System-wide Approach to Improve Outpatient Antibiotic Use

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Background on Allina Health

- Not-for-profit healthcare system serving MN and western WI
- Patient care facilities include
  - 12 hospitals (1,775 staffed beds)
    - Metro sites include Abbott Northwestern, United, Mercy, Unity
  - 13 Emergency Departments
  - 13 Urgent Cares
  - 62 Allina Health clinics
  - 23 Hospital-based clinics
  - 49 Rehabilitation locations
  - 15 Retail pharmacy sites
  - 2 Ambulatory care centers
Antibiotic Stewardship in Allina Health

• Primary focus has been inpatient
• A key driver for *Clostridium difficile* reduction
• Leadership commitment at the site and system level
• Multiple private ID provider groups across the system
  – All are members of the Allina ID Physician/Pharmacy Task Force
• Two ID pharmacists at Abbott drive several system initiatives
• Monthly antibiotic use report for inpatient antibiotic use
• Reporting structure varies at each site
• Standardized mandatory education for all employees and patients

Expansion to Outpatient Antibiotic Stewardship

• Initially driven by pharmacists in the ED
  – Providers asking for antibiotic recommendations for patients leaving
  – Pharmacists review cultures of patients discharged from ED
  – Pharmacists observing lack of standardization/best practice
  – Collaborative practice agreements for culture reviews
• Initially was a pharmacy student’s project to develop a guide to use in the ED at Abbott (2015)
• Due to increased interest and usage, expanded Allina-wide (2017)
Outpatient Antibiotic Guides

• Separated adult and pediatric recommendations
• Utilized guidelines, local antibiograms, current literature, clinical experience, and antibiotic stewardship principles
• Included:
  – First line and second line options
  – Duration of therapy
  – Additional comments useful for provider (e.g., resistance rates)
  – Tables with antibiotics requiring renal adjustment, brand/generic names, max doses for pediatrics

Outpatient Antibiotic Guides

• Adult Guide
  – Feedback from ED providers/pharmacists on original guide
  – Updated by ID pharmacists at Abbott
  – Feedback and endorsement by the Allina ID MD/RX Task Force
  – Endorsement by the Allina Primary Care Council
  – Utilized Allina Sepsis Leadership Team to prioritize ED Smart Set build
Outpatient Antibiotic Guides

• Pediatric Guide
  – Feedback from ED providers/pharmacists on original guide
  – Updated Abbott ID pharmacy resident and Children’s Minnesota ASP pharmacist
  – Approval process at Children’s Minnesota
  – Feedback by Allina Pediatric Council
  – Feedback and endorsement by the Allina ID MD/RX Task Force
  – Endorsement by the Allina Primary Care Council
  – Utilized Allina Sepsis Leadership Team to prioritize ED Smart Set build

Outpatient Antibiotic Guides

2017 Allina Health Adult Outpatient & ED Antibiotic Reference Guide
Endorsed by the Allina Health Primary Care Council and Allina Health Infectious Diseases Physician/Pharmacy Task Force

<table>
<thead>
<tr>
<th>Skin/Soft Tissue</th>
<th>First Line Therapy</th>
<th>Second Line Therapy</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cellulitis, Purulent</td>
<td>SHK/THP D5 1-2 tabs PO BID x5-14 days</td>
<td>Doxycycline 100mg PO BID x5-14 days</td>
<td>Duration: usually 7 days for uncomplicated cases. Extended duration for immunocompromised.</td>
</tr>
<tr>
<td>Cellulitis, Non-purulent</td>
<td>Cephalexin 500mg PO QID x5-14 days</td>
<td>Clindamycin 450mg PO QID x 5-14 days</td>
<td>Duration: usually 7 days for uncomplicated cases. Extended duration for immunocompromised.</td>
</tr>
<tr>
<td>Diabetic Foot, Mild</td>
<td>Ampicillin 875mg PO BID x7-14 days</td>
<td>Cephalexin 500mg PO QID x7-14 days</td>
<td>Duration: usually 2-4 weeks; depends on clinical improvement.</td>
</tr>
<tr>
<td>Diabetic Foot, Moderate</td>
<td>Amoxicillin/clavulanate 875mg PO BID</td>
<td>Levofloxacin 750mg PO daily + i.v. metronidazole 500mg PO BID</td>
<td>Treatment: 7 days; BID is the preferred treatment. Consider abscess drainage.</td>
</tr>
</tbody>
</table>

Endorsed by the Allina Primary Care Council, Allina Health Infectious Diseases Physician/Pharmacy Task Force, and Children’s Minnesota

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</thead>
<tbody>
<tr>
<td>Cellulitis, Purulent</td>
<td>SHK/THP dose based on TSH: 5mg/kg/dose PO BID (max: 320mg/day)</td>
<td>Clindamycin 10mg/kg/dose PO TID (max: 2.8g/day)</td>
<td>Duration: 7 days for uncomplicated cases. BID is the preferred treatment. Consider abscess drainage.</td>
</tr>
<tr>
<td>Cellulitis, Non-purulent</td>
<td>Cephalexin 15mg/kg/dose PO TID (max: 3g/day)</td>
<td>Clindamycin 10mg/kg/dose PO TID (max: 2.8g/day)</td>
<td>Duration: 7 days for uncomplicated cases. For immunocompromised, consider clindamycin and vancomycin.</td>
</tr>
</tbody>
</table>
Outpatient Antibiotic Guides

<table>
<thead>
<tr>
<th>Generic (Brand)</th>
<th>Require Renal Adjustment</th>
<th>Antibiotic</th>
<th>Pediatric Maximum Dose</th>
</tr>
</thead>
<tbody>
<tr>
<td>1st Generation Cephalosporins</td>
<td></td>
<td>Aminocillin</td>
<td>1-40 kg: 600 mg/day, &gt;40 kg: 1.2 g twice daily</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Aminocillin/trimethoprim</td>
<td>1-40 kg: 900 mg/day, &gt;40 kg: 1.8 g twice daily</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Cefazolin</td>
<td>1-40 kg: 100 mg/kg, &gt;40 kg: 2 g twice daily</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Cefoxitin</td>
<td>1-40 kg: 100 mg/kg, &gt;40 kg: 2 g twice daily</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Cefotaxime</td>
<td>1-40 kg: 150 mg/kg, &gt;40 kg: 3 g twice daily</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Ceftriaxone</td>
<td>1-40 kg: 150 mg/kg, &gt;40 kg: 3 g twice daily</td>
</tr>
</tbody>
</table>

2nd Generation Cephalosporins

<table>
<thead>
<tr>
<th>Generic (Brand)</th>
<th>Require Renal Adjustment</th>
<th>Antibiotic</th>
<th>Pediatric Maximum Dose</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Cefaclor</td>
<td>1-40 kg: 500 mg/day, &gt;40 kg: 1 g/day</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Cefuroxime</td>
<td>1-40 kg: 750 mg/day, &gt;40 kg: 1.5 g/day</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Cefuroxime axetil (Ceftin)</td>
<td>1-40 kg: 500 mg/day, &gt;40 kg: 1 g/day</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Cefuroxime axetil (Tofranil)</td>
<td>1-40 kg: 500 mg/day, &gt;40 kg: 1 g/day</td>
</tr>
</tbody>
</table>

3rd Generation Cephalosporins

<table>
<thead>
<tr>
<th>Generic (Brand)</th>
<th>Require Renal Adjustment</th>
<th>Antibiotic</th>
<th>Pediatric Maximum Dose</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Ceftriaxone (Ancef)</td>
<td>1-40 kg: 500 mg/day, &gt;40 kg: 1 g/day</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Cefuroxime (Zinacef)</td>
<td>1-40 kg: 500 mg/day, &gt;40 kg: 1 g/day</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Cefuroxime axetil (Tofranil)</td>
<td>1-40 kg: 500 mg/day, &gt;40 kg: 1 g/day</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Cefazolin</td>
<td>1-40 kg: 150 mg/kg, &gt;40 kg: 3 g twice daily</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Cefuroxime</td>
<td>1-40 kg: 150 mg/kg, &gt;40 kg: 3 g twice daily</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Cefotaxime</td>
<td>1-40 kg: 150 mg/kg, &gt;40 kg: 3 g twice daily</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Ceftriaxone</td>
<td>1-40 kg: 150 mg/kg, &gt;40 kg: 3 g twice daily</td>
</tr>
</tbody>
</table>

4th Generation Cephalosporins

<table>
<thead>
<tr>
<th>Generic (Brand)</th>
<th>Require Renal Adjustment</th>
<th>Antibiotic</th>
<th>Pediatric Maximum Dose</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Cefuroxime</td>
<td>1-40 kg: 500 mg/day, &gt;40 kg: 1 g/day</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Cefuroxime axetil (Tofranil)</td>
<td>1-40 kg: 500 mg/day, &gt;40 kg: 1 g/day</td>
</tr>
</tbody>
</table>

Putting the Guides into Practice

- Allina antibiotic stewardship webpage
- Education through email with link to the guides
  - ED providers
  - Primary care providers
  - ED pharmacists
- ED smart sets
  - Adult (1/2018)
  - Pediatric (2/2018)
- Clinics
  - Individual orders (3/2018)
  - Order Panels (TBD)
ED Smart Sets

- Indications are collapsed by organ systems

<table>
<thead>
<tr>
<th>Indications</th>
<th>Options</th>
</tr>
</thead>
<tbody>
<tr>
<td>For STD treatments – refer to a separate order set and/or smart set.</td>
<td></td>
</tr>
<tr>
<td><strong>Antibiotics for Skin/Soft Tissue Infections</strong></td>
<td></td>
</tr>
<tr>
<td>- Cellulitis - Purulent</td>
<td></td>
</tr>
<tr>
<td>- Cellulitis - Non-Purulent</td>
<td></td>
</tr>
<tr>
<td>- Diabetic Foot Infection - Mild</td>
<td></td>
</tr>
<tr>
<td>- Diabetic Foot Infection - Moderate</td>
<td></td>
</tr>
<tr>
<td><strong>Antibiotics for Genitourinary Infections</strong></td>
<td></td>
</tr>
<tr>
<td>- Uncomplicated Cystitis - Females, non-pregnant</td>
<td></td>
</tr>
<tr>
<td>- Uncomplicated Pyelonephritis - Females, non-pregnant</td>
<td></td>
</tr>
<tr>
<td>- Complicated Cystitis - Males, pregnant, functional abnormality, immunocompromised, indwelling or recent catheter/stent</td>
<td></td>
</tr>
<tr>
<td><strong>Antibiotics for Lower Respiratory Tract Infections</strong></td>
<td></td>
</tr>
<tr>
<td>- Community-Acquired Pneumonia</td>
<td></td>
</tr>
</tbody>
</table>

ED Smart Sets

- When indication is opened, provider is given 1\textsuperscript{st} and 2\textsuperscript{nd} line treatment options

**Antibiotics for Skin/Soft Tissue Infections**

- For Cellulitis - Purulent
  - sulfamethoxazole-trimethoprim DS (BACTRIM DS) PO - 1\textsuperscript{st} line
    - R:0, First occurrence now until 4/18/18
  - doxycycline (VIBRAMYCIN) PO - 2\textsuperscript{nd} line
    - R:0, First occurrence now until 4/18/18
**ED Smart Sets**

- Pediatric options include both liquid and tablet/capsule forms

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**ED SS PED Infectious Diseases Treatments**

- **Antibiotics for Skin/Soft Tissue Infections**
  - For Cellulitis - Purulent
  - For Cellulitis - Non-Purulent
    - cephalexin (KEFLEX) 250 mg capsule - 1st line
      - R/O, first occurrence now until 6/18/18
    - cephalexin (KEFLEX) 500 mg capsule - 1st line
      - R/O, first occurrence now until 6/18/18
    - cephalexin (KEFLEX) 125 mg/5 mL suspension - 1st line
      - R/O, first occurrence now until 6/18/18
    - cephalexin (KEFLEX) 250 mg/5 mL suspension - 1st line
      - R/O, first occurrence now until 6/18/18
    - clindamycin (CLEOCIN) PO solution - 2nd line
      - R/O, first occurrence now until 6/18/18
    - clindamycin (CLEOCIN) 300 mg capsule - 2nd line
      - R/O, first occurrence now until 6/18/18

---

**ED Smart Set Usage**

<table>
<thead>
<tr>
<th></th>
<th>Adult Smart Set</th>
<th>Pediatric Smart Set</th>
</tr>
</thead>
<tbody>
<tr>
<td>Go-Live Date</td>
<td>1/2/2018</td>
<td>2/6/2016</td>
</tr>
<tr>
<td>Usage through March 2018</td>
<td>242</td>
<td>12</td>
</tr>
<tr>
<td>Number of ED Locations</td>
<td>10</td>
<td>5</td>
</tr>
<tr>
<td>Number of Providers</td>
<td>62</td>
<td>5</td>
</tr>
</tbody>
</table>
Implementation in Clinics

- Selecting 1st line for uncomplicated cystitis (current state):
Implementation in Clinics

• Selecting 1st line for uncomplicated cystitis (future state):

  - [Medications & Orders]
    - Search for new order
    - New Order
    - Review open orders
    - Name
    - Medications
      - Ciprofloxacin HCI (CIPRO) 250 mg tablet
    - Unsigned Orders
      - new orders, reorders, and modifications
      - After visit Medications (0 Orders)
    - Adult Uncomplicated Cystitis ABX Guidelines
      - Female ≤ 65 years old, non-pregnant
      - Adult Antibiotic Guidelines
      - First Line Therapy
        - Nitrofurantoin macrocystals/macrohydrate (MACROBID) 100 mg capsule
        - Clark 50 capsule, first occurrence now until 4/15/18, etc.
      - Cephalexin 500 mg tablet
      - Dep 54 tablet, first occurrence now until 4/12/18, etc.
      - Second Line Therapy

  - [Use the nested panel as a decision tree when prescribing a medication]

  - Select First or Second line therapy to see which meds are recommended.
### Barriers Encountered

- **Getting input from key stakeholders**
  - May need to go outside of your organization to find the expertise needed
  - Opinions vary and recommendations are not always straightforward
  - Moving from an inpatient focus to outpatient
- **Putting recommendations into practice**
  - Education, education, education
  - Prioritizing build of electronic tools to make it easier for providers
  - Ensuring providers have the most updated guide

### Advice for Others

- Identify key stakeholders early
- Identify the expertise needed to create
  - Providers
  - Pharmacists
  - Informatics
- Get feedback but find a balance between too little and too much
- Determine how to provide the information and develop a plan
- Connect inpatient and outpatient IS resources
Key Acknowledgements

• Sandy Fritzlar, MD
• Ramsey Peterson, MD
• Angel Becker, PharmD
• Steve Grapentine, PharmD
• Mike Wankum, PharmD
• Allina ID Physician/Pharmacy Task Force
• Allina Primary Care Council