Optimizing Antimicrobial Stewardship
Putting Strategies into Action

A CDI Action Network Webinar
March 28, 2012

Tina Schwien, MPH, MN
Quality Improvement Consultant

Qualis Health & You

HAI Action Networks

CAUTI  CDI  SSI
New Releases from CDC

Updated web pages

• CDC’s C. difficile page
  http://www.cdc.gov/HAI/organisms/cdiff/Cdiff_infect.html

• CDC Vital Signs fact sheet www.cdc.gov/vitalsigns/hai

• CDC Vital Signs Audio Podcast: Stop C. difficile infections
  http://www2.cdc.gov/podcasts/index.asp

• CDC Safe Healthcare Blog from MMWR lead author, Dr. Cliff
  McDonald http://blogs.cdc.gov/safehealthcare

6 Steps for CDI Prevention

1. **Prescribe and use antibiotics carefully**
2. Test for C. diff when patients have diarrhea while on antibiotics or within several months of taking them
3. **Isolate** C. diff patients immediately
4. **Wear** gloves and gowns when treating C. diff patients, even during short visits (Hand sanitizer does not kill C. difficile, and hand washing may not be sufficient)
5. **Clean** room surfaces with bleach or another EPA-approved, spore-killing disinfectant after a patient with a C. diff infection has been treated there
6. **Notify** the new facility if a patient has a C. diff infection when a patient transfers

Source: http://www.cdc.gov/Features/VitalSigns/HAI/
The Optimizing AMS Webinar Series

Purpose: Create opportunity to share implementation stories, ask questions, discuss ideas for localization, connect “Silos”

Agenda
- Introductions
- Featured Hospital
- Panel Reaction
- Discussion
Today’s Guests

- Harborview Medical Center
  - John Lynch, MD, MPH, Infectious Diseases Clinic, Employee Health Services, Infection Control, Antimicrobial Stewardship Program jbylynch@u.washington.edu

- Expert Panelists*
  - Mike Myint, MD, Infectious Disease, Infection Prevention and Employee Health, Virginia Mason Medical Center michael.myint@vmmc.org
  - Rupali Jain, PharmD, BCPS, Antimicrobial Stewardship/Infectious Diseases Pharmacist, UWMC rupali@uw.edu

*Member(s) of Antimicrobial Stewardship Committee of Seattle

Approach at Harborview Medical Center

Field Trip #3
Antimicrobial Stewardship

John Lynch MD MPH / jblynch@uw.edu

Stewardship

• “the conducting, supervising, or managing of something: especially: the careful and responsible management of something entrusted to one’s care”

• “The moral and ethical responsibility for caretaking on behalf of others”

Dr. John Pauk
What is the problem?

- Antibiotics are misused in hospitals
- Antibiotic misuse adversely impacts both patients and society
- Improving antibiotic use improves patient outcomes and saves money
- Improving antibiotic use is a public health imperative

CDC, 2008

Antimicrobial Stewardship

“Antimicrobial stewardship refers to the coordinated interventions designed to improve and measure the appropriate use of antimicrobial agents...The major objectives of antimicrobial stewardship are to achieve best clinical outcomes...while minimizing toxicity and other adverse events that drives the emergence of antimicrobial-resistant strains. Antimicrobial stewardship may also reduce excessive costs attributable to suboptimal antimicrobial use.”

N Fishman, ICHE, April 2012
Harborview Medical Center

- 413 bed county hospital
- Major teaching hospital for UW
- Level 1 trauma/burn center for WWAMI
- Beds: 61 psych, 29 rehab, 89 ICU
- >60,000 ER visits/year
- $187 million in charity in 2010

Antimicrobial Stewardship

- New Drugs and Vaccines
- Improved Diagnostics
- Education
- Benchmarks
- Reduced Resistance Reservoirs
- Infection Control

Adapted from Fishman, Am J Med, 2006

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Antimicrobial Stewardship

Where we were...

- 2000 = no program
- 2001 AS introduced as Process Improvement project
- Lots of linezolid and imipenem use, CA-MRSA explosion
- 2003 - one ID physician and one ID pharmacist approved
  - Daily review of cases collected by ID pharmacist
  - No restrictions on antibiotic use
  - Tracking of total antibiotic costs, days of hospitalization, PICC lines* used, savings vs FTE
  - IV to PO conversions
  - Joint UWMC, SCCA, HMC P&T Committee
  - Development of VAP guidelines
  - 2 years of monthly meetings to review finances

HMC AS Program Origin

1. Educational programs
2. Restricted antimicrobial formularies
3. Prior approval programs
4. Streamlining programs
5. Antibiotic cycling
6. Comprehensive and computer-assisted programs
**Infectious Diseases Society of America and the Society for Healthcare Epidemiology of America Guidelines for Developing an Institutional Program to Enhance Antimicrobial Stewardship**

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**HMC AS Program in Evolution**

**Integration with Infection Control/QI**

- Decision support software (TheraDoc and Amalga)
- Use of surveillance data to focus efforts and for feedback to clinicians
- Quality improvement and patient safety effort
- Surgical Care Improvement Program (SCIP)

**Frontlines**

- Stewardship program relies on 2 channels:
  - Clinician-to-Clinician
  - Pharmacist-to-Pharmacist
- Guideline and order set review
- CPOE
- Service-oriented resource for any antibiotic questions
**HMC AS Program Structure**

- UW P&T Committee
- Infection Control Committee
- ID Clinic and OPAT Program
- HMC Antimicrobial Stewardship Team
- Care Pathways and Protocols
- CPOE
- SCIP
- Teaching
- Antibiotic Resource

**UWMC AS TEAM**

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**HMC AS Program Today**

- Review of cases reported clinical pharmacists
  - bug-drug mismatches
  - potential de-escalation interventions
  - overlapping antibiotic coverage
  - dosing
  - IV-to-PO conversion
- Review of surveillance alerts
- Discussion of complex interventions and challenges to intervention addressed as a team
- Review of VAP pathogens
- Collection of antibiotic costs
- Guidelines, clinical pathways, CPOE review

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UW P&T Committee- ID Subcommittee

**Stakeholders:** clinicians and pharmacists across UW Medicine involved in antibiotic prescribing

Decisions driven by cost-effectiveness, available clinical data and with the goal of practicing evidence based medicine as a program

Ex.
- Ceftaroline (*Teflaro*®)
- Fidaxomicin (*Dificid*®)

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UW P&T Committee- Class Reviews

**Echinocandin class review**
- Caspofungin and micafungin have similar spectrums of activity
- Caspofungin: more drug interactions and more expensive
- 2007: caspofungin replaced with micafungin
- 2008: $428,000 in savings

**Carbapenem class review**
- Imipenem and meropenem have similar spectrums
- Imipenem remained more expensive than meropenem
- 2010: Removed imipenem from formulary
- Projected savings over the next year: >$70,000*

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**UW P&T Committee- Dosing**

**Piperacillin/Tazobactam prolonged infusion**
- Usual dosing is over 30 minutes every 6 hours
- Studies of prolonged infusion – same dose over 4 hours every 8 hours – support similar outcomes in critically ill patients
- Cuts daily drug amount by 25%
- Challenges: need a line for infusion 12 hours of the day so RN education and buy-in is critical
- 2011: projected annual savings >$30,000

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**Education and Orders**

**Ventilator Associated Pneumonia**
- Serious complication of mechanical ventilation
- One of the most common ICU HAIs
- Increased LOS and mortality
- Commonly involves MDROs: MRSA, carbapenem-resistant Acinetobacter, MDR Pseudomonas

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### VAP Pathogens 2003

<table>
<thead>
<tr>
<th>Microorganism</th>
<th>Early Onset (N=30)</th>
<th>Late Onset (N=138)</th>
</tr>
</thead>
<tbody>
<tr>
<td>MSSA</td>
<td>8 (27%)</td>
<td>21 (15%)</td>
</tr>
<tr>
<td>Haemophilus</td>
<td>8 (27%)</td>
<td>20 (14%)</td>
</tr>
<tr>
<td>Strep pneumoniae</td>
<td>6 (20%)</td>
<td>1 (0.7%)</td>
</tr>
<tr>
<td>Alpha heme strep</td>
<td>5 (17%)</td>
<td>20 (14%)</td>
</tr>
<tr>
<td>MRSA</td>
<td>3 (10%)</td>
<td>32 (23%)</td>
</tr>
<tr>
<td>Acinetobacter</td>
<td>3 (10%)</td>
<td>44 (32%)</td>
</tr>
<tr>
<td>Enterobacter</td>
<td>2 (7%)</td>
<td>4 (3%)</td>
</tr>
<tr>
<td>Pseudomonas</td>
<td>0 (0%)</td>
<td>13 (9%)</td>
</tr>
</tbody>
</table>

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**Earl VAP**

- Ampicillin/sulbactam, ceftriaxone, ertapenem, or moxifloxacin (PCN allergy)

**Late VAP**

- Imipenem or meropenem + vancomycin +/− aminoglycoside or ciprofloxacin

If initial CPIS ≤ 6 without bronchoscopy, re-evaluate at day 3 and discontinue antimicrobials if CPIS ≤ 6

- De-escalation based on quantitative culture
- Consider linezolid for documented MRSA pneumonia
- Standard duration of therapy 8 days except for *Pseudomonas*
VAP Prevention 2004-2010

Early VAP - No Change

<table>
<thead>
<tr>
<th>Pathogens</th>
<th>July 03 – June 04 N=30 (%)</th>
<th>July 08 – June 10 N=72 (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>MSSA</td>
<td>8 (27)</td>
<td>21 (29)</td>
</tr>
<tr>
<td>Haemophilus spp.</td>
<td>8 (27)</td>
<td>16 (22)</td>
</tr>
<tr>
<td>Strep pneumoniae</td>
<td>6 (20)</td>
<td>13 (18)</td>
</tr>
<tr>
<td>Alpha heme strep</td>
<td>5 (17)</td>
<td>16 (22)</td>
</tr>
<tr>
<td>MRSA</td>
<td>3 (10)</td>
<td>5 (7)</td>
</tr>
<tr>
<td>Acinetobacter</td>
<td>3 (10)</td>
<td>1 (1)</td>
</tr>
<tr>
<td>Enterobacter</td>
<td>2 (7)</td>
<td>5 (7)</td>
</tr>
<tr>
<td>Pseudomonas</td>
<td>0 (0)</td>
<td>1 (1)</td>
</tr>
</tbody>
</table>
Late VAP- Yes Change

<table>
<thead>
<tr>
<th>Pathogens</th>
<th>July 03 – June 04 (N=138)</th>
<th>July 08 – June 09 (N=114)</th>
<th>July 09 – June 10 (N=83)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acinetobacter</td>
<td>44 (32%)</td>
<td>4 (4%) ↓</td>
<td>4 (5%) ↓</td>
</tr>
<tr>
<td>MRSA</td>
<td>32 (23%)</td>
<td>8 (7%) ↓</td>
<td>2 (2%) ↓</td>
</tr>
<tr>
<td>MSSA</td>
<td>21 (15%)</td>
<td>30 (26%) ↑</td>
<td>23 (28%) ↑</td>
</tr>
<tr>
<td>Haemophilus</td>
<td>20 (14%)</td>
<td>24 (21%)</td>
<td>13 (16%)</td>
</tr>
<tr>
<td>Pseudomonas</td>
<td>13 (9%)</td>
<td>14 (12%) ↑</td>
<td>15 (18%) ↑</td>
</tr>
<tr>
<td>Enterobacter</td>
<td>4 (3%)</td>
<td>12 (11%)</td>
<td>4 (5%)</td>
</tr>
<tr>
<td>Klebsiella spp.</td>
<td>7 (5%)</td>
<td>7 (6%)</td>
<td>5 (6%)</td>
</tr>
<tr>
<td>Serratia spp.</td>
<td>5 (3%)</td>
<td>7 (6%)</td>
<td>1 (1%)</td>
</tr>
<tr>
<td>E. coli</td>
<td>8 (4%)</td>
<td>6 (5%)</td>
<td>1 (1%)</td>
</tr>
</tbody>
</table>

How to Decrease Empiric Vancomycin Use?

**Active Surveillance Cultures (ASC)**
- Organisms: **MRSA**, VRE, Acinetobacter
- All ICU patients
- On ICU admit and q 7 days
- ET, nasal, wound
- +ASC = cohort, contact precautions
Can we use this information clinically?

<table>
<thead>
<tr>
<th></th>
<th>MRSA VAP</th>
<th>Other VAP</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>MRSA ASC Positive</td>
<td>12</td>
<td>21</td>
<td>33</td>
</tr>
<tr>
<td>PPV</td>
<td></td>
<td></td>
<td>36%</td>
</tr>
<tr>
<td>MRSA ASC Negative</td>
<td>3</td>
<td>221</td>
<td>334</td>
</tr>
<tr>
<td>NPV</td>
<td></td>
<td></td>
<td>99%</td>
</tr>
<tr>
<td>Total</td>
<td>15</td>
<td>242</td>
<td>257</td>
</tr>
</tbody>
</table>

Sensitivity = 80%
Specificity = 91%

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Can we decrease empiric carbapenem use?

Pseudomonas Drug Susceptibility

<table>
<thead>
<tr>
<th>Drug</th>
<th>July 08 – June 09 (N=14) (%)</th>
<th>July 09 – June 10 (N=16) (%)</th>
<th>Total (N=30) (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Amikacin</td>
<td>14 (100)</td>
<td>16 (100)</td>
<td>30 (100)</td>
</tr>
<tr>
<td>Ciprofloxacin</td>
<td>11 (79)</td>
<td>15 (94)</td>
<td>26 (87)</td>
</tr>
<tr>
<td>Ceftazidime</td>
<td>12 (86)</td>
<td>15 (94)</td>
<td>27 (90)</td>
</tr>
<tr>
<td>Ceftazidime</td>
<td>13 (93)</td>
<td>15 (94)</td>
<td>28 (93)</td>
</tr>
<tr>
<td>Gentamicin</td>
<td>13 (93)</td>
<td>13 (81)</td>
<td>26 (87)</td>
</tr>
<tr>
<td>Imipenem</td>
<td>12 (86)</td>
<td>10 (63)</td>
<td>22 (73)</td>
</tr>
<tr>
<td>Meropenem</td>
<td>12 (86)</td>
<td>13 (81)</td>
<td>25 (83)</td>
</tr>
<tr>
<td>Pip/taze</td>
<td>13 (93)</td>
<td>14 (88)</td>
<td>27 (90)</td>
</tr>
<tr>
<td>Timentin</td>
<td>11 (79)</td>
<td>12 (75)</td>
<td>23 (77)</td>
</tr>
<tr>
<td>Tobramycin</td>
<td>13 (93)</td>
<td>15 (94)</td>
<td>28 (93)</td>
</tr>
</tbody>
</table>

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Ventilator Associated Pneumonia Orders

**EMPIRIC ANTIBIOTIC INITIATION - DAY 0**

**Allergies:**
- [ ] Ventilated and radiographic evidence of pneumonia (Diagnostic Worksheet on back)
- [ ] Clinical evidence of pneumonia (fever, ET secretions, leukocytosis)
- [ ] Bronchoscopy

**EARLY VAP - Low MRD risk patient** AND ≤ 4 days in the hospital
- [ ] Ceftriaxone 1 gram IV Q12h
- [ ] Amoxicillin/clavulanate 2 gram IV every 8hrs
- [ ] Monobactam 400mg IV Q6h

If MRSA Surveillance Swab is Positive OR Unknown Surveillance Status OR Clinically Unstable, ADD:
- Vancomycin loading dose ≥ 2 g or 15 mg/kg (IV Q12h, 1000mg) based on total body weight
- Vancomycin maintenance dose 10-17 mg/kg (IV Q12h) and vancomycin trough before 4th dose (goal trough of 15-20 mcg/mL)

**LATE VAP - High MRD risk patient** OR ≥ 5 days
- [ ] Cefepime 2 gram IV every 8hrs
- [ ] Meropenem 1 gram IV every 6hrs if known Acinetobacter or other highly drug resistant organism colonization/infection

If MRSA Surveillance Swab is Positive OR Unknown Surveillance Status OR Clinically Unstable, ADD:
- Vancomycin loading dose ≥ 2 g or 15 mg/kg (IV Q12h, 1000mg) based on total body weight
- Vancomycin maintenance dose 10-17 mg/kg (IV Q12h) and vancomycin trough before 4th dose (goal trough of 15-20 mcg/mL)
VAP Order Set

- Multidisciplinary approach
- Implementation
- Replace imipenem with cefepime
- Markedly decrease empiric vancomycin use based on ASC
- Projected annual cost savings of $131,000 based only on appropriate use of these 2 drugs
Information Technology

HMC Antimicrobial Stewardship works as part of the Infection Control Team which includes an IT specialist.

We are currently working with 2 systems that can provide similar information:

- **Microsoft Amalga**
  - Easily customizable by IT
  - Simple interface
  - Does not record interventions
  - Does not link to other patient information
- **TheraDoc**
  - Customization is more complex (shared resource)
  - Records interventions
  - Has the potential to capture cost savings
  - Links to other patient information

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Metrics

- Antibiotic cost and dose per patient per day
- Overall antibiotic costs and cost per drug
- Trialing types of interventions and acceptance via TheraDoc
- *Clostridium difficile* study with IC
- SCIP fall outs
- Moving to days of therapy
Benchmarks

<table>
<thead>
<tr>
<th>Antimicrobial</th>
<th>Ceftriaxone</th>
<th>Meropenem</th>
<th>Piperacillin</th>
<th>Piperacillin/tazobactam</th>
<th>Ticarcillin</th>
<th>Cefepime</th>
<th>Imipenem</th>
<th>Metronidazole</th>
<th>Pefloxacin</th>
<th>Piperacillin/tazobactam</th>
<th>Total Adult Antibacterial Use (EFOX/1000PSS)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>HMC</strong></td>
<td>86.2</td>
<td>19.1</td>
<td>1.9</td>
<td>21.5</td>
<td>40.5</td>
<td>16.1</td>
<td>34.5</td>
<td>74.8</td>
<td>10.5</td>
<td>32.9</td>
<td>290,000</td>
</tr>
</tbody>
</table>
| **University Hospital Consortium antibiotic use data (2011)**

Administrative claim data reported to UHC from 115 academic medical center hospitals and 250 affiliated hospitals

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HMC Pharmacy Costs:
Overall vs. Antimicrobials

Confidential QI Information

<table>
<thead>
<tr>
<th>Year</th>
<th>Antimicrobial Cost per pt-day</th>
<th>Pharmacy Cost per pt-day</th>
</tr>
</thead>
<tbody>
<tr>
<td>FY03</td>
<td>$15,400</td>
<td>$48,750</td>
</tr>
<tr>
<td>FY04</td>
<td>$17,950</td>
<td>$50,000</td>
</tr>
<tr>
<td>FY05</td>
<td>$15,150</td>
<td>$48,750</td>
</tr>
<tr>
<td>FY06</td>
<td>$16,390</td>
<td>$51,700</td>
</tr>
<tr>
<td>FY07</td>
<td>$15,670</td>
<td>$51,700</td>
</tr>
<tr>
<td>FY08</td>
<td>$17,710</td>
<td>$55,710</td>
</tr>
<tr>
<td>FY09</td>
<td>$19,600</td>
<td>$58,710</td>
</tr>
<tr>
<td>FY10</td>
<td>$21,900</td>
<td>$60,710</td>
</tr>
<tr>
<td>FY11</td>
<td>$20,100</td>
<td>$58,710</td>
</tr>
<tr>
<td>FY12</td>
<td>$17,710</td>
<td>$55,710</td>
</tr>
</tbody>
</table>

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3/26/2012
More information....

Special edition of *Infection Control and Hospital Epidemiology* on Antimicrobial Stewardship, April 2012

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Thanks to...

Jeannie Chan, PharmD, MPH  
Tim Dellit, MD  
Rupali Jain, PharmD  
Paul Pottinger, MD

CDC “Get Smart for Healthcare”

The Antimicrobial Stewardship Consortium of Seattle

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Reaction from Our Panel/Discussion

- What excited you?
- What could you adapt/adopt?
- What barriers exist for you?
- What have you also tried?

Suggested Homework

Discuss **Evaluation Metrics** on your current state summary:

- What metric gives you the most leverage with senior leadership?
- How do you report these metrics? To whom? How often?
- Identify at least 1 refinement to test (PDSA) prior to next webinar

**Due Date:** by next webinar, 4/25
Next Up in the Series

- Swedish
  - Jan 25
- YVMH
  - Feb 22
- Harborview
  - Mar 28
- St. Mary
  - Apr 25

Thank You

Please complete survey as you exit the webinar!

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For more information: www.QualisHealthMedicare.org

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