JACKPOT! Integration of Information Technology and Antimicrobial Stewardship

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Disclosure

- The program chair and presenters for this continuing education activity have reported no relevant financial relationships.
...You want me to add on Antimicrobial Stewardship to my to-do list?
Describe the institution where you primarily practice

A. Large academic medical center (≥600 beds)
B. Medium-sized academic medical center (400-600 beds)
C. Community hospital, part of a health-system (200-400 beds)
D. Community hospital, not part of a health-system (200-400 beds)
E. Community hospital with ≤200 beds
F. Specialty Hospital
G. Government-based facility (i.e., Veterans Affairs)
Who is part of ASP at your institution?

A. Infectious diseases-trained pharmacist only
B. Infectious diseases physician only
C. Infectious diseases physician and pharmacist
D. Non-infectious diseases trained pharmacist only
E. Non-infectious diseases trained physician only
F. Non-infectious diseases trained physician and pharmacist
G. Other
H. We do not have an ASP at this time
Learning Objectives

- Explain the importance of information technology in antimicrobial stewardship programs
- Evaluate three ways to integrate information technology into antimicrobial stewardship programs
- Describe methods of measuring antimicrobial outcomes using information technology
Antibiotic Resistance: An Ongoing Threat

- World Health Organization: 1 of 3 greatest threats to human health
- Centers for Disease Control and Prevention (2013):
  - >2 million illnesses, >23,000 deaths due to drug resistant bacteria


Antibiotic Resistance: An Ongoing Threat

- “There may be a danger, though, in underdosage. It is not difficult to make microbes resistant to penicillin in the laboratory...” – Sir Alexander Fleming, Nobel Lecture, 1945

- Today: Drug resistance + limited pipeline of antibiotics = POST-ANTIBIOTIC ERA

UNLESS, we do something about it...
Antimicrobial Stewardship Programs

- ~50% of prescribed antibiotics = unnecessary or inappropriate
- ASPs improve antibiotic use
  - ↑ patient outcomes, ↓ unintended consequences
- Cost savings of $200,000 - $900,000 at larger hospitals

Antimicrobial Stewardship Programs

- Need for ASPs recognized nationally
  - National Action Plan for Combating Antibiotic Resistant Bacteria
  - Centers for Disease Control and Prevention
  - Joint Commission medication management standard
  - Centers for Medicare and Medicaid Services proposed conditions of participation
What are key components that make up an Antimicrobial Stewardship Program?
Antimicrobial Stewardship Programs

- Preauthorization or prospective audit with feedback intervention
- Antimicrobial restrictions
- Institutional guidelines
- Order sets
- Pharmacokinetic services
- Intravenous to oral conversions
- Allergy reconciliation
- Therapy duration limitation
- Antibiogram development
- Microbiology reporting optimization

Who are the core members that make up Antimicrobial Stewardship Program teams?
Antimicrobial Stewardship

Pharmacists

Microbiology

Information Technology

Quality, Formulary, and Policy Committees

Infection Control

ID physicians

“For ASPs to be optimized fully and truly make a viable long-term impact on patient outcomes, information technology (IT) must be employed.”
Information Technology

- Health Information Technology for Economic and Clinical Health (HITECH) Act of 2009
  - Financial incentives to qualified institutions
- Institute of Medicine has identified electronic medical record functions needed to improve patient care
What information technology does your Antimicrobial Stewardship Program have to support initiatives and goals?

A. Electronic Medical Records
B. Clinical Decision Support Systems
C. Rapid Microbiologic Tests
D. More than one form of technology
E. None at this time
Information Technology in ASPs

Electronic Medical Records

ASP GOALS

Rapid Microbiologic Tests

Clinical Decision Support Systems
Electronic Medical Records (EMR)
Does your institution have an EMR?

A. Yes
B. No
Which EMR System Does Your Facility Use?

A. Cerner®
B. Epic®
C. All Scripts™
D. CPRS®
E. Other
F. We are still using paper charts
Importance of EMR

- Promote appropriate antimicrobial use
- Efficient review of all patient data
  - Helps provide greater impact on inappropriate use
- Facilitates promotion of patient care
- Limited data on clinical outcomes and antimicrobial use with EMR alone
  - Coupled with CDSS ➔ improved clinical care and patient outcomes

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

- Through the use of EMRs, ASP can aid in:
  - Prospective audit and feedback
  - Antibiotic preauthorization/formulary restrictions
  - Guidelines and clinical pathways
  - De-escalation of therapy

*p <0.05 from previous year

HITECH Act Implemented
ASP Activities in EMRs

- Antibiotic order forms

- Dosing alerts

ASP Activities in EMRs

- Pharmacokinetic dosing
- Care pathways
- Order sets
- IV-to-PO interchange
- Best practice alerts
- Progress notes
- iVents* 

*specific to Epic®

Dellit TH et al. *Clin Infect Dis* 2007;44:159-77
EMR is Just the Beginning...

- EMR primary focus is clinical, patient care functions (ex: EPIC®)
  - Limited decision support functions
    - Medication safety, patient/medication list, etc.
- Additional clinical decision support software (CDSS) can improve ASP functionality
- Major barrier to CDSS implementation => $$$

Open Discussion

- What ASP efforts have you implemented within your EMR?
- Name barriers to building ASP-related EMR initiatives. How did you successfully overcome these barriers?
ADD-ON CLINICAL DECISION SUPPORT SYSTEMS (CDSS)
CDSS in ASP

- Patient data + population statistics + clinical guidance
- CDSS embedded in EMRs
  - Limited capabilities
- Add-on CDSS
  - “Software as a service” programs
  - Data collected from multiple sources
    - Pharmacy, microbiology
  - Robust case-finding and logic capabilities

CDSS in ASP

- Automated, near real-time surveillance, alerting, analysis, reporting
- Integrates electronic and medical administration records
- Identify opportunities to decrease risk of adverse drug events, de-escalate, and optimize therapy

Logical, actionable alert
IDSA guidelines

- "We suggest incorporation of computerized clinical decision support at the time of prescribing into ASPs" (weak recommendation, moderate-quality evidence)

- CDSS can streamline work of ASPs, identifying opportunities for interventions
Capabilities of CDSS

- EMR integration
  - Clinical information
- Treatment guidelines
- Infection control software
- Institutional antibiograms
- Prescriber metrics
- Real-time, customizable alerts
## Third-Party CDSS Vendors

<table>
<thead>
<tr>
<th>Vendor/Features</th>
<th>TheraDoc®</th>
<th>SafetySurveillor®</th>
<th>QC PathFinder®</th>
<th>Sentri7®</th>
<th>MedMined®</th>
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<tr>
<td>EMR integration</td>
<td>✓</td>
<td></td>
<td></td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Real-time alerts</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Delayed alerts</td>
<td></td>
<td></td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Customizable alerts</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Clinical information</td>
<td>✓</td>
<td></td>
<td></td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Infection control</td>
<td>✓</td>
<td></td>
<td></td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Unit antibiogram</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Prescriber metrics</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other features</td>
<td>Antibiotic assistant, pager/email alerts</td>
<td>Training modules, cost justification letters</td>
<td>Pager/email alerts, pre-programmed customizable alerts</td>
<td>User-specific reports</td>
<td>E-mail alerts, clinical experts support team</td>
</tr>
</tbody>
</table>

Benefits of CDSS

Reductions in:
- Broad spectrum antibiotics
- Antibiotic resistance
- Prescribing errors
- Adverse events
- Mortality
- Antibiotic costs

Improvements in:
- Antibiotic dosing
- Appropriate antibiotic selection
- Efficiency of ASP initiatives

CDSS in ASP

- Nebraska Medical Center
- Post-implementation:

  - Influenza vaccination
  - Pneumococcal vaccination
  - Polyantimicrobials (3+ antibacterials)
  - Redundant anaerobic coverage
  - Drug-bug mismatch
  - Vancomycin for CoNS
  - Vancomycin for MSSA
  - No positive cultures

- 10,545 alerts, 30% of alerts actionable
- Increase in intervention attempts
  - 88% intervention acceptance rate

CDSS in ASP

- Good Shepherd Medical Center, Texas
- Alerts sent via pager, e-mail

- IV to PO conversion
- ADR alert
- Targeted drugs (i.e., piperacillin-tazobactam, daptomycin)
- TAM: Susceptibility known, inpatient
- TAM: No positive bacterial cultures
- TAM: No positive fungal cultures
- Renal function alert
- Antibiotic level
- Targeted organisms (*Pseudomonas*, quinolone-resistant; *Staphylococcus aureus*, resistant; *Enterococcus*, vancomycin resistant)

- Interventions documented within system
- Antibiogram development

CDSS in ASP

- Good Shepherd Medical Center, Texas
- 99% intervention acceptance rate
  - Increased from 1986 per month to 4065 per month
- Intervention cost calculator model:
  - Cost savings increased by 96% to $249,959/month

5 “Rights” of CDSS

- CDSS is not meant to replace clinical judgement, but to assist
  
  RIGHT information
  RIGHT people
  RIGHT channels
  RIGHT intervention formats
  RIGHT points in workflow
Building Alerts

- Pre-built alerts vs. custom-built alerts
- Base alerts on institutional needs, available resources
  - Flexibility of ASP and alerts is key
- Alerts with high actionable intervention potential (pilot phase)
- Supportive of CDC, IDSA guidelines, and recommendations
Preauthorization: Does your institution restrict or regularly monitor use of antibiotics?

A. YES, all antimicrobials are restricted, none are monitored
B. YES, some antimicrobials are restricted, others are monitored
C. YES, no restricted antimicrobials, some are monitored
D. NO, we do not currently have antimicrobials restricted or monitored for use at our institution
Preauthorization: How do you ensure that restrictions are enforced and followed?

A. Daily antibiotic report print out/review
B. Customized Clinical Decision Support System alert
C. We currently do not track process compliance for restricted antimicrobials
Preauthorization

- CDSS with customizable **real-time** alerts when restricted or monitored antimicrobial ordered
  - Allows for active discussion by ASP member
    - Approval by ASP member was more effective than off-hour approval by ID fellows in:
      - Recommendation appropriateness
      - Cure rate
- Pertinent patient-related information found in CDSS summary

Prospective Audit and Feedback (PAF)

- Pre-built alerts
  - De-escalation of therapy after pre-specified duration
  - Reported (+)-cultures without antibiotics prescribed
  - Redundant antimicrobials (i.e., dual anti-anaerobic coverage)

- Customizable alerts
  - Microbe-drug mismatch
  - Specific de-escalation opportunities
  - Multi-drug resistant organisms on inappropriate therapy
  - Optimizing therapy (escalation of therapy)
Open Discussion

1) What de-escalation specific alerts have you built at your institution?

2) What other alerts have you built that would allow for PAF?

3) Name barriers you have encounter in using CDSS at your institution for ASP efforts. How did you successfully overcome these barriers?
Rapid Microbiologic Tests
Does Your Hospital Have Rapid Microbiologic Tests?

A. Yes
B. No
Which Rapid Microbiologic Tests Does Your Hospital Use?

A. Verigene®
B. Gene Xpert®
C. MALDI-TOF
D. PNA-FISH® or QuickFISH™
E. FilmArray®
F. Light Cycler®
G. T2 Candida®
H. My hospital uses >1 of these tests
I. None at this time
<table>
<thead>
<tr>
<th>Rapid Test</th>
<th>Pathogens Detected</th>
<th>Resistance Marker</th>
<th>Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>Verigene®</td>
<td><em>S. aureus</em>, CoNS, <em>Streptococcus</em> spp., <em>Enterococcus</em> spp. (including VRE)</td>
<td><em>mecA, Van A, Van B</em></td>
<td>2 – 2.5 hr</td>
</tr>
<tr>
<td></td>
<td>Enterobacteriaceae, <em>P. aeruginosa</em>, <em>Acinetobacter</em> spp., <em>Listeria</em> spp.</td>
<td><em>KPC, NDM, CTX-M, VIM, IMP, OXA</em></td>
<td></td>
</tr>
<tr>
<td>Gene Xpert®</td>
<td><em>S. aureus</em></td>
<td><em>mecA</em></td>
<td>&lt;1 hr</td>
</tr>
<tr>
<td>MALDI-TOF</td>
<td>Gram (+), Gram (-), yeast, fungi, mycobacteria</td>
<td>Under development</td>
<td>10-30 min</td>
</tr>
</tbody>
</table>
## Rapid Microbiologic Tests for Identification of Bloodstream Pathogens

<table>
<thead>
<tr>
<th>Rapid Test</th>
<th>Pathogens Detected</th>
<th>Resistance Marker</th>
<th>Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>PNA FISH®</td>
<td><em>S. aureus</em>, CoNS, <em>Enterococcus</em> spp., <em>E. coli</em>, <em>K. pneumoniae</em>, <em>P. aeruginosa</em>, <em>Candida</em> spp.</td>
<td>No</td>
<td>1.5-3 hr</td>
</tr>
<tr>
<td>QUICKFISH™</td>
<td><em>S. aureus</em>, CoNS, <em>Enterococcus</em> spp., <em>E. coli</em>, <em>K. pneumoniae</em>, <em>P. aeruginosa</em></td>
<td>No</td>
<td>&lt;30 min</td>
</tr>
<tr>
<td>FilmArray®</td>
<td><em>S. aureus</em> and CoNS, <em>Streptococcus</em> spp., <em>Enterococcus</em> spp., <em>P. aeruginosa</em>, Enterobacteriaceae, <em>A. baumannii</em>, <em>Candida</em> spp.</td>
<td><em>mecA</em>, <em>Van A</em>, <em>Van B</em></td>
<td>1 hr</td>
</tr>
<tr>
<td>Light Cycler®</td>
<td><em>S. aureus</em>, CoNS, <em>Streptococcus</em> spp., <em>Enterococcus</em> spp., Enterobacteriaceae, <em>S. maltophilia</em>, <em>Candida</em> spp.</td>
<td>No</td>
<td>6 hr</td>
</tr>
</tbody>
</table>
Impact of RMTs + ASPs

- Pre/post quasi-experimental
  - MALDI-TOF vs. historical control
  - ~500 pts with bacteremia/candidemia
- Real time notification of all (+) blood cultures + ASP
- Time to organism identification
  - 84.0 vs. 55.9 hrs, p <0.001
- Time to effective antibiotics
  - 30.1 vs. 20.4 hrs, p =0.02
- Time to optimal antibiotics
  - 90.3 vs. 47.3 hrs, p <0.001


All-cause 30-day mortality
20.3% vs. 14.5%
Impact of Rapid Microbiologic Tests + ASP: Cost Savings

- Pre/post comparative study
  - Rapid PCR MRSA/SA
  - 156 bacteremic patients
- Real time notification of all (+) blood cultures + ASP

Open Discussion

1) In what capacity is pharmacy/ASP involved in results from rapid microbiologic tests at your institution?

2) Are the services 24 hrs vs. business hours?

3) What is the process?

4) What barriers have you encountered in involving pharmacy/ASP in the process related to results from rapid microbiologic tests?
Measuring ASP-Related Outcomes
The Why

- Measurement allows comparison, highlighting differences in approach to reveal opportunities for improvement.

- “It is widely believed that you cannot manage what you cannot measure. It is also true that you cannot measure what you cannot define.”
  - Richard Platt, MD, MSc

Open Discussion

1) What ASP-related metrics are used at your institution?

2) How is this data obtained?

3) Who is responsible for obtaining, analyzing and reporting this data?

4) How and where do you document ASP-related interventions?
Sources of Data

- Purchased
  - Easy to obtain, but least accurate
- Dispensed
  - More accurate than purchased but can still overestimate usage
- Administered
  - Most accurate, best achieved with electronic medical records
Definitions

- Defined daily dose (DDD)
- Days of therapy (DOT)
- Length of therapy (LOT)
- Standardized antimicrobial administration ratio (SSAR)

Simply a numerator (DOT, DDD, LOT) & a denominator (patient days, admissions, days present)
Defined Daily Dose (DDD)

- The assumed average maintenance dose per day for a drug used for its main indication in adults
  - **WHO standards**

**Pros**
- Relatively easy to calculate

**Cons**
- May underestimate antibiotic exposure
- Not applicable in pediatrics
- Number of days of therapy may be inaccurate at times

<table>
<thead>
<tr>
<th>Drug</th>
<th>Day 1</th>
<th>Day 2</th>
<th>Day 3</th>
<th>This patient</th>
<th>Use/WHO standard</th>
</tr>
</thead>
<tbody>
<tr>
<td>Piperacillin/tazobactam (3.375g q6H)</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>12g x3 days= 36</td>
<td>36/14= 2.57</td>
</tr>
<tr>
<td>Vancomycin (1g q8H)</td>
<td>✔</td>
<td>✔</td>
<td></td>
<td>3g x 2 days = 6</td>
<td>6/2=3</td>
</tr>
</tbody>
</table>

WHO standards:
Piperacillin/tazobactam = 14g
Vancomycin = 2g
Days of Therapy (DOT)

- **Pros**
  - Not impacted by dose changes
  - Can be used in adults and pediatrics

- **Cons**
  - Patient-level antibiotic use data needed

<table>
<thead>
<tr>
<th>Drug</th>
<th>Day 1</th>
<th>Day 2</th>
<th>Day 3</th>
<th>This patient</th>
<th>DOT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Piperacillin/tazobactam (3.375g q6H)</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>3 DOT</td>
<td>3+2= 5</td>
</tr>
<tr>
<td>Vancomycin (1g q8H)</td>
<td>✔</td>
<td>✔</td>
<td></td>
<td>2 DOT</td>
<td></td>
</tr>
</tbody>
</table>
Length of Therapy (LOT)

- Number of antimicrobials dispensed/utilized is irrelevant
- Pros
  - Accounts for dosing intervals beyond 1 day (e.g. patients on q48H vancomycin)
- Cons
  - Does not differentiate between monotherapy or combination therapy

<table>
<thead>
<tr>
<th>Drug</th>
<th>Day 1</th>
<th>Day 2</th>
<th>Day 3</th>
<th>LOT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Piperacillin/tazobactam (3,375g q6H)</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>3</td>
</tr>
<tr>
<td>Vancomycin (1g q8H)</td>
<td></td>
<td>✔</td>
<td>✔</td>
<td></td>
</tr>
</tbody>
</table>
Standardized Antimicrobial Administration Ratio (SSAR)

- Developed by the CDC
- Definitions:
  - Antimicrobial day: aggregate sum of days for any amount of antimicrobial administered to a patient
  - Observed antimicrobial use (O): # of days of therapy
  - Predicted antimicrobial use (P): calculated using predictive modules developed by CDC
    - Five specific categories
IDSA Recommendation

- Every ASP must measure antibiotic use, stratified by antibiotic (weak recommendation, low-quality evidence)
- DOT is preferred
  - Not impacted by dose adjustments, patient population
  - CDC’s National Healthcare Safety Network requirement

Manual Reporting

- Excel®
- Google docs®

Free Resource
- Joint Commission Toolkit
Requirements for Manual Calculation

- Date of administration
- Patient account number or medical record number (MRN)
- Note: only valid for antimicrobials given at least once daily
  - May be inaccurate for q48H or q72H dosing
## CDSS Reports: SafetySurveillor®

<table>
<thead>
<tr>
<th>Ward/Unit</th>
<th>Census</th>
<th>Drug</th>
<th>DDD</th>
<th>Patient Days of Use (per DDD)</th>
<th>DDD/1000 Patient Days</th>
<th>Actual Days of Therapy (DOT)</th>
<th>DOT/1000 Patient Days</th>
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<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Curr</td>
<td>Avg</td>
<td>Hi</td>
<td>Lo</td>
</tr>
<tr>
<td>CICU</td>
<td>505</td>
<td>acyclovir</td>
<td>4.0 gm</td>
<td>0.3</td>
<td>2.5</td>
<td>0.2</td>
<td></td>
</tr>
<tr>
<td>CICU</td>
<td>505</td>
<td>amphotericin B liposomal</td>
<td>350.0 mg</td>
<td>0.3</td>
<td>3.3</td>
<td>3.3</td>
<td></td>
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<tr>
<td>CICU</td>
<td>505</td>
<td>ampicillin</td>
<td>2.0 gm</td>
<td>12.9</td>
<td>51.0</td>
<td>1.0</td>
<td></td>
</tr>
<tr>
<td>CICU</td>
<td>505</td>
<td>ampicillin-sulbactam (single)</td>
<td>2.0 gm</td>
<td>3.0</td>
<td>14.2</td>
<td>54.0</td>
<td>1.5</td>
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<td>CICU</td>
<td>505</td>
<td>azithromycin</td>
<td>500.0 mg</td>
<td>11.0</td>
<td>15.7</td>
<td>27.5</td>
<td>4.0</td>
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<tr>
<td>CICU</td>
<td>505</td>
<td>aztreonam</td>
<td>4.0 gm</td>
<td>0.4</td>
<td>5.8</td>
<td>9.8</td>
<td>0.4</td>
</tr>
<tr>
<td>CICU</td>
<td>505</td>
<td>cefazolin</td>
<td>3.0 gm</td>
<td>1.0</td>
<td>7.2</td>
<td>22.0</td>
<td>1.0</td>
</tr>
</tbody>
</table>

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CDSS Reports: TheraDoc®

Top 25 Anti-Infectives

- Vancomycin
- Piperacillin-Tazobactam
- Nystatin
- Acenocumarol
- Cefazolin
- Ceftriaxone
- Ciprofloxacin
- Fluconazole
- Minocycline
- Metrodiazide
- Azithromycin
- Levofoxacin
- Bactrim
- Ampicillin-Sulbactam
- Cefepime
- Amoxicillin
- Micafungin
- Ciprofloxacin
- Gentamycin
- Amoxicillin/Clavulanate
- Mupirocin Topical
- Clarithromycin
- Ceftriaxone

DOT/1000 Days Present vs Unique Orders vs Unique Patients

Monthly Average vs Period Total

- DOT/1000 Days Present: 103.25, Period Total: 103.25
- DOT: 2966.00, 2966.00
- Unique Orders: 1390.00, 1390.00
- Unique Patients: 615.00, 615.00
- Order Length (Days): 2.35

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DOT per 1000 (Days Present)

<table>
<thead>
<tr>
<th>Therapeutic Class</th>
<th>Medication / Class</th>
<th>Jul 16 TOTAL</th>
<th>Average</th>
</tr>
</thead>
<tbody>
<tr>
<td>anti-infectives</td>
<td>acyclovir</td>
<td>49.13</td>
<td>49.13</td>
</tr>
<tr>
<td>anti-infectives</td>
<td>amoxicillin-clavulanate</td>
<td>49.13</td>
<td>49.13</td>
</tr>
<tr>
<td>anti-infectives</td>
<td>azithromycin</td>
<td>20.23</td>
<td>20.23</td>
</tr>
<tr>
<td>anti-infectives</td>
<td>bacitracin</td>
<td>26.01</td>
<td>26.01</td>
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<tr>
<td>anti-infectives</td>
<td>cefazolin</td>
<td>8.67</td>
<td>8.67</td>
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<td>anti-infectives</td>
<td>ceftriaxone</td>
<td>15.90</td>
<td>15.90</td>
</tr>
<tr>
<td>anti-infectives</td>
<td>cefuroxime</td>
<td>114.16</td>
<td>114.16</td>
</tr>
</tbody>
</table>

 DOT

<table>
<thead>
<tr>
<th>Therapeutic Class</th>
<th>Medication / Class</th>
<th>Jul 16 TOTAL</th>
<th>Average</th>
</tr>
</thead>
<tbody>
<tr>
<td>anti-infectives</td>
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Goals of Measuring Outcomes of ASP

Improve patient outcomes
• Maximize clinical cure by optimizing antibiotic choice, dose, duration

Improve patient safety
• Minimize unintended consequences

Reduce resistance
• Preserve the utility of available agents

Reduce cost
• Less antimicrobial use and shorter durations

Process vs. Outcome Measures

**Process**
- Excess days of therapy
- Duration of therapy
- Compliance with guidelines or treatment algorithm
- Change in antibiotics based on microbiology results
- Conversion of IV-to-PO

**Outcome**
- Hospital length of stay
- 30-day mortality
- Unplanned hospital readmission within 30 days
- *Clostridium difficile* infection or other adverse event related to antibiotics
- Clinical failure

Moving from Process to Clinical Outcomes

- Historically, ASP outcomes have focused on cost reduction
- Measuring clinical outcomes such as antimicrobial resistance is more difficult
  - Changes in patterns of organisms prevalent in a setting
  - Changes in infection control measures
Decreased Resistance with Antimicrobial Restriction of Carbapenems

Shaded Bars: restricted
Open Bars: not restricted

Susceptibilities and Stewardship

- *Pseudomonas aeruginosa* susceptibility increased after the initiation of ASP in a 70-bed rural community hospital.

Incorporating IT into your Ideal ASP

1) What ASP-related EMR initiatives will you take back and build at your institution?

2) What de-escalation alerts will you incorporate into your ASP with the available IT support/resources?

3) What additional PAF alerts will you build at your institution?

4) How will you incorporate rapid microbiologic tests into your ASP?
Key Takeaways

- Resistance continues to be a global health threat
- Antimicrobial Stewardship Programs can help preserve the power of our currently available antimicrobials
- As the demand of ASP initiatives continues to increase, the incorporation of information technology is of vital importance in assisting with streamlining ASP efforts