, the value of the national SIR.

SSI: Colon Surgery

- Kansas hospitals reported no significant change in SSIs related to colon surgery between 2013 and 2014.
- Among the 18 hospitals in Kansas with enough data to calculate an SIR, 22% had an SIR significantly higher (worse) than 0.98, the value of the national SIR.

C. difficile Infections

Laboratory Identified Hospital-Onset C. difficile Infections

When a person takes antibiotics, good bacteria that protect against infection are destroyed for several months. During this time, patients can get sick from Clostridium difficile (C. difficile), bacteria that cause potentially deadly diarrhea, which can be spread in healthcare settings.

- Kansas hospitals reported no significant change in C. difficile infections between 2013 and 2014.
- Among the 49 hospitals in Kansas with enough data to calculate an SIR, 8% had an SIR significantly higher (worse) than 0.92, the value of the national SIR.

* statistically significant
### KANSAS

#### ACUTE CARE HOSPITALS

Healthcare-associated infection (HAI) data give healthcare facilities and public health agencies knowledge to design, implement, and evaluate HAI prevention efforts.

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<tr>
<td>CLABSI</td>
<td>48 Total Hospitals in Kansas: 146</td>
<td>↑ 6%</td>
<td>↑ 24%</td>
<td>↓ 39%</td>
<td>0.61</td>
<td>0.50</td>
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<td>CAUTI</td>
<td>52</td>
<td>↓ 10%</td>
<td>↑ 1%</td>
<td>↓ 1%</td>
<td>1.01</td>
<td>1.00</td>
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<tr>
<td>SSI, Abdominal Hysterectomy</td>
<td>43</td>
<td>↑ 107%</td>
<td>↑ 4%</td>
<td>↓ 14%</td>
<td>0.86</td>
<td>0.83</td>
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<tr>
<td>SSI, Colon Surgery</td>
<td>44</td>
<td>↑ 3%</td>
<td>↑ 45%</td>
<td>↓ 42%</td>
<td>1.42</td>
<td>0.98</td>
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<tr>
<td>MRSA Bacteremia</td>
<td>67</td>
<td>↑ 15%</td>
<td>↓ &lt; 1%</td>
<td>↓ 45%</td>
<td>0.55</td>
<td>0.87</td>
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<tr>
<td>C. difficile Infections</td>
<td>66</td>
<td>↑ 1%</td>
<td>↓ 8%</td>
<td>↓ 8%</td>
<td>0.92</td>
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*The number of hospitals that reported to NHSN and are included in the SIR calculation. This number may vary across HAIs; for example, some hospitals do not use central lines or urinary catheters, or do not perform colon or abdominal hysterectomy surgeries.

^2Nat’l baseline time period varies by HAi type. See first column of this table for specifics.

#### WHAT IS THE STANDARDIZED INFECTION RATIO?

The standardized infection ratio (SIR) is a summary statistic that can be used to track HAI prevention progress over time; lower SIRs are better. The SIR for a facility or state is adjusted to account for factors that might cause infection rates to be higher or lower, such as hospital size, teaching status, the type of patients a hospital serves, and surgery and patient characteristics.

#### WHAT IS KANSAS DOING TO PREVENT HEALTHCARE-ASSOCIATED INFECTIONS?

Prevention efforts to reduce specific HAIs:
- Central line-associated bloodstream infections
- Catheter-associated urinary tract infections
- Multidrug-resistant infections (C. difficile)
- Antibiotic stewardship

- Healthcare personnel influenza vaccination
- Targeted Assessment for Prevention (TAP) strategy

For prevention effort details, see glossary.

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Outpatient Data Coming Soon
Frequency Of First-line Antibiotic Selection Among US Ambulatory Care Visits For Otitis Media, Sinusitis, And Pharyngitis


## Adult Treatment CDC for Acute Rhinosinusitis, Bronchiolitis, Common Cold, Pharyngitis and Cystitis

The U.S. Food and Drug Administration is advising that the serious side effects associated with fluvoxamine (e.g., ciprofloxacin, enoxatetracil, levofloxacin, moxifloxacin and ofloxacin) antibiotic drugs generally outweigh the benefits for patients with acute sinusitis, acute bronchitis, and uncomplicated urinary tract infections who have other treatment options. For patients with these conditions, fluvoxamine should be reserved for those who do not have alternative treatment options.

### Adult Treatment Guidelines

<table>
<thead>
<tr>
<th>Condition</th>
<th>Epidemiology</th>
<th>Diagnosis</th>
<th>Management</th>
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<tr>
<td><strong>Acute rhinosinusitis</strong></td>
<td>About 1 out of 8 adults (12%) in 2012 reported receiving a diagnosis of rhinosinusitis in the previous 12 months, resulting in more than 30 million diagnoses. Ninety-nine percent of rhinosinusitis cases are viral, and antibiotics are not recommended to help even if the causative agent is bacterial.</td>
<td>Diagnose acute bacterial rhinosinusitis based on symptoms that are:</td>
<td>If a bacterial infection is established:</td>
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<td>- Severe (3–4 days), such as fever 39°C (102°F) and purulent nasal discharge or facial pain,</td>
<td>- Watchful waiting is encouraged for uncomplicated cases for which reliable follow-up is available.</td>
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<td>- Persistent (&gt;10 days) without improvement, such as nasal discharge or daytime cough, or</td>
<td>Amoxicillin or amoxicillin-clavulanate is the recommended first-line therapy.</td>
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<td>- Worsening (3–4 days) such as worsening or new onset fever, daytime cough, or nasal discharge after initial improvement of a viral upper respiratory infections (URI) lasting 5–6 days.</td>
<td>Macrolides such as azithromycin are not recommended due to high levels of <em>Streptococcus pneumoniae</em> antibiotic resistance (40%).</td>
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<td><strong>Acute uncomplicated bronchiolitis</strong></td>
<td>Cough is the most common symptom for which adult patients visit their primary care provider, and acute bronchiolitis is the most common diagnosis in these patients.</td>
<td>- Evaluation should focus on ruling out pneumonia, which is rare among otherwise healthy adults in the absence of abnormal vital signs (heart rate &gt; 100 beats/min, respiratory rate &gt; 24 breaths/min, or oral temperature &gt; 38 °C) and abnormal lung examination findings (focal consolidation, egophony, fremitus).</td>
<td>- For penicillin-allergic patients, doxycycline or a respiratory fluoroquinolone (levofloxacin or moxifloxacin) are recommended as alternative agents.</td>
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<td>- Colored sputum does not indicate bacterial infection.</td>
<td>Routine treatment of uncomplicated acute bronchitis with antibiotics is not recommended, regardless of cough duration. Options for symptomatic therapy include:</td>
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<td>- For most cases, chest radiography is not indicated.</td>
<td>- Cough suppressants (codeine, dextromethorphan).</td>
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<td><strong>Common cold or non-specific upper respiratory tract infection (URI)</strong></td>
<td>The common cold is the third most frequent diagnosis in office visits, and most adults experience two to four colds annually. At least 200 viruses can cause the common cold.</td>
<td>- Prominent cold symptoms include fever, cough, rhinorrhea, nasal congestion, postnasal drip, sore throat, headache, and myalgias.</td>
<td>- First-generation antihistamines (diphenhydramine).</td>
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<tr>
<td><strong>Pharyngitis</strong></td>
<td>Group A beta-hemolytic streptococcal (GAS) infection is the only common indication for antibiotic therapy for sore throat cases. Only 5–10% of adult sore throat cases are caused by GAS.</td>
<td>- Clinical features alone do not distinguish between GAS and viral pharyngitis; a rapid antigen detection test (RADT) is necessary to establish a GAS pharyngitis diagnosis.</td>
<td>- Decongestants (pseudoephedrine and phenylephrine) combined with a first-generation antihistamine may provide short-term symptom relief of nasal symptoms and cough.</td>
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<td>- Those who meet two or more criteria (e.g., fever, tonsillar exudates, tender cervical lymphadenopathy, absence of cough) should receive a RADT. Threat cultures are not routinely recommended for adults.</td>
<td>- Non-steroidal anti-inflammatory drugs can be given to relieve symptoms.</td>
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<tr>
<td><strong>Acute uncomplicated cystitis</strong></td>
<td>Cystitis is among the most common infections in women and is usually caused by E. coli.</td>
<td>- Classic symptoms include dysuria, frequent voiding of small volumes, and urgency. Hematuria and suprapubic discomfort are less common.</td>
<td>- Evidence is lacking to support antibiotics (as monotherapy), opioids, intranasal corticosteroids, and nasal saline irrigation as effective treatments for cold symptom relief.</td>
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<td>- Nitrites and leukocyte esterase are the most accurate indicators of acute uncomplicated cystitis.</td>
<td>- Patients and providers must weigh the benefits and harms of symptomatic therapy.</td>
</tr>
</tbody>
</table>

### Notes:

1. [Kostka JK, LeBlanc ME, Gormley DJ, et al.].
2. [Kunselman M, Vlahakis NE, et al.].
3. [Kung AW, Dershwitz M, Rachik E, et al.].
4. [Rosenberg R, Shulman ST, et al.].
5. [Shulman ST, Kagan MN, et al.].
7. [Kagan MN, et al.].
8. [Kagan MN, et al.].
# Pediatric Treatment CDC Recommendations

Acute rhinosinusitis, Acute Otitis Media, Bronchiolitis, Pharyngitis, Common cold, and Urinary Tract Infections

Antibiotic prescribing guidelines establish standards of care, focus quality improvement efforts, and improve patient outcomes. The table below summarizes the most recent principles of appropriate antibiotic prescribing for children obtaining care in an outpatient setting for the following six diagnoses: acute rhinosinusitis, acute otitis media, bronchiolitis, pharyngitis, common cold, and urinary tract infection.

<table>
<thead>
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<th>Management</th>
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<tbody>
<tr>
<td>Acute rhinosinusitis</td>
<td>90–98% of sinusitis cases are viral, and antibiotics are not recommended to help even if the causative agent is bacterial.</td>
<td>Halitosis, fatigue, headache, decreased appetite, but most physical exam findings are non-specific and do not distinguish bacterial from viral causes. A bacterial diagnosis may be established based on the presence of one of the following criteria: • Persistent symptoms without improvement: nasal discharge or daytime cough &gt;10 days. • Worsening symptoms: worsening or new onset fever, daytime cough, or nasal discharge after initial improvement of viral URI. • Severe symptoms: fever &gt;39°C, purulent nasal discharge for at least 3 consecutive days. Imaging tests are no longer recommended for uncomplicated cases.</td>
<td>If a bacterial infection is established: • Amoxicillin or amoxicillin-clavulanate remain first-line therapy. • For children with a non-type I hypersensitivity to penicillin, a combination of clindamycin and a third-generation cephalosporin (ceftriaxone or cefepoxide) may be appropriate. • Recommendations for treatment of children with a history of type I hypersensitivity to penicillin vary.1,2 • In children who are vomiting or who cannot tolerate oral medication, a single dose of ceftriaxone can be used.1 • For further recommendations on alternative antibiotic regimens, consult the American Academy of Pediatrics or the Infectious Diseases Society of America guidelines.</td>
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<td>Acute otitis media (AOM)</td>
<td>4–10% of children with AOM treated with antibiotics experience adverse effects.</td>
<td>AOM is the most common childhood infection for which antibiotics are prescribed.</td>
<td>• Mild cases with unilateral symptoms in children 6–23 months of age or unilateral or bilateral symptoms in children &gt;2 years may be appropriate for watchful waiting based on shared decision-making. • Amoxicillin remains first-line therapy for children who have not received amoxicillin within the past 30 days. • Amoxicillin-clavulanate is recommended if amoxicillin has been taken within the past 30 days, if concurrent purulent conjunctivitis is present, or if the child has a history of recurrent AOM unresponsive to amoxicillin. • For children with a non-type I hypersensitivity to penicillin: ceftriaxone, cefotaxime, ceftobiprole, or cefixime may be appropriate choices. • Prophylactic antibiotics are not recommended to reduce the frequency of recurrent AOM. • For further recommendations on alternative antibiotic regimens, consult the American Academy of Pediatrics guidelines.4</td>
</tr>
<tr>
<td>Pharyngitis</td>
<td>4.6 Recent guidelines aim to minimize unnecessary antibiotic exposure by emphasizing appropriate use of rapid antigen detection test (RADT) testing and subsequent treatment.</td>
<td>Recent guidelines aim to minimize unnecessary antibiotic exposure by emphasizing appropriate use of rapid antigen detection test (RADT) testing and subsequent treatment. During the winter and spring, up to 30% of symptomatic children can be colonized with group A beta-hemolytic streptococci (GAS), leading to more false positives from RADT testing and increases in unnecessary antibiotic exposure. Streptococcal pharyngitis is primarily a disease of children 5–15 years old and is rare in preschool children.</td>
<td>• Amoxicillin and penicillin V remain first-line therapy. • For children with a non-type I hypersensitivity to penicillin: cephalexin, cefadroxil, clindamycin, clarithromycin, or azithromycin are recommended. • For children with an immediate type I hypersensitivity to penicillin: clindamycin, clarithromycin, or azithromycin are recommended. • Recommended treatment course for all oral beta lactams is 10 days.</td>
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1. 2018. The U.S. Food and Drug Administration is advising that the serious side effects associated with fluoroquinolones (i.e. ciprofloxacin, levofloxacin, moxifloxacin, and ofloxacin) antibacterial drug generally outweigh the benefits for patients with acute sinusitis, acute bronchiolitis, and uncomplicated urinary tract infections who have other treatment options. For patients with these conditions, fluoroquinolones should be reserved for those who do not have alternative treatment options.
Pediatric Treatment CDC Recommendations Acute Rhinosinusitis, Acute Otitis Media, Bronchiolitis, Pharyngitis, Common cold, and Urinary Tract Infections

**Common cold or non-specific upper respiratory tract infection (URTI)**

The course of most uncomplicated viral URIs is 5 to 7 days. Colds usually last around 10 days.

- **At least 200 viruses can cause the common cold.**
- **Viral URIs are often characterized by nasal discharge and congestion or cough,** usually nasal discharge begins as clear and changes throughout the course of the illness.
- **Fever, if present, occurs early in the illness.**
- **Management of the common cold, nonspecific URI, and acute cough illness should focus on symptomatic relief. Antibiotics should not be prescribed for these conditions.**
- **There is potential for harm and no proven benefit from over-the-counter cough and cold medications in children younger than 6 years. These substances are among the top 20 substances leading to death in children <2 years old.**
- **Low-dose inhaled corticosteroids and oral prednisolone do not improve outcomes in non-asthmatic children.**

- **Bronchiolitis**
- Bronchiolitis is the most common lower respiratory tract infection in infants.
- It is most often caused by respiratory syncytial virus but can be caused by many other respiratory viruses.
- **Bronchiolitis occurs in children <24 months and is characterized by tachycardia, cough, wheezing, tachypnea, and/or increased respiratory effort.**
- **Routine laboratory tests and radiologic studies are not recommended, but a chest x-ray may be warranted in atypical disease (absence of viral symptoms, severe distress, frequent recurrences, lack of improvement).**
- **Usually patients worsen between 3-5 days, followed by improvement.**
- **Antibiotics are not helpful and should not be used.**
- **Nasal suctioning is mainstay of therapy.**
- **Albuterol can be trialed but should only be dispensed if there is a documented improvement. Only 1 in 4 children with bronchiolitis will have any response to albuterol.**
- **Nebulized racemic epinephrine has also shown some benefit in bronchiolitis.**
- **There is no evidence to support routine suctioning of the lower pharynx or larynx (deep suctioning).**
- **There is no role for corticosteroids, ribavirin, or chest physical therapy in the management of bronchiolitis.**

- **Urinary tract infections (UTIs)**
- **UTIs are common in children, affecting 8% of girls and 2% of boys by age 7.**
- **The most common causative pathogen is E. coli, accounting for approximately 85% of cases.**
- **In infants, fever and or strong-smelling urine are common.**
- **In school-aged children, dysuria, frequency, or urgency are common.**
- **A definitive diagnosis requires both a urinalysis suggestive of infection and a urine culture positive for bacteria.**
- **Urine analysis is suggestive of infection with the presence of pyuria (leukocyte esterase or ≥5 WBCs per high powered field), bacteria, or nitrates.**
- **Nitrates are not a sensitive measure for UTI in children and cannot be used to rule out UTIs.**

- **Urinalysis testing for all children 2-24 months with unexplained fever is no longer recommended.**
- **Initial antibiotic treatment should be based on local antimicrobial susceptibility patterns. Suggested agents include TMP-SMX, amoxicillin-clavulanate, cefixime, cefprozil, or cephalaxin.**
- **Duration of therapy should be 7 to 14 days.**
- **Antibiotic treatment of asymptomatic bacteriuria in children is not recommended.**
- **Antibiotic prophylaxis to prevent recurrent UTIs is not recommended.**
- **Febrile infants with UTIs should undergo renal and bladder ultrasonography during or following their first UTI. Abnormal imaging results require further testing.**

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Pediatric References:
Treatment Guidelines
Stormont-Vail Guidelines for Diagnosis and Treatment of Diarrhea

Diarrhea for >2 and <14 days & temperature ≥38.5 degrees C (≥101.3 degrees F) without exposure to hospital, nursing home or antibiotics

Traveled outside of the country
- No improvement with conservative treatment for 3-5 days
- Order molecular stool pathogen panel
- Treat for specific pathogen if indicated

Disabling illness or inflammatory response and no improvement with conservative treatment measures (oral fluids and electrolyte replacement).
- Condition stable and improving, with no inflammatory response
- Order molecular stool pathogen panel
- Treat for specific pathogen if indicated

Diarrhea for <14 days with Exposure to hospital, nursing home, or antibiotics

Mild or moderate diarrhea and no inflammatory response (e.g., WBC ≤15,000 mm^3 or no fever), no decreased urine output or organ failure, patient is not elderly or in ICU and does not have co-existing condition.
- Molecular Stool Pathogen panel NOT INDICATED. Unless no improvement then treat as disabling illness
- Treat with only fluid and electrolyte therapy unless condition worsens.
- If condition worsens, treat as for patients with ≥6 stools/day.

Severe diarrhea and any of the following: passage of ≥6 stools/day; diarrhea lasting >72 hours; inflammatory response (WBC ≥15,000 mm^3, fever, or dysenteric stool), decreased urine output; organ failure; patient is elderly or has co-existing condition; serum albumin <2.5 g/dl; patient is in ICU.
- Molecular Stool Pathogen panel
- Order Molecular Stool Pathogen panel
- Treat for specific pathogen identified if indicated

Persistent diarrhea (≥14 days)

Colitis present (passage of small-volume stool containing visible blood, with or without mucus, fecal urgency, and tenesmus)

- Order molecular stool pathogen panel
- Treat for specific pathogen identified if indicated

For purposes of diagnostic workup and treatment, diarrhea is defined as abnormal and unexplained increase in frequency (“three per day) and change in consistency (liquid or watery) of stool.

Evaluation and Treatment of Patients with Severe Diarrhea, According to Whether There Are Symptoms of Colitis, Fever, Exposure to Hospital, Nursing Home, or Antibiotics, and Persistent Diarrhea. All patients with diarrhea should receive fluids and electrolytes and soft foods that are easy to digest such as bananas, toast, and broiled or baked meats and vegetables.

CDAD denotes *Clostridium difficile*-associated diarrhea, ICU denotes intensive care unit, and WBC denotes white-cell count.

Inflammatory response: WBC ≥15,000 mm^3 (or fever)

For treatment recommendations, please refer to “SVHC Stool Pathogen treatment Guidelines”.

*This guideline does not replace clinical judgement.

Reference:
Modified from Dupont HL. Acute Infectious Diarrhea in Immunocompetent Adults. NEJM 2014: 370:1332-40.
New Community Acquired Pneumonia Guidelines Coming Summer 2017
Asymptomatic Bacteria
Antibiotic Dosing Appropriate For Indication
Sepsis
What needs to be done STAT?

- IV access
- IV fluids
- Identify a infectious source
- Obtain Cultures
- Antibiotics

Give with in the first hour

HOW? & Why?

SCCM ANTIBIOTICS
Clinical Practice Guidelines for Clostridium difficile Infection in Adults: 2010 Update by the Society for Healthcare Epidemiology of America (SHEA) and the Infectious Diseases Society of America (IDSA)

International Clinical Practice Guidelines for the Treatment of Acute Uncomplicated Cystitis and Pyelonephritis in Women: A 2010 Update by the Infectious Diseases Society of America and the European Society for Microbiology and Infectious Diseases

2012 Infectious Diseases Society of America Guidelines for the Diagnosis and Treatment of Asymptomatic Bacteriuria in Adults

Clinical Practice Guidelines by the Infectious Diseases Society of America for the Treatment of Methicillin-Resistant Staphylococcus Aureus Infections in Adults and Children
Time is of the Essence

OR of death = 1.119 (per hr of delay) (95%CI 1.103-1.136, p<0.0001)

**Example of Sepsis order set**

Not an all inclusive indications & antibiotic list shown here

<table>
<thead>
<tr>
<th>Antibiotics - Life threatening &amp; Etiology Unclear (Suspect Intra Abdominal or Skin Source) for ADULT SEVERE SEPSIS</th>
</tr>
</thead>
<tbody>
<tr>
<td>meropenem (MERREM) IV/PB</td>
</tr>
<tr>
<td>levoFLOXacin/metroNIDAZOLE IV (if carbapenem allergy)</td>
</tr>
<tr>
<td>levoFLOXacin (LEVAQUIN)</td>
</tr>
<tr>
<td>metroNIDAZOLE (FLAGYL)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Antibiotics - Intra-abdominal or Biliary Source for ADULT SEVERE SEPSIS</th>
</tr>
</thead>
<tbody>
<tr>
<td>piperacillin-tazobactam (ZOSYIN) IV/PB</td>
</tr>
<tr>
<td>meropenem (MERREM) IV/PB</td>
</tr>
<tr>
<td>levoFLOXacin/metroNIDAZOLE IV (if penicillin allergy)</td>
</tr>
<tr>
<td>levoFLOXacin (LEVAQUIN)</td>
</tr>
<tr>
<td>metroNIDAZOLE (FLAGYL)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Antibiotics - Potential Rash for ADULT SEVERE SEPSIS</th>
</tr>
</thead>
<tbody>
<tr>
<td>cefTRIAXone (ROCEPHIN) IV/PB</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Antibiotics - Urinary Source for ADULT SEVERE SEPSIS (Single Response)</th>
</tr>
</thead>
<tbody>
<tr>
<td>— Select cefepime for suspected pseudomonas.</td>
</tr>
<tr>
<td>cefTRIAXone (ROCEPHIN) IV/PB</td>
</tr>
<tr>
<td>levoFLOXacin (LEVAQUIN) IV/PB (if penicillin allergic)</td>
</tr>
<tr>
<td>cefepime (MAXIPIME) IV/PB (for suspected pseudomonas)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Antibiotics - Pulmonary Source CAP non-ICU without pseudomonal risk for ADULT SEVERE SEPSIS (Single Response)</th>
</tr>
</thead>
<tbody>
<tr>
<td>cefTRIAXone with azithromycin</td>
</tr>
<tr>
<td>cefTRIAXone (ROCEPHIN)</td>
</tr>
<tr>
<td>azithromycin (ZITHROMAX)</td>
</tr>
<tr>
<td>levoFLOXacin (LEVAQUIN) piggyback IV</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Antibiotics - Pulmonary Source CAP ICU without pseudomonal risk for ADULT SEVERE SEPSIS (Single Response)</th>
</tr>
</thead>
<tbody>
<tr>
<td>cefTRIAXone with azithromycin</td>
</tr>
<tr>
<td>cefTRIAXone (ROCEPHIN)</td>
</tr>
<tr>
<td>azithromycin (ZITHROMAX)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Antibiotics - Pulmonary Source CAP non-ICU / ICU with pseudomonal risk for ADULT SEVERE SEPSIS (Single Response)</th>
</tr>
</thead>
<tbody>
<tr>
<td>— Pseudomonal Risk Factors:</td>
</tr>
<tr>
<td>1. Frequent administration of antibiotics (4 or more courses over the past year)</td>
</tr>
<tr>
<td>2. Recent hospitalization (2 or more days duration in the past 30 days)</td>
</tr>
<tr>
<td>3. Isolation of Pseudomonas during a previous hospitalization</td>
</tr>
<tr>
<td>4. Severe underlying COPD (FEV1 ≤ 50 percent predicted)</td>
</tr>
<tr>
<td>cefepime with levoFLOXacin</td>
</tr>
<tr>
<td>cefpime (MAXIPIME) injection</td>
</tr>
<tr>
<td>levoFLOXacin (LEVAQUIN)</td>
</tr>
<tr>
<td>cefpime with tobramycin and azithromycin</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Antibiotics - ADD ON for suspected MRSA for ADULT SEVERE SEPSIS</th>
</tr>
</thead>
<tbody>
<tr>
<td>vancomycin (VANCOCIN)</td>
</tr>
<tr>
<td>vancomycin (VANCOCIN)</td>
</tr>
</tbody>
</table>
Rapid Diagnostic Testing
**S. aureus/CNS PNA FISH®**

- 90 min. identification and differentiation of *S. aureus* and CNS from GPCC-positive blood cultures
- Helps ensure earlier...
  - Appropriate and effective therapy for true *S. aureus* bacteremia
  - Discontinuation of therapy for patient with CNS contaminated blood cultures

---

**Gram Stain**

![Gram Stain](image)

**PNA FISH® in 90 Minutes**

- **GPCC**
- **S. aureus (30%)**
- **CNS (70%)**

---

**AdvanDx**
GNR Traffic Light® PNA FISH®

- 90 min. identification and differentiation of *E. coli*, *K. pneumoniae* and *P. aeruginosa* from GNR-positive blood cultures
  - Helps optimize antibiotic therapy (Pseudomonal vs. non-Pseudomonal) 1-2 days earlier for Gram-Negative bacteremia
  - Helps improve clinical outcomes while controlling antibiotic use
Film Array Multiplex Biofilm

Virology Testing and More
FilmArray Respiratory Panel

1 Test. 20 Respiratory Pathogens. All in about an hour.

**Viruses**
- Adenovirus
- Coronavirus HKU1
- Coronavirus NL63
- Coronavirus 229E
- Coronavirus OC43
- Human Metapneumovirus
- Human Rhinovirus/Enterovirus
- Influenza A
- Influenza A/H1
- Influenza A/H1-2009
- Influenza A/H3
- Influenza B
- Parainfluenza 1
- Parainfluenza 2
- Parainfluenza 3
- Parainfluenza 4
- Respiratory Syncytial Virus

**Bacteria**
- *Bordetella pertussis*
- *Chlamydophila pneumoniae*
- *Mycoplasma pneumoniae*
FilmArray Blood Culture Identification Panel

1 Test. 27 Targets. All in about an hour.

**Gram + Bacteria**
- Enterococcus
- Listeria monocytogenes
- Staphylococcus
- Staphylococcus aureus
- Streptococcus
- Streptococcus agalactiae
- Streptococcus pyogenes
- Streptococcus pneumoniae

**Gram – Bacteria**
- Acinetobacter baumannii
- Haemophilus influenzae
- Neisseria meningitidis
- Pseudomonas aeruginosa

**Yeast**
- Candida albicans
- Candida glabrata
- Candida krusei
- Candida parapsilosis
- Candida tropicalis

**Antibiotic Resistance**
- meca - methicillin resistant
- vanA/B - vancomycin resistant
- KPC - carbapenem resistant
How Do You Treat This and for How Long?
# SV Stool Pathogen Treatment Guidelines

**P&T approved 6/23/2015 & MEC 8/14/2015**

<table>
<thead>
<tr>
<th>Species</th>
<th>Background</th>
<th>Treatment</th>
</tr>
</thead>
</table>
| **Campylobacter spp.** | - Gram-negative, microaerophilic bacterium  
- Symptoms: Diarrhea (often bloody), abdominal cramps, fever  
- Transmission: Contaminated food (poultry), water, or contact with infected animals  
- Most common infectious agent precipitant of Guillain-Barre Syndrome, reactive arthritis, and IBS | - Primary  
  ○ Azithromycin 500 mg BID for 3 days  
  ○ For 14 days if bacteremic  
- Alternate  
  ○ Erythromycin 500 mg PO four times daily for 3 days  
  ○ Ciprofloxacin 500 mg PO BID for 5 days  
  ○ For 14 days if bacteremic |
| **Clostridium difficile** | - Spore-forming, gram-positive anaerobic bacillus  
- Symptoms: Watery diarrhea, fever, loss of appetite, nausea, abdominal pain/tenderness  
- Transmission: Contact with any surface, device, or material contaminated with feces  
- Avoid anti-motility agents: May mask symptoms and precipitate toxic megacolon  
- Use of probiotics not routinely recommended due to:  
  ○ Lack of standardization of products  
  ○ Variations in bacterial counts  
  ○ Risk of inducing bacteremia or fungicemia  
- Children ≤ 2 generally do not need treatment unless previous antibiotic use or other risk factors for toxicogenic | - Discontinue any antibiotics that may have caused  
  ○ Clindamycin, cephalosporins, penicillins, fluoroquinolones  
- Initial episode  
  ○ Mild-to-moderate: WBC < 15K and Scr < 1.5x baseline  
    ▪ Metronidazole 500mg PO three times daily x10-14 days  
  ○ Severe: WBC ≥ 15K OR Scr > 1.5x baseline  
    ▪ Vancomycin 125mg PO four times daily x10-14 days  
  ○ Severe, complicated: Hypotension or shock, ileus, megacolon  
    ▪ Vancomycin 500mg PO or per tube four times daily PLUS metronidazole 500mg every 8 hours IV  
    ▪ Consider rectal vancomycin 500 mg in 100 NS PR Q6H as a retention enema if complete ileus  
- First recurrence  
  ○ Same as initial episode,  
  ○ Metronidazole 500 mg PO three times daily X 10-14 days  
  ○ Do not use metronidazole beyond the first recurrence or long-term chronic therapy because potential for cumulative neurotoxicity  
- Second recurrence |
SVH Meningitis Encephalitis Panel Treatment Guidelines

<table>
<thead>
<tr>
<th>Bacteria <strong>Pseudomonas aeruginosa, Staphylococcus aureus, Staphylococcus epidermidis, Enterococcus</strong> species, and other pathogens can cause CNS infections but are not included on the FilmArray Meningitis/Encephalitis Panel used at Stormont Vail**</th>
</tr>
</thead>
</table>
| **Species** | **Background** | **Adult Treatment**  
(Dosing based on normal renal and hepatic function) | **Pediatric Treatment (>1 month of age)**  
(Dosing based on normal renal and hepatic function) |
| **Escherichia Coli (K1)** | • **Risk Factors:**  
- Age <1 month  
- Age 1-23 months  
- Head trauma  
- Neurosurgery  
- Presence of a shunt or other neurosurgical device  
- CSF leak | Primary:  
- Ceftriaxone 2 g IV q12h  
Alternative:  
- Cefepime 2 g IV q8h  
- Meropenem 2 g IV q8h  
- Aztreonam 2 g IV q6h  
- Trimethoprim-sulfamethoxazole: 5 mg TMP/kg IV q6h  
- Ampicillin 2 g IV q4h | Primary:  
- Ceftriaxone 50 mg/kg IV q12h (maximum 4 gm/day)  
PLUS  
- Gentamicin 2.5 mg/kg IV q8h  
Alternative:  
- Meropenem 40 mg/kg IV q8h (maximum dose: 2 g)  
Treatment duration:  
- Minimum of 21 days or 2 weeks beyond first sterile culture, whichever is longer |
| **Haemophilus influenzae**  
**Uncommon since introduction of *H. influenzae* type B vaccine**  
**Rifampin chemoprophylaxis may be required for household and/or childcare contacts** | • **Risk Factors:**  
- Age 1-23 months  
- Head trauma  
- Basilar skull fracture  
- A parameningeal focus (sinusitis, otitis) of infection is often present in adults | Dexamethasone 0.15 mg/kg q6h should be administered prior to or concurrent with the first dose of antibiotic and continued for 4 days in microbiologically confirmed *H. influenzae* type b meningitis  
Primary:  
- Ceftriaxone 2 g IV q12h  
Alternative:  
- Cefepime 2 g IV q8h  
- Meropenem 2 g IV q8h  
- Aztreonam 2 g IV q6h  
- Chloramphenicol 25 mg/kg IV q6h (maximum 4 gm/day)  
Treatment duration:  
- 7-10 days | Dexamethasone 0.15 mg/kg q6h should be administered to infants and children prior to or concurrent with the first dose of antibiotic and continued for 4 days in microbiologically confirmed *H. influenzae* type b meningitis  
Primary:  
- Ceftriaxone 50 mg/kg IV q12h (maximum 4 gm/day)  
Alternative:  
- Chloramphenicol 25 mg/kg IV q6h (maximum 4 gm/day)  
Treatment duration:  
- 7-10 days |

The provider retains decision-making authority for therapy.
<table>
<thead>
<tr>
<th>Species</th>
<th>Background</th>
<th>Adult Treatment*</th>
<th>Pediatric Treatment*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adenovirus</td>
<td>• Virus family: <em>Adenoviridae</em>&lt;br&gt;• Incubation: 3 – 10 days&lt;br&gt;• Symptoms: Wide range&lt;br&gt;</td>
<td>• Usually mild and self-limiting&lt;br&gt;• Primarily use supportive care:&lt;br&gt;</td>
<td>• Usually mild and self-limiting&lt;br&gt;• Primarily use supportive care:&lt;br&gt;</td>
</tr>
<tr>
<td></td>
<td>o Common cold&lt;br&gt;o Pharyngitis&lt;br&gt;o Bronchitis&lt;br&gt;o Pneumonia&lt;br&gt;o Conjunctivitis&lt;br&gt;o Fever&lt;br&gt;• Transmission via:&lt;br&gt;</td>
<td>o Prevent dehydration (oral/ IV fluids)&lt;br&gt;o Pain and fever medications as needed&lt;br&gt;o Plenty of rest&lt;br&gt;</td>
<td>o Prevent dehydration (oral/ IV fluids)&lt;br&gt;o Pain and fever medications as needed&lt;br&gt;o Plenty of rest&lt;br&gt;</td>
</tr>
<tr>
<td></td>
<td>o Respiratory droplets&lt;br&gt;o Close personal contact&lt;br&gt;o Direct contact with secretions&lt;br&gt;• Increase in infections during summer</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bordetella pertussis</td>
<td>• Bacterial family: <em>Alcaligenaceae</em>&lt;br&gt;• Incubation: 5 – 10 days&lt;br&gt;• Stages and associated symptoms&lt;br&gt;</td>
<td>• Primary:&lt;br&gt;</td>
<td>• Primary (&lt; 6 months):&lt;br&gt;</td>
</tr>
<tr>
<td></td>
<td>o Catarhal (7-10 days)&lt;br&gt;</td>
<td>o Azithromycin 500 mg PO daily x 1 day, then 250mg PO daily x 4 days&lt;br&gt;</td>
<td>o Azithromycin 10 mg/kg PO once daily x 5 days&lt;br&gt;</td>
</tr>
<tr>
<td></td>
<td>• Mild progressive cough&lt;br&gt;</td>
<td>o Clarithromycin 500 mg PO BID x 7 days&lt;br&gt;</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Low grade fever&lt;br&gt;• Coryza&lt;br&gt;o Paroxysmal (1-6 weeks)&lt;br&gt;</td>
<td>• Alternative:&lt;br&gt;</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Numerous, rapid coughing&lt;br&gt;• Difficulty clearing mucus&lt;br&gt;• High-pitched “whoop”&lt;br&gt;• Cyanosis&lt;br&gt;o Convalescent (7-10 days)&lt;br&gt;</td>
<td>• Bactrim DS - 1 tab PO BID x 14 days&lt;br&gt;</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Less persistent coughs&lt;br&gt;• Gradual recovery&lt;br&gt;• Transmission via:&lt;br&gt;</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>o Respiratory droplets&lt;br&gt;• Primarily a toxin-mediated disease</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*The provider retains decision making authority for therapy*
Procalcitonin
eFigure 1. PCT Algorithm for Antibiotic Stewardship

Procalcitonin (PCT) algorithm for stewardship of antibiotic therapy in patients with LRTI

- **< 0.1 µg/l**
  - Bacterial etiology very unlikely
  - NO antibiotics!

- **0.1 - 0.25 µg/l**
  - Bacterial etiology unlikely
  - No antibiotics

- **>0.25 - 0.5 µg/l**
  - Bacterial etiology likely
  - Antibiotics yes

- **>0.5 µg/l**
  - Bacterial etiology Very likely
  - Antibiotics YES!

---

**Control PCT after 6-24 hours**

- Initial antibiotics can be considered in case of:
  - Respiratory or hemodynamic instability
  - Life-threatening comorbidity
  - Need for ICU admission
  - PCT < 0.1 µg/l: CAP with PSI V or CURB65 >3, COPD with GOLD IV
  - PCT < 0.25 µg/l: CAP with PSI 2/3 or CURB 65>2, COPD with GOLD > III
  - Localised infection (abscess, empyema), L.pneumophilia
  - Compromised host defense (e.g. immuno-suppression other than corticosteroids)
  - Concomitant infection in need of antibiotics

---

**Consider the course of PCT**

- If antibiotics are initiated:
  - Repeated measurement of PCT on days 3, 5, 7
  - Stop antibiotics using the same cut offs above
  - If initial PCT levels are >5-10 µg/l, then stop when 80-90% decrease of peak PCT
  - If initial PCT remains high, consider treatment failure (e.g. resistant strain, empyema, ARDS)
  - Outpatients: duration of antibiotics according to the last PCT result:
    - >0.25-0.5 µg/l: 3 days
    - >0.5 - 1.0 µg/l: 5 days
    - >1.0 µg/l: 7 days

---

**Abbreviations:**
- PCT procalcitonin
- CAP community-acquired pneumonia
- PSI pneumonia severity index
- COPD chronic obstructive pulmonary disease
- GOLD global initiative for obstructive lung disease

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Vaccines
Routine Vaccine Schedule Compliance?

2017 Recommended Immunizations for Adults: By Age

If you are this age, talk to your healthcare professional about these vaccines:

- Flu (Influenza)
- Td/Tdap (Tetanus, diphtheria, pertussis)
- Shingles (Zoster)
- Pneumococcal
- Meningococcal
- MMR (Measles, mumps, rubella)
- HPV (Human papillomavirus)
- Chickenpox (Varicella)
- Hepatitis A
- Hepatitis B
- Hib (Haemophilus influenzae type b)

For more information, call 1-800-CDC-INFO (1-800-232-4636) or visit www.cdc.gov/vaccines
Tdap and Td Preventative Covered for Adults?

• Medicare Part B
  • Only cuts or injury

• Medicare Part D
  • Preventative
    • Tdap (Adacel or Boostrix)
    • Td (Tenivac)
Kansas Pharmacy Regulation for Vaccine Administration

- Current Statute limits "the administration of influenza vaccine to a person six years of age or older and may administer vaccine, other than influenza vaccine, to a person 18 years of age or older pursuant to a vaccination protocol…..”

What Are You Or Your Organization(s) Doing To Promote Antibiotic Stewardship?
State Antibiotic Stewardship Programs

http://www.astho.org/Infectious-Disease/Antimicrobial-Resistance/Polices-to-Promote-Antimicrobial-Stewardship-Programs/State-Health-Agency-Webpages/
CMS proposal includes mandatory antibiotic stewardship programs

Implementing an Antibiotic Stewardship Program: Guidelines by the Infectious Diseases Society of America and the Society for Healthcare Epidemiology of America


REPORT TO THE PRESIDENT ON COMBATING ANTIBIOTIC RESISTANCE

Executive Office
President’s Council
Science and Technology

September 2008

NATIONAL ACTION PLAN FOR COMBATING ANTIBIOTIC-RESISTANT BACTERIA

MARCH 2015

Advance Access published April 13, 2016
Kansas Healthcare-Associated Infections and Antimicrobial Resistance Advisory Committee
Kansas Healthcare-Associated Infections and Antimicrobial Resistance Advisory Work Items

• Value of regional antibiograms

• Reimbursement Issues

• Guidelines
  • Dental association antibiotic prophylaxis
  • Surgical prophylaxis
  • Duration of therapy

• Resources Needed
### STORMONT-VAIL HEALTHCARE LABORATORY

#### ANTIBIOTIC SUSCEPTIBILITY OF COMMON ORGANISMS INPATIENT AND OUTPATIENT

Data Are Percent Susceptible -- Minimum Inhibitory Concentration

COMBINED URINE AND SYSTEMIC, January – December 2016

<table>
<thead>
<tr>
<th></th>
<th>E. coli</th>
<th>Klebsiella pneumoniae</th>
<th>Enterobacter aerogenes</th>
<th>Enterobacter cloacae</th>
<th>Serratia marcescens</th>
<th>Proteus mirabilis</th>
<th>Pseudomonas aeruginosa</th>
<th>Hemophilus influenzae</th>
<th>Staph. aureus MRSA</th>
<th>Staph. epidermidis</th>
<th>Enterococcus faecalis</th>
<th>VRE</th>
<th>Enterococcus faecium</th>
<th>Vancomycin</th>
<th>Streptococcus Group B</th>
<th>Streptococcus pneumoniae</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>TOTAL # ISOLATES</strong></td>
<td>5627</td>
<td>1019</td>
<td>165</td>
<td>270</td>
<td>77</td>
<td>526</td>
<td>528</td>
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<td>48</td>
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<tr>
<td>Amp/Sulbactam*</td>
<td>68</td>
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<td>NT</td>
<td>NT</td>
<td>100</td>
<td>NT</td>
<td>NT</td>
</tr>
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N/A = Not applicable; NT = Not Tested; * Amox-K Clav; ** Oxacillin used to predict methicillin susceptibility and to predict resistance to all current beta lactam drugs.

***Enterobacter cloacae Ceftriaxone result may cause inducible β lactamase mediated resistance.***
Kansas Healthcare-Associated Infections and Antimicrobial Resistance Advisory Work Items

• Value of regional antibiograms

• Reimbursement Issues

• Guidelines
  • Dental association antibiotic prophylaxis
  • Surgical prophylaxis
  • Duration of therapy

• Resources Needed
Checklist for Antibiotic Prescribing in Dentistry

Pretreatment
- Correctly diagnose an oral bacterial infection.
- Consider therapeutic management interventions, which may be sufficient to control a localized oral bacterial infection.
- Weigh potential benefits and risks (i.e., toxicity, allergy, adverse effects, *Clostridium difficile* infection) of antibiotics before prescribing.
- Prescribe antibiotics only for patients of record and only for bacterial infections you have been trained to treat. Do not prescribe antibiotics for oral viral infections, fungal infections, or ulcerations related to trauma or aphthae.
- Implement national antibiotic prophylaxis recommendations for the medical concerns for which guidelines exist (e.g., cardiac defects).
- Assess patients' medical history and conditions, pregnancy status, drug allergies, and potential for drug-drug interactions and adverse events, any of which may impact antibiotic selection.

Prescribing
- Ensure evidence-based antibiotic references are readily available during patient visits. Avoid prescribing based on non-evidence-based historical practices, patient demand, convenience, or pressure from colleagues.
- Make and document the diagnosis, treatment steps, and rationale for antibiotic use (if prescribed) in the patient chart.
- Prescribe only when clinical signs and symptoms of a bacterial infection suggest systemic immune response, such as fever or malaise along with local oral swelling.
- Revise empiric antibiotic regimens on the basis of patient progress and, if needed, culture results.
- Use the most targeted (narrow-spectrum) antibiotic for the shortest duration possible (2-3 days after the clinical signs and symptoms subside) for otherwise healthy patients.
- Discuss antibiotic use and prescribing protocols with referring specialists.

Patient Education
- Educate your patients to take antibiotics exactly as prescribed, take antibiotics prescribed only for them, and not to save antibiotics for future illness.

Staff Education
- Ensure staff members are trained in order to improve the probability of patient adherence to antibiotic prescriptions.
Kansas Healthcare-Associated Infections and Antimicrobial Resistance Advisory Work Items

• Value of regional antibiograms

• Reimbursement Issues

• Guidelines
  • Dental association antibiotic prophylaxis
  • Surgical prophylaxis
  • Duration of therapy

• Resources Needed
Education

• Pharmacists

• Providers

• Public
GET SMART: KNOW WHEN ANTIBIOTICS WORK
Many antibiotics prescribed in doctors’ offices, clinics, and other outpatient settings are not needed. This program focuses on appropriate prescribing and use for common illnesses in children and adults.

GET SMART FOR HEALTHCARE
Many patients in hospitals, nursing homes, and other healthcare facilities receive antibiotics to fight infections, but these drugs are often prescribed incorrectly. CDC helps clinicians prescribe the right drugs for the right patients at the right doses and times.

GET SMART: KNOW WHEN ANTIBIOTICS WORK ON THE FARM
This program promotes appropriate use of antibiotics in animals, serves as a liaison among the public health community, veterinarians, and food animal producers, and builds relationships between CDC and the animal agriculture industry within the United States.

GET SMART ABOUT ANTIBIOTICS WEEK
An annual observance to raise awareness of the threat of antibiotic resistance and the importance of appropriate antibiotic prescribing and use.

New Initiative to Fight Antibiotic Resistance
CDC's Antibiotic Resistance Solutions Initiative would support prevention programs, outbreak surveillance, antibiotic use and resistance monitoring, and antibiotic stewardship programs to address this threat.

National Action Plan to Combat Antibiotic-Resistant Bacteria
This strategy, released on March 27, 2015, provides goals and direction to help the nation contain the spread of resistant bacterial strains, manage existing antibiotics to preserve their effectiveness, and help ensure a steady pipeline of new, effective antibiotics and diagnostics.

https://www.cdc.gov/getsmart/index.html
A Commitment to Our Patients about Antibiotics

Antibiotics only fight infections caused by bacteria. Like all drugs, they can be harmful and should only be used when necessary. Taking antibiotics when you have a virus can do more harm than good: you will still feel sick and the antibiotic could give you a skin rash, diarrhea, a yeast infection, or worse.

Antibiotics also give bacteria a chance to become more resistant to them. This can make future infections harder to treat. It means that antibiotics might not work when you really do need them. Because of this, it is important that you only use an antibiotic when it is necessary to treat your illness.

How can you help? When you have a cough, sore throat, or other illness, tell your doctor you only want an antibiotic if it is really necessary. If you are not prescribed an antibiotic, ask what you can do to feel better and get relief from your symptoms.

Your health is important to us. As your healthcare providers, we promise to provide the best possible treatment for your condition. If an antibiotic is not needed, we will explain this to you and will offer a treatment plan that will help. We are dedicated to prescribing antibiotics only when they are needed, and we will avoid giving you antibiotics when they might do more harm than good.

If you have any questions, please feel free to ask us.

Sincerely,
**WAIT.** Do not fill your prescription just yet. Your healthcare professional believes your illness may resolve on its own.

First, follow your healthcare professional’s recommendations to help you feel better without antibiotics and continue to monitor your own symptoms over the next few days.

- Rest
- Drink extra water and fluids
- Use cool mist vaporizer or saline nasal spray to relieve congestion
- For sore throats in older adults and children, try ice chips, sore throat spray, or lozenges

If you **do not feel better in ___ days/hours, or get worse**, go ahead and fill your prescription.

If you **feel better, you do not need the antibiotic**, and do not have to risk the side effects.

**Waiting to see if you really need an antibiotic can help you take antibiotics only when it is actually necessary.** Antibiotics can cause side effects like a skin rash, diarrhea, a yeast infection, or worse.

Antibiotics can also make future bacterial infections stronger and harder to treat. You can protect yourself and others by learning when antibiotics are and aren’t needed.
**Six Smart Facts About Antibiotic Use**

1. **Antibiotics are life-saving drugs**
   - Using antibiotics wisely is the best way to preserve their strength for future bacterial illnesses.

2. **Antibiotics only treat bacterial infections**
   - If your child has a viral infection like a cold, talk to a doctor or pharmacist about symptom relief. This may include over-the-counter medicine, a humidifier, or warm liquids.

3. **Some ear infections DO NOT require an antibiotic**
   - A doctor can determine what kind of ear infection your child has and if antibiotics will help. The doctor may follow expert guidelines to wait a couple of days before prescribing antibiotics since your child may get better without them.

4. **Most sore throats DO NOT require an antibiotic**
   - Only 1 in 5 children seen by a doctor for a sore throat has strep throat, which should be treated with an antibiotic. Your child’s doctor can confirm strep throat by running a test.

5. **Green colored mucus IS NOT a sign that an antibiotic is needed**
   - As the body’s immune system fights off an infection, mucus can change color. This is normal and does not mean your child needs an antibiotic.

6. **There are potential risks when taking any prescription drug**
   - Antibiotic use can cause complications, ranging from an upset stomach to a serious allergic reaction. Your child’s doctor will weigh the risks and benefits before prescribing an antibiotic.

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**Viruses or Bacteria: What's got you sick?**

Antibiotics only treat bacterial infections. Viral illnesses cannot be treated with antibiotics. When an antibiotic is not prescribed, ask your healthcare professional for tips on how to relieve symptoms and feel better.

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**Antibiotics Aren’t Always the Answer**

[www.cdc.gov/getsmart](http://www.cdc.gov/getsmart)
GET SMART: Know When Antibiotics Work

Antibiotic Stewardship Weekly Update 12/19/2016

Total tested: 117
- Positive influenza A: 1
- Positive influenza B: 0

Point of care flu from clinics
- Total ran: 28
  - Positive influenza A: 0
  - Positive influenza B: 0

Rapid RSV
- Total tested: 21
  - Positive: 4

Respiratory Panel tests performed: 76
  - **Rhinovirus:** 14
  - Adenovirus: 1
  - RSV: 3
  - Parainfluenzae: 2
  - Coronavirus: 7
  - Metapneumovirus: 1

Meaningful Use: Generate Lists of Patients
Hover over report > Click on Pencil > Specify Run As User or PCP > Select Run
Education for Patient List Report: PTE/D/E
Is it Really a Penicillin Allergy?

Evaluation and Diagnosis of Penicillin Allergy for Healthcare Professionals

Did You Know? 5 Facts About Penicillin Allergy (Type 1, Immunoglobulin E (IgE)-mediated)
1. Approximately 10% of all U.S. patients report having an allergic reaction to a penicillin class antibiotic in their past.
2. However, many patients who report penicillin allergies do not have true IgE-mediated reactions. When evaluated, fewer than 1% of the population are truly allergic to penicillins.1
3. Approximately 80% of patients with IgE-mediated penicillin allergy lose their sensitivity after 10 years.2
4. Broad-spectrum antibiotics are often used as an alternative to penicillins. The use of broad-spectrum antibiotics in patients labeled “penicillin-allergic” is associated with higher healthcare costs, increased risk for antibiotic resistance, and suboptimal antibiotic therapy.3
5. Correctly identifying those who are not actually penicillin-allergic can decrease unnecessary use of broad-spectrum antibiotics.3

10% of the population reports a penicillin allergy but <1% of the whole population is truly allergic.

Before prescribing broad-spectrum antibiotics to a patient thought to be penicillin-allergic, evaluate the patient for true penicillin allergy (IgE-mediated) by conducting a history and physical, and, when appropriate, a skin test and challenge dose.

History and Physical Examination
The history and physical examination are important components when evaluating a patient’s drug reactions.3

- Questions to ask during the examination:
  - What medication were you taking when the reaction occurred?
  - What kind of reaction occurred?
  - How long ago did the reaction occur?
  - How was the reaction managed?
  - What was the outcome?

- Characteristics of an IgE-mediated (Type 1) reaction:
  - Reactions that occur immediately or usually within one hour1
  - Hives: Multiple pink/red raised areas of skin that are intensely itchy
  - Angioedema: Localized edema without hives affecting the abdomen, face, extremities, genitalia, oropharynx, or larynx
  - Wheezing and shortness of breath
  - Anaphylaxis: requires signs or symptoms in at least two of the following systems:
    - Skin: Hives, flushing, itching, and/or angioedema (continued on next page)
    - Respiratory: Cough, nasal congestion, shortness of breath, chest tightness, wheeze, sensation of throat closure or choking, and/or change in voice quality (laryngeal edema)
    - Cardiovascular: Hypotension, faintness, tachycardia, or less commonly bradycardia, tunnel vision, chest pain, sense of impending doom, and/or loss of consciousness
    - Gastrointestinal: Nausea, vomiting, abdominal cramping, and diarrhea

Penicillin Skin Tests and Challenge Doses
Based on the patient history and physical exam, additional tests may be needed to confirm a penicillin allergy. Penicillin skin testing is a reliable and useful method for evaluating IgE-mediated penicillin allergy.4

- Positive result means the patient is likely to have a penicillin allergy. If negative, the skin test is usually followed by an oral penicillin challenge (e.g., with amoxicillin) to safely rule out an IgE-mediated penicillin allergy.1,4
- Skin tests currently include penicilloylpolyamine, the major antigenic determinant that indicates hypersensitivity to penicillin.3
- However, it is important to note that the patient can also be allergic to other reactive breakdown products, called minor determinants, which include penicillin G, phenoxymethylpenicillin, penicillic acid, and penilloate—many of which are not commercially available. Of these, only penicillin G is available from pharmacies.
- To rule out penicillin allergy, an oral challenge dose can be done after skin testing. The negative predictive value of skin testing with the major and minor determinants is more than 95%, but approaches 100% when followed by a challenge dose.3

Special Considerations
Patients with severe hypersensitivity syndromes
Patients with other severe hypersensitivity syndromes—like Stevens-Johnson syndrome, toxic epidermal necrolysis, serum sickness, acute interstitial nephritis, hemolytic anemia, and drug rash with eosinophilia and systemic symptoms (DRESS)—should not use the offending drug in the future. The skin test and challenge described here are not appropriate for patients with these severe hypersensitivity syndromes.1

Cephalosporins in penicillin-allergic patients
Many cephalosporins, especially in the later generations, can be safely tolerated despite a penicillin allergy.6,9 Patients with anaphylaxis or other severe reactions to penicillin may require further evaluation prior to the use of cephalosporins.

Pediatric patients
Children who are receiving amoxicillin or ampicillin and have Epstein-Barr virus infection can develop a non-allergic, non-pruritic rash that can appear similar to an IgE-mediated reaction.10

For more information about appropriate antibiotic use, visit www.cdc.gov/gatsmart.

References
PrePen Data

- CDC ASP Guidelines
  - Assess Penicillin Allergy To Ensure Optimal Antibiotic Use

- CDC Reduce C Dif With Penicillin testing

Penicillin Allergy Skin Testing: Elective Surgery Patients

Why Penicillin Allergy Skin Testing?
Allergy to penicillin and related antibiotics is the most commonly reported drug allergy in the United States. It is estimated that 10% of patients, or 30 million people, self-report as being penicillin allergic; however, 9 out of 10 reporting penicillin allergy are not truly allergic when tested.1
- 9 out of 10 reporting penicillin allergy are not truly allergic.2
- 80% of patients with IgE-mediated penicillin allergy lose their sensitivity after 10 years.3
- Carrying an inaccurate diagnosis of penicillin “allergy” could adversely affect the quantity and quality of healthcare used.4
- Patients labeled penicillin-allergic have a threefold increased risk of adverse events (ADE).5
- Identifies patients with true type I penicillin allergies

Antibiotic Stewardship Initiative
- Help decrease antibiotic resistance
- Reduce second line antibiotic use in elective surgery
- Reduced OR Time to first incision due to prolong administration times with vancomycin

Inclusion Criteria
- Patients who fit the following criteria can be scheduled at the Allergy clinic by placing a work queue order in EPIC. If you have any questions please call 321128:
  - History of allergic reaction to penicillin (Unclear/unknown reaction, rash)
  - Refer to antihistamine chart on reverse side.

Exclusion Criteria
- Patients with a history of anaphylaxis or severe reaction to penicillins or cephalosporins

Who not to test?
Patient should receive beta-lactam antibiotic
- Patients with the following Beta-Lactam Allergy History:
  - Intolerance (i.e. headache, nausea, vomiting, etc.)
  - Patients that have tolerated cephalosporins in the past
  - Patient’s can be tested if they desire.

Who to Test?
- Anyone Patient whom has a Beta-Lactam (Penicillin or Cephalosporin) Allergy History

How to Send Patients for Testing:
- Once identified as being eligible for testing the patient can be scheduled at the Allergy clinic by placing a work queue order in EPIC. If you have any questions please call 321128:
- Testing should be scheduled for a date prior to the date of surgery to avoid delays in surgery.
- Patients should be instructed to hold antihistamine medications according to the instructions on the reverse side of this flyer.

Helpful Reminders
- Patients must be at least 18 years of age
- Patients should hold antihistamine products according to the chart on the reverse side of this flyer.
- The test takes approximately 1-1.5 hours to complete.
Proton Pump Inhibitors: Use in Adults

The Centers for Medicare & Medicaid Services (CMS), Medicaid Integrity Group (MIG) has identified issues with the utilization of medications in the proton pump inhibitor (PPI) drug therapy class. The U.S. Food and Drug Administration (FDA) approves product labeling for prescription drugs. The MIG has identified that some providers may have prescribed PPIs outside of FDA-approved product labeling for indication, dosage, duration of therapy. Therefore, CMS’s goal is to improve quality of care and enhance patient safety by educating providers on the proper use of PPIs in adults.

This fact sheet summarizes for providers the current FDA-approved product labeling for the use of PPI medications in adult patients. After reading this fact sheet, providers should be able to accurately:

- Recall the FDA-approved indications for PPI use in adults and the specific indications for each PPI;
- Recall the FDA-approved dosing options for adults; and
- Describe the adverse reactions of and risks related to long-term use of PPIs.

Overview of Proton Pump Inhibitors

PPIs block the acid-producing enzyme system in the stomach wall and prevent acid production in the stomach. Lack of acid in the stomach prevents ulcer formation; promotes healing of existing ulcers in the esophagus, stomach, and duodenum, and provides symptom relief. PPIs differ in how they are metabolized by the body, how they interact with other medications, and the length of time they are active in the body. However, there is no evidence that one PPI is more effective than another.

FDA-Approved Indications for Proton Pump Inhibitors in Adults

PPIs are used for the prevention and treatment of gastric acid-related conditions. The FDA-approved indications for use include:

- Healing of erosive esophagitis (EE);
- Maintenance of healed EE;
- Treatment of gastroesophageal reflux disease (GERD);
- Risk reduction for gastric ulcers (GU) associated with nonsteroidal anti-inflammatory drugs (NSAIDs);
- Helicobacter pylori (H. pylori) eradication to reduce the risk of duodenal ulcer (DU) recurrence, in combination with antibiotics;
- Pathological hypersecretory conditions, including Zollinger-Ellison (ZE) syndrome, and
- Short-term treatment and maintenance of DUs.

Risk of Hypomagnesemia

In March 2011, the FDA published a Drug Safety Communication to inform consumers and health professionals that long-term use of PPIs can cause hypomagnesemia. In 25 percent of patients, magnesium supplementation was not sufficient to correct PPI-induced hypomagnesemia: rather, PPI therapy had to be discontinued. The deficiency did not appear to be dose-related and reappeared after rechallenge with a PPI. The FDA recommends obtaining a serum magnesium level prior to initiation of therapy if a patient is to be on prolonged treatment.[14]

Risk of Clostridium difficile-Associated Diarrhea

On February 8, 2012, the FDA published a Drug Safety Communication to inform patients and providers that PPIs may be associated with an increased risk of CDAD. Symptoms of CDAD include abdominal pain, fever, and watery stools. Patients who take a PPI and develop diarrhea that does not improve should be evaluated for CDAD. Patients with advanced age, certain chronic medical conditions, and patients taking broad spectrum antibiotics are at greatest risk for developing CDAD. The FDA recommends using the lowest dose and shortest duration of PPI therapy possible and recommends advising patients to seek medical attention if they develop symptoms of CDAD.[15] The previously mentioned Medication Guide also informs patients and providers about the risk of CDAD when taking a PPI.

Resources

Please visit http://www.medicaid.gov/Medicaid-CHIP-Program-Information/By-State/By-State.html for links to State Medicaid program websites.

The Center for Drug Evaluation and Research (CDER) hosts a website providing health professionals with current information on generic and prescription drugs. Visit http://www.fda.gov/Drugs/ResourcesForYou/HealthProfessionals to access drug-related databases, information on drug recalls and alerts, current information on new and generic drug approvals, and information on drug safety and availability.

Section 1927(g)(1)(B) of the Social Security Act identifies the predetermined standards that the State’s drug use review program must use to assess data on drug use. Visit http://www.usa.gov/OP_Home/search/1927.htm for information on the compendia.

Proton Pump Inhibitors: Use in Adults
New Resource Available: 
Antimicrobial Stewardship Programs, a Toolkit for Critical Access Hospitals in Kansas

February 22, 2017,

Greetings Kansas Infection Preventionists!

The Kansas Department of Health and Environment’s Healthcare Associated Infections & Antimicrobial Resistance (HA/AR) Program, is pleased to announce a new resource, Antimicrobial Stewardship Programs, a Toolkit for Critical Access Hospitals in Kansas. This resource was developed based on previous surveys and direct feedback from critical access hospitals in Kansas which identified specific needs for these settings.

The toolkit is now available on our HA/AR Program website. We are available for any questions.

We hope you find this toolkit useful. We welcome any feedback and additional recommendations you may have from your own experiences. This will assist in development of future versions of this document.

Sincerely,

Bryna Stacey
Program Director, Healthcare-Associated Infections & Antimicrobial Resistance
Kansas Strategic Antibiotic Stewardship Pharmacy Meeting

2/27/2017
Kansas Pharmacy Antibiotic Stewardship Initiatives and Future Desires

• Pharmacist Vaccine programs

• Educating providers and other pharmacists.

• Some hospitals providing discharge medication information to retail pharmacies

• Some pharmacies have access to hospital EMRs

• Discuss pharmacist may question if a patient needs an antibiotic and patient may have a virus. Concerns of pharmacists and provider relationship.

• Unable to access NHSN

• Some physicians are take the ASP CDC Pledge postmarking prescriptions and informing their patients they have a virus but if not better in a few days to fill prescriptions
  • Discuss concern with that since patients may keep the prescription for another time and not go to their provider in the future
Kansas Strategic Antibiotic Stewardship Pharmacy Task Force

Workgroup
Questions?
References


- Society for Healthcare Epidemiology of America, Infectious Diseases Society of America and Pediatric Infectious Diseases Society. Policy Statement on Antimicrobial Stewardship by the Society for Healthcare Epidemiology of America (SHEA), the Infectious Diseases Society of America (IDSA), and the Pediatric Infectious Diseases Society (PIDS). Infection Control and Hospital Epidemiology Special Topic Issue: Antimicrobial Stewardship. April 2012; 33(4): 322-337


- Dellit TH et al. IDSA and the Society of Healthcare epidemiology of American guidelines for developing an institutional program to enhance antimicrobial stewardship. CID 2007; 44:159-77.


- Cohen SH et al. Clinical Practice Guidelines for Clostridium Difficile Infection in Adults: 2010 Update by the Society of Healthcare Epidemiology of America (SHEA) and Infectious Disease Society of America (IDSA) Infect Control Hosp Epidemiol 2010, 31(5):431-455

- OpenBiome http://www.openbiome.org