Pharmacists in the Emergency Department: Heroes Antimicrobial Stewardship Needs

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Disclosures

All planners, presenters, reviewers, and ASHP staff of this session report no financial relationships relevant to this activity.
Spread the Word

• Please use #IDintheED and #ASHP18 for tweets during this session
Thank you!
Pharmacists in the Emergency Department: Heroes Antimicrobial Stewardship Needs

Meghan E. Groth, Pharm.D, BCPS
Respiratory Medical Science Liaison
GlaxoSmithKline
@EMpharmgirl
Learning Objectives

• Describe the current state of antimicrobial stewardship in the ED
• Evaluate the role of the ED pharmacist in antimicrobial stewardship
• Discuss the utility and implementation of rapid diagnostic technologies and beta-lactam allergy testing in the ED
• Determine ED stewardship opportunities for patients presenting with community-acquired pneumonia, skin and soft tissue infection, and urinary tract infection
• Evaluate the impact of the ED on outpatient stewardship
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Pharmacists: Heroes in Disguise?

- Why should we care?
- Why pharmacists?
Roles of the emergency medicine pharmacist: 
A systematic review

Cristina Roman, B.Pharm. (Hons), M.PharmPrac., Pharmacy Department and Emergency and Trauma Centre, The Alfred Hospital, Melbourne, Australia.

Gail Edwards, B.Pharm., Pharmacy Department, The Alfred Hospital, Melbourne, Australia.

Michael Dooley, B.Pharm., Grad.Dipl.Hosp.Pharm., Ph.D., FISOPP, FSHPA, FAAQHC, Pharmacy Department, The Alfred Hospital, Melbourne, Australia, and Faculty of Pharmacy and Pharmaceutical Sciences, Monash University, Melbourne, Australia.

Biswa Mita, M.B.B.S., M.H.S.M., Ph.D., FACHEM, Emergency and Trauma Centre, The Alfred Hospital, Melbourne, Australia, and Department of Epidemiology and Preventive Medicine, Monash University, Melbourne, Australia.

Purpose. Results of a systematic literature review to identify roles for emergency medicine (EM) pharmacists beyond traditionally reported activities and to quantify the benefits of these roles in terms of patient outcomes are reported.

Summary. Emergency department (ED)-based clinical pharmacy is a rapidly growing practice area that has gained support in many countries globally, particularly over the last 5–10 years. A systematic literature search covering the period 1995–2010 was conducted to characterize emerging EM pharmacist roles and the impact on patient outcomes. Six databases were searched for research publications on pharmacist participation in patient care in a general ED or trauma center that documented interventions by ED-based pharmacists; 15 results satisfied the inclusion criteria. Six reported studies evaluated EM pharmacist involvement in the care of critically ill patients, 5 studies evaluated antimicrobial stewardship (AMS) activities via pharmacist review of positive cultures, 2 studies assessed pharmacist involvement in generating orders for nurse-administered home medications and 2 reviewed publications focused on EM pharmacist involvement in management of healthcare-associated pneumonia and dosing of phenytoin. A diverse range of positive patient outcomes was identified. The included studies were assessed to be of low quality.

Conclusion. A systematic review of the literature revealed 3 key emerging areas of practice for the EM pharmacist that are associated with positive patient outcomes. These included involvement in management of critically ill patients, AMS roles, and ordering of home medications in the ED.

Keywords: emergency medicine, pharmacists, pharmacy service hospital, resuscitation, trauma centers

Am J Health-Syst Pharm. 2013; 70:796-806
One Hero’s Humble Beginnings
Why me?

Mark "Tony" Mixon @IDintheED · Jun 13
This is a great point that can't be understated. We work elbow to elbow with the providers our entire shift. I haven't made a recommendation via the phone once since I started in the ED, just have to look to the right or left #IDintheED

Chris Bland @blandman19
ED pharmacists have amazing relationships with their prescribers and serve as great continuity for care. Can greatly impact prescribing long-term. Maximize their presence. #IDinthED twitter.com/sidpharm/statu...
A Hero Is Tested

- Challenges:
  - Guidelines
  - Pathways
  - Order Sets
Current State and Challenges

• Education alone insufficient

You have to teach early and often because education has the half-life of a beta lactam. #IDintheED

7:25 PM - 13 Jun 2018
Logistics

- Physical location?
- Are antibiotics in cabinets?
  - ALL antibiotics?
  - Restricted ABX?
- Second doses
  - Boarder patients
- Culture review
What does stewardship look like?

• High-risk conditions
  • Sepsis alerts

• Restricted ABX

• Culture review
A Day in the Life of a Hero
Case 1

• 65 yo F
• 40 pack year smoker
• COPD
• Uncontrolled HTN
• NKDA
Case 1

- Fever, tachycardia, cough
- Sepsis alert
- Vanco, pip/tazo
- Thoughts?
Case 2

- 34 yo M, 120 kg
- Takes creatine supplements
- Uncomplicated abscess
- PCN allergy (rash)
Case 2

• I&D in ED

• 1 gram vanco, discharge with cephalexin 500 QID + SMX/TMP 1 DS tab BID

• Thoughts?
Case 3

- 21 yo F pw syncope
- No PMH, UPT (-), UA (+)
- Latex allergy
- DC with cipro
Case 3

- C/S returns after d/c
- Amp $\geq 32$ (R)
- Cipro $\leq 0.25$ (S)
- Nitrofurantoin $\leq 16$ (S)
- TMP-SMX = 32 (I)
- Thoughts?
Pharmacists in the Emergency Department: Heroes Antimicrobial Stewardship Needs

Jenny Koehl, Pharm.D., BCPS
Emergency Medicine Clinical Pharmacist
Massachusetts General Hospital
Boston, MA
@jlkoehl
Patient Case 1

Patient: 65 YO female with COPD and uncontrolled HTN
CC: Fever, tachycardia, increased shortness of breath, and cough

Bay 5
Vancomycin 2000 mg
Piperacillin/Tazobactam 4.5 grams
Do we even need antibiotics?

YES

NO

1. Do not verify
2. Educate provider

What antibiotics do we need?

Diagnostic Uncertainty!
CMS 3 – Hour Sepsis Bundle

Labs
- Lactate
- Blood Cultures → before antibiotics

Broad-Spectrum Antibiotics
- Tailored to local (ED) susceptibility patterns
- Individualized to patient/infection/bacteria

Fluids (if shock)
- 30 mL/kg crystalloid
Every 1 hour delay in antibiotics = 7.6% decrease in survival

<table>
<thead>
<tr>
<th>Time to antibiotics</th>
<th>OR</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 1 hr</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>1 – 2 hrs</td>
<td>1.07</td>
<td>0.165</td>
</tr>
<tr>
<td>2 – 3 hrs</td>
<td>1.14</td>
<td>0.021</td>
</tr>
<tr>
<td>3 – 4 hrs</td>
<td>1.19</td>
<td>0.009</td>
</tr>
<tr>
<td>&gt; 6 hrs</td>
<td>1.52</td>
<td>&lt;0.001</td>
</tr>
</tbody>
</table>

Right Time, or Right Drug?

- Inappropriate Therapy: 14.5%
- Survival rate: 79.4% vs 51.7%

- Inappropriate Therapy: 19.9%
- Survival rate: 52.0% vs 10.3%

Time Pressure

Lack of antimicrobial stewardship

Non-specific diagnostic criteria

Broad-spectrum antimicrobials

Lack of rapid diagnostic tools

“SEP-1 (reporting) will promote the overuse of the antibiotics that are our last line of defense against drug-resistant bacteria”
-AHA
So what are we doing about this?
What Antibiotics Should We Order?

- No previous respiratory culture data
- No hospital or antibiotic exposure in the last 90 days
Cetriaxone + Azithromycin

Blondeau JM, Theriault N. J Infect Dis Ther. 2017 Feb;5(1)
Questions

1. Is the patient infected?
2. What is the patient infected with?
3. What will treat the infection?
Blood Cultures

Low Specificity
- Colonization
- Contamination

Low Sensitivity
- Severity
- Duration
- Microbial growth

Sputum Cultures
Rapid Molecular Diagnostic Testing

Questions

1. Is the patient infected?
2. What is the bug?
3. What will treat the infection?

Answers

- PCT
- Respiratory panel; influenza/RSV PCR; MRSA PCR; urinary antigens
- Rapid genotypic and phenotypic results

Green DA, StGeorge K. J Clin Microbiol. 2018 Sep 25;56(10). PMID: 29899007
Procalcitonin: High NEGATIVE predictive value


<table>
<thead>
<tr>
<th>Diagnosis</th>
<th>PCT (N=826)</th>
<th>Usual Care (N=830)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Asthma</td>
<td>37.7%</td>
<td>40.8%</td>
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<tr>
<td>COPD</td>
<td>32.2%</td>
<td>31.5%</td>
</tr>
<tr>
<td>Bronchitis</td>
<td>25.3%</td>
<td>23.1%</td>
</tr>
<tr>
<td>CAP</td>
<td>20.3%</td>
<td>19.6%</td>
</tr>
<tr>
<td>Other LRTI</td>
<td>5.1%</td>
<td>5.1%</td>
</tr>
</tbody>
</table>

- PCT Median level: 0.05 μg/L
- Antibiotic-days: 4.2±5.8 vs 4.3±5.6
- Received any antibiotics by day 30: 471 (57.0%) vs 513 (61.8%)
<table>
<thead>
<tr>
<th></th>
<th>Control group</th>
<th>PCT group</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Initiation of antibiotics n (%)</td>
<td>2894 (86.3%)</td>
<td>2351 (71.5%)</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>Duration of antibiotics (days), mean (±SD)</td>
<td>9.4 ± 6.2</td>
<td>8.0 ± 6.5</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>Total exposure (days), mean (±SD)</td>
<td>8.1 ± 6.6</td>
<td>5.7 ± 6.6</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>Mortality</td>
<td>10%</td>
<td>8.6%</td>
<td>0.037</td>
</tr>
<tr>
<td>Treatment failure</td>
<td>24.9%</td>
<td>23%</td>
<td>0.068</td>
</tr>
<tr>
<td>Antibiotic-related side effects</td>
<td>22.1%</td>
<td>16.3%</td>
<td>&lt; 0.0001</td>
</tr>
</tbody>
</table>
Expert Consensus

PCT use is **appropriate** for antibiotic de-escalation and **discontinuation**. However, **initiation or escalation** of antibiotic therapy in specific scenarios, including acute respiratory infections, **should not be based solely on PCT serum levels**. Clinical and radiological findings, evaluation of severity of illness and of patient's characteristics should be taken into account.

## Diagnostic Stewardship: bacterial detection

<table>
<thead>
<tr>
<th>Test</th>
<th>Organism(s) Detected</th>
<th>Resistance Marker(s)</th>
<th>Time to Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>Verigene BC-GN (Nanosphere)</td>
<td>Acinetobacter spp., Citrobacter spp., E. coli, Enterobacter spp., K. oxytoca, K. pneumoniae, P. aeruginosa, Proteus spp.</td>
<td>CTX-M, IMP, KPC, NDM, OXA, VIM</td>
<td>2.5 hr</td>
</tr>
<tr>
<td><strong>Polymerase chain reaction</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>StaphSR (GeneOhm)</td>
<td>S. aureus</td>
<td>SCC mec</td>
<td>2 hr</td>
</tr>
<tr>
<td>Xpert MRSA/SA BC (Cepheid)</td>
<td>S. aureus</td>
<td>meca</td>
<td>1 hr</td>
</tr>
<tr>
<td>MALDI-TOF</td>
<td></td>
<td>None</td>
<td>30 min</td>
</tr>
<tr>
<td>MALDI-TOF (bioMerieux)</td>
<td></td>
<td>None</td>
<td>30 min</td>
</tr>
<tr>
<td>PNA-FISH</td>
<td></td>
<td>None</td>
<td>20 min</td>
</tr>
</tbody>
</table>

**MRSA PCR**

- Surrogate marker for MRSA lower respiratory tract infections
- **95-99% negative predicted value**

### Pharmacist-ordered MRSA PCR testing

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Pre-PCR (n=27)</th>
<th>PCR (n=30)</th>
<th>Difference</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Duration of Anti-MRSA Therapy</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hours</td>
<td>74 ± 48.9</td>
<td>27.4 ± 18.7</td>
<td>46.6</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>Days</td>
<td>4.0 ± 2.0</td>
<td>2.13 ± 0.86</td>
<td>1.9</td>
<td>&lt;0.0001</td>
</tr>
</tbody>
</table>

Diagnostic Stewardship
- Right test
- Right patient

Antimicrobial Stewardship
- Right time
- Right interpretation

Patient assessment
- Rapid diagnostic test ordered
- Test results released and interpreted
- Diagnosis & therapeutic selection

What Cultures and RDTs Should We Order?

- Influenza/RSV
- MRSA PCR
- PCT
• **Influenza/RSV**: negative
• **MRSA PCR**: negative
• **PCT**: 0.2 μg/L
Antibiotic Acquisition

• Pharmacist verification
• Liaison with central pharmacy

• Restricted antibiotics
  – Infectious diseases consultation
  – First dose approval

We Can Mix Meds and Prime Lines Too!
<table>
<thead>
<tr>
<th></th>
<th>Pre-ADC Group</th>
<th>Post-ADC Group</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n</td>
<td>Mean ± S.D.</td>
<td>n</td>
</tr>
<tr>
<td>Ward</td>
<td>37</td>
<td>302 ± 265</td>
<td>33</td>
</tr>
<tr>
<td>Intensive care unit</td>
<td>15</td>
<td>236 ± 193</td>
<td>13</td>
</tr>
<tr>
<td>Step-down unit</td>
<td>13</td>
<td>223 ± 228</td>
<td>10</td>
</tr>
<tr>
<td>Sepsis or concern for sepsis</td>
<td>12</td>
<td>283 ± 283</td>
<td>28</td>
</tr>
</tbody>
</table>

Antibiotic Administration

- IV to PO
- Administration order
- Compatibility
- Push-dose antibiotics

<table>
<thead>
<tr>
<th>Cephalosporin</th>
<th>Carbapenem</th>
<th>Aminoglycoside</th>
<th>Lipopeptide</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cefazolin</td>
<td>Meropenem</td>
<td>Gentamicin</td>
<td>Daptomycin</td>
</tr>
<tr>
<td>Cefepime</td>
<td>Ertapenem</td>
<td>Tobramycin</td>
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</tr>
<tr>
<td>Cefotetan</td>
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<tr>
<td>Cefoxitin</td>
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<td></td>
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<tr>
<td>Ceftazidime</td>
<td></td>
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<tr>
<td>Ceftriaxone</td>
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<td></td>
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<tr>
<td>Cefuroxime</td>
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<td></td>
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<tr>
<td>Aztreonam</td>
<td></td>
<td></td>
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</tbody>
</table>
Second-dose antibiotics

• **One-third** of patients had a delay in 2nd antibiotic dose
  – 72% with q6 hour antibiotics
  – 47% with q8 hour antibiotics
• More frequent for inpatients boarding and **3-hour sepsis bundle compliance**
• Delayed 2nd dose antibiotics associated with increased mortality

**Solutions:**
• Course out antibiotics
• Pharmacist-to-pharmacist handoff
• Select antibiotics with less frequent dosing if appropriate

Diagnostic Stewardship

Antimicrobial Stewardship

Right Drug
Right Dose
Right Patient
Right Time
Pharmacists in the Emergency Department: Heroes Antimicrobial Stewardship Needs

Erin K. McCreary, Pharm.D., BCPS
Antimicrobial Stewardship/Infectious Diseases Clinical Pharmacist
University of Pittsburgh Medical Center
Pittsburgh, PA
@erinmccreary
The Truth About Penicillin Allergies

• They are bad
  – More FQ, clindamycin, vancomycin, aztreonam use
  – More *C. difficile*, MRSA, VRE infection and colonization
  – More surgical site infections

• They are... questionable
  – >95% of patients with reported allergies have negative skin tests
  – Rates of true anaphylaxis
    • 1/207,191 (0.00048%) → oral penicillin exposure
    • 1/95,298 (0.00105%) → parental penicillin exposure
  – No fatalities in over 100,000,000 oral amoxicillin courses

• They are not forever

• Med chem matters....
Cefazolin does not share a common side chain with any other beta-lactams

<table>
<thead>
<tr>
<th>Agent</th>
<th>Cefaclor</th>
<th>Cefadroxil</th>
<th>Cefprozil</th>
<th>Cephalexin</th>
</tr>
</thead>
<tbody>
<tr>
<td>Amoxicillin</td>
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<tr>
<td>Ampicillin</td>
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<tr>
<td>Aztreonam</td>
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<td>Cefclizide</td>
<td>Cefilozone</td>
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<tr>
<td>Cefaclor</td>
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<td>Cefadroxil</td>
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<td>Amoxicillin</td>
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<td>Cefdinir</td>
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<td>Cefixime</td>
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<td>Cefotaxime</td>
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<td>Penicillin G</td>
<td></td>
<td>Cefoxitin</td>
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</tbody>
</table>

*Agents not listed are either not approved for use in the United States (ceftizoxime, ceftibiprole) or do not share common side chains (e.g., piperacillin, ticarcillin, nafcillin, dicloxacillin).

*Aztreonam cross-reacts with ceftazidime and ceftiozane, with which it shares an identical side-chain.

*Identical R1 side chain

*Identical R2 side chain

Table 1. FDA-approved Beta-lactam Antibiotics with Similar Side Chains

![amoxicillin](image1)

![cephalexin](image2)

University of Wisconsin Health. 2016.
5.1. Cefazolin does not share a common side chain with any other beta-lactams

Table 1. FDA-approved Beta-lactam Antibiotics with Similar Side Chains

<table>
<thead>
<tr>
<th>Agent</th>
<th>Ampicillin</th>
<th>Amoxicillin</th>
<th>Cefaclor</th>
<th>Cefadroxil</th>
<th>Cefazolin</th>
<th>Ceftazidime</th>
<th>Cefixime</th>
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</table>

*Agents not listed are either not approved for use in the United States (ceftizoxime, cefibropile) or do not share common side chains (e.g., piperacillin, ticarcillin, nafcillin, dicloxacillin).

*Aztreonam cross-reacts with cefazidime and cefiolozone, with which it shares an identical side chain.

*Identical R1 side chain

*Identical R2 side chain
You can ask these questions
(or students, residents, doctors, nurses...)

- **What** age reaction occurred
- **When** reaction occurred in relation to taking the antibiotic
- **What** reaction looked like
- **Where** reaction occurred (localized v. whole body)
- **How** reaction was treated (did they need to seek urgent medical care?)
- Was the medication was ever **re-challenged**?
- Have they have tried **similar antibiotics**?
  - E.g. Augmentin, Amoxicillin, Keflex/Cephalexin
Don’t forget the most important part...

- **Educate the patient** why your questions are important
- **DOCUMENT your findings** – do not delete allergies from profiles
Don’t forget the most important part…

- **Educate the patient** why your questions are important

- **DOCUMENT your findings** – do not delete allergies from profiles
Don’t forget the most important part…

• **Educate the patient** why your questions are important

• **DOCUMENT your findings** – do not delete allergies from profiles

---

The person who completed this documentation is an amazing human.

ED pharmacists think this is cool too, I promise.
What if you CAN’T get a reliable patient history?

- Medication history (inpatient, outpatient records)
- Oral antibiotic challenge
- Test doses / Graded challenge
- Penicillin skin testing
- Desensitization
What if you CAN’T get a reliable patient history?

- Medication history (inpatient, outpatient records)
- Oral antibiotic challenge
- Test doses pathway
- Graded challenge order set
  - Penicillin skin testing
  - Desensitization
Oral antibiotic challenge

History of any benign, acute rash
Delayed-onset rash
Unknown history >12 months ago

250 mg oral amoxicillin + 1 hour observation

Reaction ≤ 12 months ago
History of shortness of breath
Anaphylaxis

PCN Skin Test

Oral challenge
Test dose: Harvard style

Figure 1. Penicillin Hypersensitivity Pathway.²⁻⁵

**Type II-IV HSR**
- Serum sickness
- Stevens-Johnson Syndrome
- Toxic Epidermal Necrolysis
- Acute Interstitial Nephrolysis
- Drug Rash Eosinophilia
- Systemic Symptoms (DRESS) Syndrome
- Hemolytic anemia
- Drug Fever

**Type I (IgE-mediated) HSR**
- Anaphylaxis
- Angioedema
- Wheezing
- Laryngeal edema
- Hypotension
- Hives/urticaria
- **Unknown reaction WITHOUT mucosal involvement, skin desquamation or organ involvement**

**Mild reaction**
- Minor rash (not hives)
- Maculopapular rash (mild Type IV HSR)
- Record lists allergy, but patient denies

Avoid using PCN or cephalosporin; use alternative agents by microbial coverage

If clinical indication for a PCN or cephalosporin, please involve the Infectious Disease service and Allergy/Immunology.

**OK to:**
- Use 3rd/4th/5th generation cephalosporins or carbapenems by Test Dose Procedure
  - OR
  - Use alternative agent by microbial coverage
  - OR
  - Aztreonam
  - OR
  - If a PCN or a 1st/2nd generation cephalosporin is preferred, penicillin skin testing is indicated, call/consult Allergy/Immunology.

**OK to:**
- Use full dose 3rd/4th/5th generation cephalosporin
  - OR
  - Use penicillin or 1st/2nd generation cephalosporin by Test Dose Procedure
  - OR
  - Use carbapenem

Graded Challenge Order Set

- Education / clinical decision support
- Link to guideline
- Nursing communication orders and monitoring parameters
- Oral and intravenous challenges
- Rescue medication orders

Intravenous Medications [200962]
- Ampicillin [200964]
  - ampicillin (OMNIPEN) intraVENOUS [800009]: 20 mg, Intravenous, ONCE For 1 Doses
  - ampicillin (OMNIPEN) intraVENOUS [800009]: 200 mg, Intravenous, ONCE Starting H+60 Minutes For 1 Doses
  - ampicillin (OMNIPEN) intraVENOUS [800009]: 2 g, Intravenous, ONCE Starting H+120 Minutes For 1 Doses
- Penicillin G SODIUM [200965]
  - penicillin G SODIUM intraVENOUS [300069]: 0.02 Million Units, Intravenous, ONCE For 1 Doses
  - penicillin G SODIUM intraVENOUS [300069]: 0.2 Million Units, Intravenous, ONCE Starting H+60 Minutes For 1 Doses
  - penicillin G SODIUM intraVENOUS [800009]: 2 Million Units, Intravenous, ONCE Starting H+120 Minutes For 1 Doses
- Oxacillin [200966]
  - oxacillin intraVENOUS [800065]: 20 mg, Intravenous, ONCE For 1 Doses
  - oxacillin intraVENOUS [800065]: 200 mg, Intravenous, ONCE Starting H+60 Minutes For 1 Doses
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Sometimes allergies are real

- Serum sickness
- Stevens-Johnson syndrome
- Toxic epidermal necrolysis
- Acute interstitial nephritis
- Drug rash eosinophilia systemic symptoms (DRESS) syndrome
- Hemolytic anemia
- Drug fever
- Anaphylaxis*
Patient Case 2

- 34 yo M, 120 kg
- PMH: unremarkable
- PCN allergy (rash)
- Home medications: creatine supplements
- Diagnosis:
  - Uncomplicated abscess
- Treatment:
  - I&D in ED
  - 1 gram vancomycin, discharge with cephalexin 500 QID + SMX/TMP 1 DS tab BID
The infection we love to hate

• Common infection, common challenge

• Questions we will address today...
  – Is combination therapy (cephalexin + TMP/SMX) necessary for abscess with cellulitis?
    – Do abscesses need antibiotics?
  – That gram of vanco...
    – Does anyone know what to do with oritavancin or dalbavancin yet?
- Patients receiving non-recommended antibiotics
  - 71% nonpurulent infections
  - 68% purulent infections
- Mild abscess treatment
  - 44% I&D
  - 88% antibiotics
- 29% patients with mild cellulitis had blood cultures drawn
- 21% patients with mild disease admitted
- 34% patients with severe disease discharged
What if I told you...

**TABLE 2 (Continued)**

| Organism (no. of isolates) and drug | MIC$_{50}$ (μg/ml) | MIC$_{90}$ (μg/ml) | MIC range (μg/ml) | % of isolates with breakpoint according to$^c$: | | 
| --- | --- | --- | --- | CLSI | EUCAST | 
| | | | | S | I | R | S | I | R | 
| Beta-hemolytic streptococci (1,493)$^{h}$ | | | | | | |
| Solithromycin | 0.015 | 0.03 | 0.004–0.5 | — | — | — | | |
| Telithromycin | 0.015 | 0.12 | 0.008–>32 | 75.2 | 0.4 | 24.4 | | |
| Azithromycin | 0.12 | >32 | 0.03–>32 | 84.9 | 1.1 | 14.0 | | |
| Clindamycin | ≤0.25 | >2 | ≤0.25–>2 | 100.0 | — | — | | |
| Penicillin | ≤0.06 | ≤0.06 | ≤0.06–0.12 | 100.0 | — | — | | |
| Amoxicillin-clavulanate | ≤1 | ≤1 | ≤1–2 | 100.0 | — | — | | |
| Ceftriaxone | ≤0.06 | 0.12 | ≤0.06–0.5 | 100.0 | — | — | | |
| Linezolid | 1 | 1 | ≤0.12–1 | 100.0 | — | — | | |
| Moxifloxacin | ≤0.12 | 0.25 | ≤0.12–4 | 100.0 | — | — | | |
| Tetracycline | ≤0.5 | >8 | ≤0.5–>8 | 53.5 | 1.7 | 44.8 | | |
| TMP-SMX | ≤0.5 | ≤0.5 | ≤0.5–>4 | 100.0 | — | — | | |
| Vancomycin | 0.25 | 0.5 | ≤0.12–1 | 100.0 | — | — | | |

$^g$ TMP-SMX, trimethoprim-sulfamethoxazole.

$^h$ Organisms include *Streptococcus pyogenes* (689 isolates), *Streptococcus agalactiae* (579), and *Streptococcus dysgalactiae* (225).
And what if I told you...

TABLE 2 (Continued)

<table>
<thead>
<tr>
<th>Organism (no. of isolates) and drug*</th>
<th>MIC&lt;sub&gt;50&lt;/sub&gt; (µg/ml)</th>
<th>MIC&lt;sub&gt;90&lt;/sub&gt; (µg/ml)</th>
<th>MIC range (µg/ml)</th>
<th>% of isolates with breakpoint according to&lt;sup&gt;c&lt;/sup&gt;:</th>
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</thead>
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<td>CLSI S I R</td>
<td>EUCAST S I R</td>
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<tr>
<td><strong>Beta-hemolytic streptococi (1,493)</strong></td>
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<tr>
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<td>Clindamycin</td>
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<td>&gt;2</td>
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<td>84.9 1.1 14.0</td>
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<tr>
<td>Penicillin</td>
<td>≤0.06</td>
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<td>100.0  —  —</td>
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* TMP-SMX, trimethoprim-sulfamethoxazole.

<sup>c</sup> Organisms include Streptococcus pyogenes (689 isolates), Streptococcus agalactiae (579), and Streptococcus dysgalactiae (225).
TOP 10 MYTHS REGARDING THE DIAGNOSIS AND TREATMENT OF CELLULITIS

Erin K. McCreary, PHARMD, BCPS,* Melissa E. Heim, PHARMD, BCCCP,† Lucas T. Schulz, PHARMD, BCPS (AQ-ID),* Robert Hoffman, MD,‡ Jeffrey Pothof, MD,§ and Barry Fox, MD||

2. For patients who warrant MRSA coverage but do not need intravenous antibiotics, TMP-SMX, doxycycline, or linezolid can be initiated. Providers should note that while studies have demonstrated the activity of TMP-SMX against β-hemolytic streptococci, overall the activity of TMP-SMX and doxycycline against β-hemolytic streptococci is largely unknown (8,47).

   a. If TMP-SMX or doxycycline is initiated, it is reasonable to consider combination therapy with a β-lactam antibiotic for the treatment of possible mixed MRSA/streptococcal infection (8).
Early studies did not control thymidine content of test media
   - ↑thymidine ↓sulfa inhibitory effect
• Nonpurulent cellulitis → β-lactam monotherapy
• Impetigo, purulent cellulitis, abscess, wound → TMP/SMX monotherapy
   - Talan 2016
     • 2 DS TMP/SMX PO BID x 7 days = 80% cure of drained abscess
   - Miller 2015
     • 2 SS TMP/SMX PO BID x 10 days = 76.4% cure (abscess, cellulitis, & mixed)
Speaking of that bad-looking abscess patient

- Oritavancin and dalbavancin FDA-approved in 2014
  - Dalbavancin updated to one-time dose in 2016

- ED administration to avoid hospital admission sounds dreamy...
### Table 1. Oritavancin Exclusion Criteria

1. Sepsis or Septic shock
2. ABSSSI including:
   - Orbital cellulitis
   - Diabetic foot infections
   - Burn related infection
   - Bite wound
   - Osteomyelitis
   - Necrotizing fasciitis
   - Catheter/device related infection
   - Environmental/polymicrobial source
3. Severe allergy to:
   - Oritavancin
   - Dalbavancin
   - Vancomycin
   - Daptomycin
   - Telavancin
4. CDU or inpatient admission planned
5. Age < 18 years old

### Table 2. Risk Factors for Oral Antibiotic Outpatient Treatment Failure

1. Psychosocial concern for adherence
2. Acquired Immunodeficiency Syndrome
3. Intravenous Drug User
4. Cognitively impaired
5. Chronic edema
6. Lymphedema
7. Chronic leg ulcers
8. Cirrhosis
9. Duration of infection greater than 7 days
10. History of ABSSSI at same site within last 3 months
11. Oral treatment failure (>24 hours of appropriate therapy)*
12. Incarcerated
13. Diabetes mellitus
14. Immunosuppression

*Expanding redness does not necessarily mean treatment failure
Physician diagnoses patient with ABSSSI

Oritavancin exclusion criteria? (Table 1)

Yes → Order intravenous antibiotics for ABSSSI

No → ≥1 risk factor(s) for oral outpatient ABX treatment failure? (Table 2)

Yes → Appropriate candidate for oritavancin

No → Can patient take oral medication?

Yes → Discharge from ED on oral antibiotics

No → Physician discusses ABSSSI treatment options with patient, including oritavancin

Appropriate candidate for oritavancin

Approval via 3333 pager is not required for oritavancin administered in the ED for ABSSSI. The 3333 pager is available from 0700-2200 daily if questions arise.
Order intravenous antibiotics for ABSSSI

Patient accepts treatment with oritavancin?

No

Yes

Physician orders oritavancin selecting “use is approved for restricted indication”

Pharmacist completes progress note to document no exclusion criteria & ≥1 risk factor

Administer oritavancin (Consider MPP room at UH)

Discharge with ABSSSI information sheet (includes return precautions and close outpatient follow-up)
1) Cellulitis, erysipelas, wound infection, and/or major cutaneous abscess of a minimum surface area of 75cm² with at least two of the following:
- Purulent drainage or discharge
- Erythema
- Fluctuance
- Heat or localized warmth
- Edema/induration
- Pain or tenderness to palpation

Including patients who present with any of the following signs of systemic inflammation:
- Elevated WBC > 12,000 cells/mm³
- Bandemia >10%
- Fever ≥ 38.0°C
- Swollen proximal lymph node

AND/OR

2) Documented failure / non-compliance of outpatient oral antibiotic therapy for ABSSSI

Patient presents to Emergency Department (ED)

Assess for criteria for use (Table 1) and absence of exclusion criteria

Contact Infectious Diseases to discuss patient and obtain approval code

Order oritavancin 1,200mg IV ONCE (single dose treatment)

Patient discharged from ED with instructions to
1) Present to ED should symptoms worsen or fail to improve within 3 days, and 2) Follow-up with PCP and/or ID in 3-7 days

<table>
<thead>
<tr>
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<tr>
<td>Septic shock, known or suspected bacteremia, diabetic wound infections, catheter-site infections, infections involving prosthetic device, suspected Gram negative pathogens including animal bites, concomitant infection at a secondary site, burns, end-stage renal disease, evolving or necrotizing process, infections caused by pathogens known to be vancomycin resistant, receiving chronic systemic immunosuppressive therapy, prednisone use &gt; 15 mg/day, CD4 &lt;200, neutropenia with ANC &lt;500, LFT &gt;/= 3 times the ULN, total bilirubin &gt;/= 2 times the ULN, hyperuricemia, requiring aPTT monitoring, allergy to vancomycin, pregnant/nursing</td>
</tr>
</tbody>
</table>

Table 1. Criteria for Use
Nothing is as good as it seems

- Who owns the process?
- Who is the perfect candidate?
- Insurance verification?
- Patient-provider discussions on cost of care
  - Our first patient requested admission...
- Infusion time
- Discharge instructions
- Monitoring/follow-up
- Resistance development?
Patient Case 3

• 21 yo F presents syncope

• No PMH, UPT (-), UA and culture sent
  — UA “positive”

• Discharge with cipro

• C/S returns after discharge
  — Amp >/= 32 (R)
  — Cipro </= 0.25 (S)
  — Nitrofurantoin</=16 (S)
  — TMP-SMX = 32 (I)
This is my 83 yo grandfather.

He was in a car crash.

UA done in routine trauma workup.

My father sends me this text a few hours later...
What’s the problem? It matches...

- Does this patient(s) have a UTI?
- Who is performing culture review?
  - Case manager
  - Pharmacist
  - Nurse
  - Etc...
- Are you calling on every culture?
- When is this occurring?
- Need MD collaboration to change therapy
Oh, “UTI”s

- **ASP-bundles**
  - Pre-implementation review of prescribing (people LOVE data)
  - Multidisciplinary work group (AS is a team sport)
  - Empiric treatment algorithm
    - Broad range of patients
    - Autonomy in decision-making
  - Education, audit, feedback (education alone is not sufficient)
  - ↑ nitrofurantoin use (associated w/ ↓ 30d return visit)
  - ↓ cephalosporin use
- **Pharmacist + MD culture-call back program**
  - ↓ 30d return ED visits and hospital readmissions
  - 25% patients had modified therapy
Culture follow-up isn’t just for UTIs!

• Culture follow up **with symptom assessment** for pharyngitis
  – ↓ antibiotic prescribing: 97% to 71.3% (p < 0.001)
  – ↑ appropriateness of therapy: 6% to 81.5% (p < 0.001)

• Discharge instructions **for symptom assessment** for URTIs
  – Nurse practitioner-driven initiative in primary care clinic
  – Prescribe full Rx with detailed instructions
    • Stopping / Disposing
    • Completing
    • Changing

Discharge Prescription Review?

- Majority of ABX use occurs **outside** the hospital

- Providers prescribed **269.4 million outpatient** ABX in 2015
  = 838 ABX Rx per 1000 persons

- ED MDs prescribed **14.8 million outpatient** ABX
  = 457 Rx per ED MD

- 3\(^{rd}\) highest rate of prescribing
  (1. Derm   2. PCPs)
“The antibiotic course has had its day”

• “Always complete the full prescription, even if you feel better”
  – Not supported by evidence
• Prolonged ABX exposure does increase risk of ABX resistance
• Taking any ABX for any reason disrupts normal flora \( \rightarrow \) bigger problem in peds?
• Should we be more concerned with underdosing or using the wrong regimen?

Shorter courses seem okay....
  – Pharyngitis (3 vs 10)
  – CAP (5 vs 10)
  – Cellulitis (5 vs 14)
  – Pyelonephritis (7 vs 14)
  – HAP/VAP (8 vs 15)
  – Intraabdominal infections (4 vs 7-14)

Llewelyn MJ, et al. The antibiotic course has had its day. BMJ. 2017.
A little thing that made a big difference

- 25 bed critical access hospital with ED + PCP clinics
- Viral respiratory illnesses
- Launched Wellness Bag initiative in January 2017
  - Cough drops
  - Tissues
  - Hand sanitizer
  - Choosing Wisely patient education flyer
- Decreased ABX prescribing by 84% (!!!!)
- “Extremely rewarding” to all healthcare team members

1. ED pharmacists can have a significant impact on antibiotic use by
   • Getting the right antibiotics, faster in patients with sepsis
   • Recommending cultures and RDT
   • Following up on cultures and RDT
   • Engaging in system-level committees for ASP efforts
   • Allergy assessment and medication history
   • Common infection treatment protocols
   • Culture call back
   • Discharge prescription review

2. Emergency Department engagement is essential for successful stewardship efforts across the continuum of care

3. Little things go a long way to make a huge difference
And we didn’t even touch on...

• Post-exposure prophylaxis
• Infection control efforts
• Antibiotic indications on orders
• Disease-state specific order sets for ED
• Guideline or clinical pathway development
• Community-acquired intraabdominal infections
• Outpatient fever & neutropenia protocols
• Pediatrics (mostly)
• And more....

Stewardship opportunities in the ED are endless!!!
Additional Resources for ED Stewardship

We want to hear from YOU

• What are you doing in your practice?
• What questions do you have for us?
• How can we overcome barriers together?
• Work to disseminate our successes (and failures!)
Pharmacists in the Emergency Department: The Heroes Antimicrobial Stewardship Needs

Meghan E. Groth, Pharm.D., BCPS
Jenny Koehl, Pharm.D., BCPS
Erin K. McCreary, Pharm.D., BCPS