PEDIATRIC ANTIBIOTIC STEWARDSHIP: EVERY PRESCRIPTION, EVERY TIME

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DISCLOSURE

No personal or financial disclosures
LEARNING OBJECTIVES

• Discussion general principles regarding antibiotic resistance
• Understand how to determine local antimicrobial resistance patterns when making prescribing decisions.
• Review of common pediatric primary care conditions that require antibiotics and recommendations for prescribing
• Core principles of an antibiotic stewardship program and resources for practice
TIMELINE OF ANTIBIOTICS

- 1943 penicillin
  - 1940 resistant *Staph*
  - 1965 resistant *pneumococcus*
- 1950 erythromycin – 1959 resistant *streptococcus*
- 1960 methicillin – 1962 MRSA
- 1996 levofloxacin – 1996 resistant *pneumococcus*
- 2000 linezolid – 2001 resistant *Staph*

cdc.gov/drugresistance
ANTIBIOTIC RESISTANCE

- 2 million antibiotic resistant infections annually in US
- 23,000 deaths from resistant infections
- Predicted 10 million deaths per year worldwide due to antimicrobial resistant by 2050 (O’Neil, 2014)
- CDC has prioritized bacteria into three categories
  - Urgent, serious, and concerning

CDC, 2018
CDC 2015 data: 500,000 infections and 15,000 deaths annually
Cost to US health system $6.3 billion per year (Shanshan, Z. et al, 2016)
URGENT THREAT: CARBAPENEM-RESISTANT ENTEROBACTERIACEAE (CRE)

Colistin resistant *E.coli* found in US in May 2016 and in Canada in Sept 2016.
URGENT THREAT: GONORRHEA

31% of new gonorrhea infections are resistant to at least one drug (CDC, 2017)
SERIOUS THREAT LEVEL

- Multidrug-resistant Acinetobacter
- Drug-resistant Campylobacter
- **Fluconazole-resistant Candida**
- Extended spectrum $\beta$-lactamase producing Enterobacteriaceae
- Vancomycin-resistant Enterococcus
- Multidrug-resistant *Pseudomonas aeruginosa*
- Drug-resistant non-typhoidal *Salmonella*
- Drug-resistant *Salmonella Typhi*
- Drug-resistant *Shigella*
- **Methicillin-resistant *Staphylococcus aureus* (MRSA)**
- Drug-resistant *Streptococcus pneumoniae*
- Drug-resistant tuberculosis
METHICILLIN-RESISTANT STAPHYLOCOCCUS AUREUS (MRSA)

80,461 SEVERE MRSA INFECTIONS PER YEAR
11,285 DEATHS FROM MRSA PER YEAR

THREAT LEVEL SERIOUS
This bacteria is a serious concern and requires prompt and sustained action to ensure the problem does not grow.

STAPH BACTERIA ARE A LEADING CAUSE OF HEALTHCARE-ASSOCIATED INFECTIONS
## Local Resistance – Antibiogram

### Antibiogram 2015
Numbers are percent susceptible

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<tbody>
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<td><strong>Staphylococcus aureus (mSsa) not CF</strong></td>
<td>772 (U39)</td>
<td>99</td>
<td>100</td>
<td>83</td>
<td>65</td>
<td>63</td>
<td>52</td>
<td>98</td>
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<tr>
<td><strong>Staphylococcus aureus (mRs) not CF</strong></td>
<td>157 (U3)</td>
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<td>0</td>
<td>0</td>
<td>31</td>
<td>75</td>
<td>17</td>
<td>97</td>
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<td>5</td>
<td>95</td>
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<tr>
<td><strong>Staphylococcus aureus (CF) mSsa and mRs</strong></td>
<td>214</td>
<td>81</td>
<td>62</td>
<td>71</td>
<td>72</td>
<td>59</td>
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<td>98</td>
<td>100</td>
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<tr>
<td><strong>Staph epidermidis</strong></td>
<td>106 (U51)</td>
<td>32</td>
<td>26</td>
<td>32</td>
<td>59</td>
<td>36</td>
<td>26</td>
<td>65</td>
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<td>8</td>
<td>98</td>
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<tr>
<td><strong>CNS (coag neg Staph; excludes epidermidis)</strong></td>
<td>102</td>
<td>64</td>
<td>64</td>
<td>54</td>
<td>84</td>
<td>43</td>
<td>43</td>
<td>87</td>
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<td>98</td>
<td>66</td>
<td>100</td>
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<tr>
<td><strong>Streptococcus pyogenes</strong></td>
<td>113</td>
<td>100</td>
<td></td>
<td>68</td>
<td>90</td>
<td></td>
<td></td>
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<tr>
<td><strong>Streptococcus pneumoniae</strong></td>
<td>74</td>
<td>100</td>
<td>90</td>
<td>96</td>
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<td>78</td>
<td>100</td>
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<tr>
<td><strong>Viridans streptococci</strong></td>
<td>42</td>
<td>93</td>
<td>84</td>
<td>88</td>
<td>45</td>
<td></td>
<td></td>
<td>51</td>
<td>100</td>
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<tr>
<td><strong>Enterococcus faecium</strong></td>
<td>26 (U18)</td>
<td>27</td>
<td></td>
<td>4</td>
<td></td>
<td></td>
<td></td>
<td>27</td>
<td>100</td>
<td>39</td>
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<tr>
<td><strong>Enterococcus faecalis</strong></td>
<td>145 (U106)</td>
<td>100</td>
<td></td>
<td>29</td>
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<td></td>
<td></td>
<td>51</td>
<td>84</td>
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</table>
REGIONAL TRENDS IN RESISTANCE
PERCENTAGE OF URETHRAL *NEISSERIA GONORRHOEAE* ISOLATES WITH REDUCED AZITHROMYCIN SUSCEPTIBILITY,* BY SEX OF SEX PARTNER AND YEAR — GONOCOCCAL ISOLATE SURVEILLANCE PROJECT, UNITED STATES, 2000–2014

Kirkcaldy et al. (2016) *MMWR* 65(7):1–19
Community Antibiotic Prescriptions per 1,000 Population by State - 2015

Each year 269.4 million antibiotic prescriptions are written in the United States; enough to give 4 out of every 5 people one prescription.

Data source: QuintilesIMS Xponent, 2015
PREVALENCE OF INAPPROPRIATE ANTIBIOTIC PRESCRIBING

• Targets based on lowest prescribing regions for sinusitis, otitis media, streptococcal pharyngitis, and no antibiotics for asthma, allergy, bronchitis, bronchiolitis, influenza, URI
• For 0-19 yr olds: 29% of antibiotic prescriptions are inappropriate
  • 100% of URI/asthma/bronchitis
• For all ages: **50% of antibiotics are inappropriately prescribed**

Fleming-Dutra et al., 2016
UPPER RESPIRATORY PATHOGENS
(AOM/SINUSITIS)

• *S. pneumoniae* (15-25%)
• Nontypeable *H. influenzae* (50-60%)
• *M. catarrhalis* (12-15%)
• Sterile (15-20%)

***Viruses***

Wald & DeMuri, 2018
AOM TREATMENT

- High-dose amoxicillin is still first line
  - Efficacy against common pathogen, safety, low cost, acceptable taste, and narrow microbiologic spectrum

- If amoxicillin in past 30 days or β-lactamase–positive *H. influenzae* and *M. catarrhalis* suspected
  - High-dose amoxicillin-clavulanate (90 mg/kg/day amoxicillin)
  - cefdinir (14 mg/kg per day in 1 or 2 doses)
  - cefuroxime (30 mg/kg per day in 2 divided doses)
  - cefpodoxime (10 mg/kg per day in 2 divided doses)
  - ceftriaxone (50 mg/kg, administered intramuscularly)

- ~33% of antibiotic prescriptions for AOM are not first line (ie amoxicillin)

Lieberthal, AS et al. (2013); Hersh AL et al (2016)
DURATION OF THERAPY

- < 2 yrs: 10 days
- 2 yr to 5 yr olds with mild to moderate symptoms: 7 days
- ≥ 6 yrs with mild to moderate symptoms: 5 to 7 days

Lieberthal, AS et al. (2013). Diagnosis and Management of Acute Otitis Media, Pediatrics, 131, e964-e999.
<table>
<thead>
<tr>
<th>Initial Immediate or Delayed Antibiotic Treatment</th>
<th>Antibiotic Treatment After 48–72 h of Failure of Initial Antibiotic Treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Recommended First-line Treatment</strong></td>
<td><strong>Alternative Treatment (if Penicillin Allergy)</strong></td>
</tr>
<tr>
<td>Amoxicillin (80–90 mg/kg per day in 2 divided doses)</td>
<td>Cefdinir (14 mg/kg per day in 1 or 2 doses)</td>
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<tr>
<td></td>
<td>or Cefuroxime (30 mg/kg per day in 2 divided doses)</td>
</tr>
<tr>
<td>Amoxicillin-clavulanate (90 mg/kg per day of amoxicillin, with 6.4 mg/kg per day of clavulanate [amoxicillin to clavulanate ratio, 14:1] in 2 divided doses)</td>
<td>Cefpodoxime (10 mg/kg per day in 2 divided doses)</td>
</tr>
<tr>
<td></td>
<td>Ceftriaxone (50 mg IM or IV per day for 1 or 3 d)</td>
</tr>
</tbody>
</table>

Lieberthal, AS et al. (2013). Diagnosis and Management of Acute Otitis Media, Pediatrics, 131, e964-e999.
- One case of non-anaphylactic reaction (N = 153)

Terico & Gallagher (2014)
- Review of 1950 to 2013 literature
- Cross-reactivity of < 5%

Campagna et al (2012)
- Review
- Overall cross reactivity rate ~ 1%
PNEUMOCOCCUS RESISTANCE

• Resistance to invasive pneumococcal strains has decreased since vaccinating with PCV 7/13 (Tomczyk, S. et al., 2014)

• Invasive pneumococcal disease caused by 13 strains as well as penicillin resistance has decreased (Gaviria-Agudelo CL, et al., 2016)

• Pneumococcal infections are rare in children since introducing PCV13 vaccine (Greenhow, Hung & Herz, 2017)
USE OF MACROLIDES TO TREAT AOM

• Meta-analysis of 10 trials indicated greater likelihood of clinical failure if macrolides were prescribed (azithromycin or clarithromycin) (Courter et al., 2010)

• **BUG-DRUG MISMATCH!**

• Up to 70% of macrolide prescriptions are inappropriate (Hersh et al, 2016)
Prevalence of *S. pneumoniae* primary pathogen has decreased from 40-45% in 1999 to 15-25% in 2017 (Wald & DeMuri, 2018)

High-dose amoxicillin was based on penicillin resistant *S. pneumoniae*

*H. flu* and *M. catarrhalis* are resistant to amoxicillin

Regular dose amoxicillin-clavulanate will treat resistant *H. flu* and *M. catarrhalis* – no need for high dose amoxicillin clavulanate

Consider amoxicillin-clavulanate 45 mg/kg/d in 2 divided doses of 400 mg/57 mg

SINUSITIS

• 2012 Guidelines from Infectious Disease Society

• 2013 Guidelines from American Academy of Pediatrics
SCHEMATIC CHARACTERIZATION OF THE NATURAL HISTORY AND TIME COURSE OF FEVER AND RESPIRATORY SYMPTOMS WITH UNCOMPLICATED URI IN CHILDREN
Signs & Symptoms either:

a) Persistent & not improving (≥10 days);
b) Severe (≥3–4 days); or
c) Worsening or “double-sickening” (≥3–4 days)

Risk for Resistance

No

Initiate first-line antimicrobial therapy

Improvement after 3–5 days

Worsening or no improvement after 3–5 days

Risk for antibiotic resistance

- Age <2 or >65, daycare
- Prior antibiotics within the past month
- Prior hospitalization past 5 days
- Comorbidities
- Immunocompromised

Yes

Initiate second-line antimicrobial therapy

Improvement after 3–5 days
Improvement after 3–5 days

Complete 5–7 days of antimicrobial therapy

Worsening or no improvement after 3–5 days

Broaden coverage or switch to different antimicrobial class

Improvement after 3–5 days

Complete 7–10 days of antimicrobial therapy

Improvement

Complete 5–7 days of antimicrobial therapy

Worsening or no improvement after 3–5 days

Refer to specialist

- CT or MRI to investigate noninfectious causes or suppurative complications
- Sinus or cerebrospinal fluid cultures for pathogen-specific therapy

Complete 7–10 days of antimicrobial therapy
<table>
<thead>
<tr>
<th>Clinical Presentation</th>
<th>Severe Acute Bacterial Sinusitis&lt;sup&gt;a&lt;/sup&gt;</th>
<th>Worsening Acute Bacterial Sinusitis</th>
<th>Persistent Acute Bacterial Sinusitis</th>
</tr>
</thead>
<tbody>
<tr>
<td>Uncomplicated acute bacterial sinusitis without coexisting illness</td>
<td>Antibiotic therapy</td>
<td>Antibiotic therapy</td>
<td>Antibiotic therapy or additional observation for 3 days</td>
</tr>
<tr>
<td>Acute bacterial sinusitis with orbital or intracranial complications</td>
<td>Antibiotic therapy</td>
<td>Antibiotic therapy</td>
<td>Antibiotic therapy</td>
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<tr>
<td>Acute bacterial sinusitis with coexisting acute otitis media, pneumonia, adenitis, or streptococcal pharyngitis</td>
<td>Antibiotic therapy</td>
<td>Antibiotic therapy</td>
<td>Antibiotic therapy</td>
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SINUSITIS TREATMENT

• Amoxicillin is first line (Wald et al, 2013)
  • In children > age 2 yrs, no daycare and no antibiotics for 4 weeks use 45 mg/kg/day divided BID
  • High risk of resistance: amox 80-90 mg/kg/day

• Children < 2 yrs, daycare or recent antibiotics
  • Amoxicillin-clavulanate 80-90 mg/kg/day of amox (max 2 gm/day)
  • Consider amoxicillin-clavulanate 45 mg/kg/d in 2 divided doses of 400 mg/57 mg (WId and DeMuri, 2018)

• PCN allergic
  • Cefdinir, cefuroxime or cefpodoxime
  • Moderate to severe sinusitis in children < 2 yrs with Type I allergy:
    • Clindamycin and cefixime
SECOND-LINE ANTIBIOTICS FOR SINUSITIS

• Start amoxicillin or amox-clav for 3 days
  • If symptoms improving, continue for 7 more days (total of 10 to 14 days)
• If worsening or no improvement after 3 days:
  • High dose amoxicillin/clavulanate
  • cefuroxime (Ceftin)
  • cefdinir (Omnicef)
  • cefpodoxime (Vantin)
Figure. Percentage of Visits in Which Antibiotics Were Prescribed That Are First-line and Non-First-line for Otitis Media, 2010-2011

A. Otitis media. First-line: amoxicillin or amoxicillin-clavulanate. B. Sinusitis. First-line: amoxicillin or amoxicillin-clavulanate. C. Pharyngitis. Amoxicillin or penicillin. Estimates were based on 1705 sampled visits for otitis media, 463 for pediatric sinusitis, 1223 for adult sinusitis, 1006 for pediatric pharyngitis and 830 for adult pharyngitis. Broad cephalosporin includes second- and third-generation agents. Pediatric patients were defined as those 19 years or younger.

Hersh et al., 2016
SINUSITIS: DURATION OF THERAPY

- Wald (2013) “optimal duration has not received systematic study”
- AAP (2013) 10 days or 7 days after improvement
  - majority have improvement in 3 days
- ISDA (2012) 5 to 7 days
- AAO (2015) 5 to 10 days
SINUSITIS

Don’t Forget

• Saline nasal spray or drops
  – Liquefies secretions
  – Decreases crusting near the sinus ostia
  – Nasal saline alone may be as effective as NS + amox (Ragab et al, 2015)

• Topical decongestants
  – Decrease tissue edema and nasal resistance, probably enhances drainage of secretion from sinus ostia

• Corticosteroids
  – Helpful in chronic sinusitis or if allergic rhinitis concurrently
  – No evidence for use in acute sinusitis
COMMUNITY ACQUIRED PNEUMONIA

- *S. pneumoniae* is the most common cause of bacterial pneumonia in patients of all ages
- Infants 4 to 16 weeks:
  - Consider chlamydia
- Respiratory viruses most common in first 2 to 3 years of life (80% of CAP)
- Over 5 yrs through adolescence:
  - Consider mycoplasma
- CA-MRSA
- Virus

Jain et al., 2015
PNEUMONIA ANTIBIOTIC CHOICES IN CHILDREN

Fully immunized children < age 5 years:

- Bacterial pneumonia (*S. pneumoniae*)
  - Amoxicillin 80-90 mg/kg/day
  - PCN allergy: Clindamycin or a macrolide
- Unimmunized for Hib or PCV
  - Ceftriaxone 50 mg/kg
- Infant with suspected chlamydial pneumonia
CHILDREN 5 YRS OR OLDER

• Guidelines say amoxicillin 90 mg/kg to max 4 gm per day
• Treat for 10 days
• Mycoplasma or other atypical most likely
  • Azithromycin
  • Erythromycin
  • Doxycycline if > 7 yrs
• Outpatient pediatric primary care (N = 10,414) (Handy et al, 2017)
  • 40.7% received amoxicillin
  • 42.5% received macrolide (≥ age 5, recent antibx, private insurance)
  • 16.8% received broad spectrum antibiotics (suburbs, private insurance)

• 28 children’s hospitals (Williams et al, 2017)
  • Before ISDA guideline penicillin for CAP was rare (<10%)
  • Increase after guideline to 27.6% (29.5% vs 20.1%)

• 53 hospitals (3802 charts) (Parikh et al, 2017)
  • Implemented evidence-based tools to promote judicious use of antibiotics
  • Narrow spectrum antibx use increased by 67% in the ED, 43% in the inpatient setting, and 25% at discharge
  • Macrolides decreased by 22% in the ED and 27% in the inpatient setting
STREP PHARYNGITIS

- Pathogen: Streptococcus pyogenes
- Strep 20-30% of pharyngitis
- Most rapid strep tests are 90 to 95% accurate
  - Rapid tests and throat cultures cannot differentiate between GAS pharyngitis and GAS carriers

- Likelihood of positive strep is higher with fewer viral symptoms (cough, rhinorrhea)
  - patients with any viral feature were ~30% less likely to have GAS, and patients with ≥2 features were >40% less likely to have GAS (Shapiro et al, 2017)
STREP PHARYNGITIS

Treatment (Red Book, 2018; ISDA, 2012):

- **Penicillin**
  - PO 250 mg BID if < 27 kg or 500 mg BID if > 27 Kg
  - IM penicillin G benzathine single dose of 600 000 U (<27kg), > 27 kg and adults 1.2 million U
- **Amoxicillin** 50 mg/kg in a single daily dose (max 1gm)
- **1st generation cephalosporin**
  - Cephalexin (Keflex) 40-50 mg/kg/day dosed BID (max 500 mg BID)
  - Cefadroxil (Duricef) 30 mg/kg/day (max 1 gm)
- **Clindamycin** 7 mg/kg/dose tid (max 500 mg tid)
PCN ALLERGIC

- 1st generation cephalosporin (cephalexin)

- If immediate Type 1 hypersensitivity:
  - clindamycin 20 mg/kg/day divided TID (max 1.8 gm/day)
  - Or macrolide
    - Azithromycin (12 mg/kg/day [maximum, 500 mg]) for 5 days
      • Macrolides have resistance (5% to 10%, up to 20%)

(AAP Red Book, 2018)
Figure. Percentage of Visits in Which Antibiotics Were Prescribed That Are First-line and Non-First-line for Otitis Media, 2010-2011

A, Otitis media. First-line: amoxicillin or amoxicillin-clavulanate. B, Sinusitis. First-line: amoxicillin or amoxicillin-clavulanate. C, Pharyngitis. Amoxicillin or penicillin. Estimates were based on 1705 sampled visits for otitis media, 463 for pediatric sinusitis, 1223 for adult sinusitis, 1006 for pediatric pharyngitis and 830 for adult pharyngitis. Broad cephalosporin includes second- and third-generation agents. Pediatric patients were defined as those 19 years or younger.

Hersh et al., 2016
20-25% of children may be asymptomatic carriers during the winter months

- May be colonized by GAS pharyngitis for ≥6 months

**Eradication therapy**

- Clindamycin 30 mg/kg/day in 3 doses (max 300 mg/dose) × 10 days
- Augmentin 40 mg amoxicillin/kg/d in 3 doses (max = 2000mg amoxicillin/d)
- Penicillin V: 50 mg/kg/d in 4 doses × 10 d (max = 2000 mg/d) PLUS rifampin: 20 mg/kg/d in 1 dose × last 4 d of treatment (max = 600 mg/d)

(Red Book, 2018; ISDA, 2012):
SKIN AND SOFT TISSUE INFECTIONS GUIDELINES

• Impetigo
  • Bullous or nonbullous impetigo: mupirocin or retapamulin BID x 5 days (Stevens et al, 2014; RedBook 2018)
  • Oral therapy for 7 days (dicloxacillin or cephalexin)
S. AUREUS SKIN AND SOFT TISSUE INFECTIONS

- 2014 IDSA Guidelines (Stevens et al.)
- 2018 Red Book

https://www.cdc.gov/mrsa/community/photos/photo-mrsa-8.html
Purulent skin and soft tissue infections (SSTIs).


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

- Purulent cellulitis
  - TMP-SMX
  - Clindamycin
  - If > 8 yrs: Doxycycline
- Non-purulent cellulitis
  - Cover for both CA-MRSA and β strep
  - cephalexin and dicloxacillin
  - amoxicillin and/or TMP-SMX or a tetracycline
- Duration of therapy: 5 to 7 days

Liu, C. et al. (2011); Stevens et al. (2014)
## LOCAL ANTIBIOGRAM – NOT EVERYTHING IS MRSA

### Gram Positive Organisms† (Percent (%) Susceptible)

<table>
<thead>
<tr>
<th></th>
<th>No. Tested†</th>
<th>Penicillin</th>
<th>Oxacillin</th>
<th>Clindamycin</th>
<th>Erythromycin</th>
<th>Gentamicin</th>
<th>Nitrofurantoin</th>
<th>Levofloxacin</th>
<th>Tetracycline</th>
<th>Rifampin</th>
<th>Trimeth/sulfa</th>
<th>Vancomycin</th>
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<tbody>
<tr>
<td><strong>Enterococcus species</strong></td>
<td>1841</td>
<td>95</td>
<td></td>
<td></td>
<td>79</td>
<td>↑94</td>
<td>81</td>
<td>↑↑↑20</td>
<td></td>
<td></td>
<td></td>
<td>94</td>
</tr>
<tr>
<td><strong>Staphylococcus aureusTT</strong></td>
<td>10410</td>
<td>8</td>
<td>57</td>
<td>77</td>
<td>46</td>
<td>98</td>
<td>100</td>
<td>52</td>
<td>92</td>
<td>99</td>
<td>96</td>
<td>100</td>
</tr>
<tr>
<td><strong>Staphylococcus coagulase neg.</strong></td>
<td>578</td>
<td>×</td>
<td>50</td>
<td>67</td>
<td>47</td>
<td>90</td>
<td>55</td>
<td>83</td>
<td>98</td>
<td>64</td>
<td>100</td>
<td></td>
</tr>
</tbody>
</table>

†The actual number of isolates tested against each antibiotic may vary. Blank indicates not tested against that drug.

Tacoma Pierce County Health Department, 2017
The diagnosis of *C. difficile* disease is based on *C. difficile* toxins in stool OR enzyme immunoassay (EIA) OR nucleic acid amplification tests/PCR

- Routine testing not recommended
- Pathogen shedding for weeks
  - 13% to 24% at 2 weeks and 6% at 4 weeks after therapy

C. DIFFICILE TREATMENT

- Stop antibiotics
- Moderate or severe disease: empirical antibiotic treatment
  - Metronidazole
    - (30 mg/kg per day, orally, in 4 divided doses, maximum 2 g/day)
  - Oral vancomycin or vancomycin administered by enema
    - (40 mg/kg per day, orally, in 4 divided doses, to a maximum daily dose not to exceed 2 g)
  - Duration of therapy: 10 days
- Up to 30% of patients experience a recurrence after discontinuing therapy
- Good hand washing to prevent spread

AAP Committee on Infectious Disease (2013). *Clostridium difficile* Infection in Infants and Children. *Pediatrics, 131*(1), 196-200
AAP RedBook, 2015
ANUBITICS IN INFANCY AND ALLERGIES (MITRE ET AL, 2018)

• Antibiotic use during infancy was associated with an increased risk of both cow’s milk allergy and egg allergy

• Antibiotics prescribed during infancy were associated with a greater than 2-fold risk of asthma in childhood

• Incidence of atopic dermatitis, allergic rhinitis, contact dermatitis, urticaria, and other allergies were significantly increased
NATIONAL FOCUS ON ANTIMICROBIAL RESISTANCE

• President Obama’s FY2016 budget included $1.2 billion for National Strategy on Combating Antibiotic-Resistant Bacteria

• The CDC has developed guidelines and tools for inpatient and outpatient settings
Get Smart: Know When Antibiotics Work

For Healthcare Professionals

CDC’s Get Smart program has resources for healthcare professionals working in outpatient and inpatient healthcare settings, as well as community pharmacies.

OUTPATIENT HEALTHCARE PROFESSIONALS
Adult and pediatric treatment guidelines, materials to use with patients in the outpatient setting...

INPATIENT HEALTHCARE PROFESSIONALS
Resources to implement antibiotic stewardship programs in an inpatient setting, success stories...
Outpatient Healthcare Professionals

Recommendations for appropriate antibiotic prescribing, including clinical practice guidelines, have been developed to improve outpatient treatment of common infections in children and adults. CDC's Get Smart: Know When Antibiotics Work program has developed materials that outpatient healthcare professionals can use to educate their patients about when antibiotics treatment is appropriate.

ADULT TREATMENT RECOMMENDATIONS

PEDIATRIC TREATMENT RECOMMENDATIONS
**Pediatric Treatment Recommendations**

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.

Download a Quick Reference Table (5 pages) of this information, as well as resources for your practice from Get Smart’s Print Materials for Healthcare Professionals section.

<table>
<thead>
<tr>
<th>Condition</th>
<th>Epidemiology</th>
<th>Diagnosis</th>
<th>Management</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acute sinusitis</td>
<td>Sinusitis may be caused by viruses or bacteria, and antibiotics are not guaranteed 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.</td>
<td>If a bacterial infection is established: • Watchful waiting for up to 3 days may be offered for children with mild-moderate symptoms.</td>
</tr>
</tbody>
</table>

https://www.cdc.gov/getsmart/community/for-hcp/outpatient-hcp/pediatric-treatment-rec.html
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.⁴

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

https://www.cdc.gov/getsmart/
CORE ELEMENTS OF OUTPATIENT ANTIBIOTIC STEWARDSHIP

- **Commitment**
  - Write and display public commitments in support of antibiotic stewardship.

- **Action for policy and practice**
  - Use evidence-based diagnostic criteria and treatment recommendations
  - Use delayed prescribing practices or watchful waiting, when appropriate

- **Tracking and reporting**
  - Self-evaluate antibiotic prescribing practices
  - Implement an antibiotic prescribing tracking and reporting system.

- **Education and expertise**
  - Educate patients about the potential harms of antibiotic treatment
Get Smart: Know When Antibiotics Work

Print Materials for Healthcare Professionals

These print materials focus on when it is and is not appropriate to prescribe antibiotics and explain why antibiotic resistance is one of the world’s most pressing public health problems.

These print materials focus on the issue of antibiotic resistance and emphasize the importance of appropriate antibiotic prescribing and use. These materials are print-friendly and we encourage you to share them widely with your partners and colleagues. To order small quantities of select materials for free or to purchase large quantities, click here.

Antibiotic Stewardship Commitment Posters

Written public commitments in support of antibiotic stewardship that are placed in examination rooms have been shown to reduce inappropriate antibiotic prescriptions. These posters can also facilitate patient communication about appropriate antibiotic use. We encourage you to add your healthcare facility logo, healthcare professional photo or signature to any of these posters. Print the posters via your office printers, or send to a
Many common infections are becoming resistant to antibiotics. As a parent, ask questions to make sure your sick child is getting the best care possible, which might not include an antibiotic.

The Facts:

- **Antibiotics can have reactions and side effects.**

  Harmful effects from antibiotics, such as side effects and allergic reactions, cause 1 out of 5 emergency department visits for adverse drug events and lead to 50,000 emergency department visits in children each year.¹

- **Antibiotics can be overused and misused.**

  It is estimated that more than half of antibiotics are unnecessarily prescribed to children in doctor office settings for cough and cold illness, most of which are caused by viruses.

- **Antibiotics can only cure infections caused by bacteria, not viruses.**
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.
Dear Child Care Professional:

I have carefully evaluated ___________________ and have diagnosed him/her as having:

- Cold
- Cough
- Flu
- Middle ear fluid (Otitis Media with Effusion, OME)
- Viral sore throat
- Other: _______________________

This illness is caused by a virus. Antibiotic treatment will not cure a viral illness (antibiotics only are effective in treating bacterial infections). In fact, if antibiotics are given when they are not needed, they may be harmful by increasing the child’s risk of a resistant infection.

This child may return to day care when he/she does not have a fever. At that point most children can participate in activities, and do not require so much care that the health and safety of other children would be jeopardized. Excluding children with viral illness does not decrease the spread of infection to other children because viruses are likely to be spread even before symptoms of illness occur.

Sincerely yours,
WHAT YOU CAN DO

• Know what pathogen you are treating and prescribe appropriately
• Do not prescribe antibiotics for viral infection
  • Avoid “Vitamin Z”
• Know your local resistance pattern
• Consider an antibiotic stewardship program for your facility
REFERENCES

- AAP Committee on Infectious Disease (2013). *Clostridium difficile* Infection in Infants and Children. *Pediatrics, 131*(1), 196-200


• Lieberthal, AS et al. (2013). Diagnosis and Management of Acute Otitis Media, *Pediatrics,* 131, e964-e999.


• doi:10.1097/PEC.0000000000000868


• Sanchez GV, Fleming-Dutra KE, Roberts RM, Hicks LA. Core Elements of Outpatient Antibiotic Stewardship. *MMWR Recomm Rep* 2016;65(No. RR-6):1–12. DOI: [http://dx.doi.org/10.15585/mmwr.rr6506a1](http://dx.doi.org/10.15585/mmwr.rr6506a1)


