Antimicrobial Stewardship in the Community Hospital
Practical Tools & Techniques for Implementation

Case for Antimicrobial Stewardship Programs (ASP)

• 30% of hospital pharmacy budgets due to ABX
• 50% of ABX use estimated to be inappropriate
• Resistant organisms develop 2º inappropriate use
  – MDRO infections have ↑ morbidity and mortality
  – MDROs have ↑ costs (LOS, tx failures)
• Evidence shows ASP can improve:
  – Individual patient outcomes
  – Decrease resistance patterns
  – Decrease Clostridium difficile infection
  – Decreases costs of care

Utilization and Resistance

ESKAPE

- Enterobacter
- S aureus
- Klebsiella (KPC) (NDM-1)
- Acinetobacter
- P aeruginosa
- Enterococcus /ESBL

KPC = K pneumoniae carbapenemases; ESBL = extended-spectrum β-lactamase.

Geographical Distribution of KPC-Producers

- 2001: Sporadic isolate(s)
- November 2006: Widespread

Centers for Disease Control and Prevention.
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**Geographical Distribution of KPC-Producers**

[Map showing geographical distribution of KPC-producers with a legend indicating sporadic and widespread isolates.]

*Centers for Disease Control and Prevention.*

**Antibiotic Armageddon**

A chart comparing the number of new antimicrobials and resistance levels, labeled "Then" and "Now." The chart illustrates a decline in new antimicrobials and an increase in resistance.

**Incidence and Mortality of CDI Are Increasing in the United States**

A graph showing the increase in incidence, mortality, and principal diagnoses of CDI from 1993 to 2005.


ASP Goals

- Prevent or slow emergence of ABX resistance
- Optimize selection, dose, duration of Tx
- Reduce adverse drug events
- Reduce secondary infection (eg. CDI, MDROs)
- Reduce morbidity and mortality
- Reduce length of stay
- Reduce health care expenditure

Can Antimicrobial Stewardship Limit the Emergence of Resistance?

- Best evidence for:
  - Decreased resistant Gram-negative bacilli
  - Decreased CDI
  - Decreased VRE
  

Impact of Antimicrobial Formulary Interventions on ESBL E. coli and Klebsiella Species

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ASP Can Make a Difference with HA-CDI
Tertiary Care Hospital, Quebec, Canada (2003-2006)


CDAD = C difficile-associated diarrhea; Abx = antibiotics.

ASP Can Improve Individual Patient Clinical Outcomes

Patients at Risk for MRSA Treated Appropriately Pre- and Postdecision Support Tool Intervention

Patients at Risk for Pneumonia aeruginosa Treated Appropriately Pre- and Postdecision Support Tool Intervention

Economic Outcomes

Randomized Controlled Trial

<table>
<thead>
<tr>
<th>Cost</th>
<th>AMP (median)</th>
<th>UP (median)</th>
<th>Difference (95% CI)*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Antibiotics</td>
<td>$53</td>
<td>$95</td>
<td>$42 ($-3, $103)</td>
</tr>
<tr>
<td>Infection-associated costs</td>
<td>$172</td>
<td>$246</td>
<td>$74 ($-40, $197)</td>
</tr>
<tr>
<td>Total costs</td>
<td>$10,021</td>
<td>$10,615</td>
<td>$594 ($-4510, $5331)</td>
</tr>
</tbody>
</table>

*95% CI (bias corrected) calculated by bootstrapping around the median.

Annual savings (600 interventions/month)
- Antibiotics: $302,400
- Infection-associated costs: $533,000
- Total costs: > $4,250,000

Total Antibiotic Expenditures

MHH 1995-2003

Antimicrobial Stewardship

The Cost of Discontinuing a Program

- Large tertiary care academic medical center: ASP Active 2002-2009
- FY01-09: ABX Utilization cost savings > $14 million
- FY08: Discontinued ASP = CONSEQUENCES
  - >$1 million ABX costs FY09 compared with FY08
  - 33-147% increased cost of broad spectrum agents
  - Overall DDD increased 4.8% AND broad spectrum DDD increased 26.8%
- Conclusions:
  - ASP is a long term proposition
  - The lack of ASP has significant costs


Key Elements for Successful ASP

- Establish compelling need and goals for ASP
- Senior leadership support
- Effective local physician champion
- Adequate resources (pharmacy, infection preventionist [IP], microbiology, information technology [IT])
- Primary objectives: optimize clinical outcomes and reduce adverse events, not reduce costs
- Good teamwork
- Agreed upon process and outcome measures

Guidelines

Domestic and International

- IDSA/SHEA Guidelines suggest:
  - Physician and pharmacist compensated for time
- Guidelines for Antimicrobial Stewardship in Hospitals in Ireland:
  - Smaller hospitals should have at least one pharmacist with part-time responsibilities
  - Regional committees should be set up to serve smaller hospitals or develop regional guidelines
- European Union Project Antibiotic Stewardship International:
  - An antibiotic officer is needed
    - For smaller hospitals, individual could be either physician, pharmacist, or trained microbiologist

Physician Champion

- Basic knowledge of antibiotics*
- Must show interest in taking a leadership role in the local community
- Respected by his or her peers
- Good interpersonal skills
- Good team player
- Basic understanding of human factors and culture transformation

*Does not need to be an infectious disease specialist.
Collaboration and Role of the Pharmacist
Continuation, Advancement of Knowledge…1990s-Current

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Antibiotic Stewardship Activities

- Restrictive formulary
- Generic substitution
- Therapeutic substitution
- Restricted use of formulary compounds
- Guidelines for appropriate/desired use
- Antibiotic order sheets
- Prior authorization
- Automatic stop orders
- Selective reporting of susceptibilities
- Computer-assisted programs

Front-end Approach

Physician writes order for "restricted drug"

Order arrives in pharmacy; pharmacist informs physician that drug is "restricted*/"not part of the pathway*/"nonformulary"

Prescribing physician and the "GATE KEEPER" converse

Approval or alternative antibiotic selected
Back-end Approach

Physician writes order → Antibiotic is dispensed

1) Antibiotic changed or continued based on practice guidelines
2) Prescribing physician contacted and recommendation made

At a later date, antibiotics are reviewed
(Targeted list of antibiotics, culture/sensitivity mismatches, ICU patients)

Criteria for Selecting Cases for ASP Review

- High-cost agents (eg, linezolid, daptomycin, echinocandins)
- Broad-spectrum agents (eg, carbapenems, piperacillin/tazobactam)
- High risk of adverse effects (eg, aminoglycosides)
- Intravenous to oral
- Syndromic approach (eg, asymptomatic bacteriuria)
- High-use agents (facility dependent)
- Double coverage of organisms (eg, anaerobes)
- 3 or more anti-infectives for >3 days
- Susceptibility mismatch

Measures

- Process
  - Measure surrogate impacts of program
  - Accountability
  - Resource utilization
  - Cost effectiveness
- Outcome
  - Most difficult to measure
  - Literature suggests improvement in patient and institutional level antimicrobial susceptibility
  - Patient-specific outcomes more difficult to show

Potential Measurements

- Antimicrobial use
  - Defined daily dose
  - Days of therapy
- Timely antibiotic administration and duration
- Cultures obtained before antibiotic(s) administered
- Adverse drug events
- Antimicrobial resistance patterns
- C difficile rates
- Physician’s acceptance of ASP recommendations

What Can Physicians Do?

*Can You Improve Through General Guidelines?*

- Avoid unnecessary use, especially viral URIs (75%)
- Short course – always wins or ties CAP 3d, HAP 8d
- Automatic stop orders work
- Pathogen-directed therapy
  - Microbiology based diagnosis when possible
- Seriously ill – start broad → then pathogen specific
- Play the numbers
  - Pathogen always >10^6/mL
- Dose issue – vancomycin

Reducing Treatment of Asymptomatic Bacteriuria

- Educate about appropriate indication for sending urine cultures
  - Signs and symptoms of UTI
  - Pregnant women at 12-16 weeks gestation
    - Treatment prevents pre-term labor and LBW
    - Prior to TURP and other urologic procedures where mucosal bleeding is expected
- Educate about NOT treating positive cultures in the absence of symptoms in other patients
  - Particularly in the following populations
    - Diabetic women, Older persons in the community or in long term care, Spinal cord injury patients, Patients with indwelling catheter

Implementation of SSI Reduction Efforts

• Should be based in a perioperative care committee representing leadership from preoperative testing, anesthesia, operating room (OR) nursing, pharmacy, and infection control
• A physician champion greatly facilitates this activity
• The committee reports to physician leadership through OR committee or other appropriate group
• A uniformly applied set of standing orders reflecting national best practices, with limited physician-specific choices, is the output

Recommended Antibiotic Prophylaxis

<table>
<thead>
<tr>
<th>Surgical Service</th>
<th>Routine Antibiotic</th>
<th>Penicillin or Cephalosporin Allergy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thoracic</td>
<td>Cefazolin OR cefuroxime</td>
<td>Clindamycin</td>
</tr>
<tr>
<td>Upper abdominal</td>
<td>Cefazolin OR cefuroxime</td>
<td>Clindamycin</td>
</tr>
<tr>
<td>Colorectal</td>
<td>Cefoxitin OR Cefotetan OR Ampicillin/Sulbactam OR Ertapenem OR Cefazolin plus metronidazole</td>
<td>Clindamycin OR Vancomycin</td>
</tr>
<tr>
<td>General surgery/endocrine</td>
<td>Cefazolin OR cefuroxime</td>
<td>Clindamycin OR Vancomycin</td>
</tr>
<tr>
<td>Hepatobiliary (complicated)</td>
<td>Cefazolin OR cefuroxime OR Cefoxitin OR Cefotetan OR Ceftriaxone OR Ampicillin/sulbactam</td>
<td>Clindamycin OR Vancomycin</td>
</tr>
<tr>
<td>Trauma, reconstructive, and hand surgery</td>
<td>Cefazolin OR cefuroxime OR Ampicillin/sulbactam</td>
<td>Clindamycin OR Vancomycin</td>
</tr>
<tr>
<td>Vascular</td>
<td>Cefazolin OR ceftazidime (add vancomycin if synthetic graft is being placed)</td>
<td>Clindamycin OR Vancomycin</td>
</tr>
<tr>
<td>Orthopedics with TJR</td>
<td>Cefazolin OR cefuroxime</td>
<td>Clindamycin OR Vancomycin</td>
</tr>
</tbody>
</table>

2011 ASHP Draft prophylaxis guidelines

IMPLEMENTING ASP IN A COMMUNITY HOSPITAL
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Hospital 1

- Hospital make-up
  - 150-bed hospital in a rural setting
  - Single ICU (4 beds), mostly chronically ventilated patients
  - Private practice physicians admit patients; no hospitalist team
  - ID physician: 2 private practice groups from the community provide consultation and have admitting privileges
  - Pharmacy: 4 full-time pharmacists; pharmacy services from 7:00 AM to 10:00 PM daily
- Formulary structure
  - P&T committee chaired by chief medical officer
  - Microbiology laboratory: contract service

ICU=intensive care unit; ID=infectious disease; P&T=pharmacy and therapeutics.

Stewardship Program: Option 1

- Form antimicrobial stewardship committee
  - Invite members from each ID practice to cochair the committee
  - Have representation from key admitting groups within the community serve on the committee
  - Committee reports directly to P&T committee
- Initial stewardship activities
  - Antimicrobial formulary
  - Daily review of targeted anti-infectives by registered pharmacist
  - Prepare antibiogram if not already available
- Resources needed
  - 25% to 50% of a full-time equivalent registered pharmacist
  - Hourly reimbursement for ID specialist's time

Stewardship Program: Option 2

- No support from leadership for formal stewardship committee
- Identify key pharmacy champion willing to work on this as a project
- Take all stewardship initiatives through P&T committee
- Meet with key ID physicians to seek approval of and advice on initial pharmacy-based stewardship tasks
  - Start by reviewing antibiotic formulary
  - Intravenous to oral switch programs
  - Vancomycin >72 hours without positive culture

Presentation Slides
Keys to Success for Hospital 1

- Commitment from the private practice ID physicians
  - This should be done with support from the hospital for at least part of their services
- If no reimbursement approved, consider recruiting help
  - A good stewardship program can likely decrease the number of nonbillable “curb-side” calls the groups likely receive, and most programs still generate a lot of consults

Hospital 2

- Hospital make-up
  - 80-bed hospital in a suburb of a midsize city
  - No ICU
  - Hospitalist service primarily admit patients from 3 large practices in the area
  - ID physician: ID physician visits once per week from local teaching hospital; otherwise available by phone
  - Pharmacy: 2 full-time pharmacists; pharmacy services from 7:00 AM to 7:00 PM daily
- Formulary structure
  - Part of a large health system (>20 hospitals) with central P&T committee
- Microbiology laboratory: contract service

Stewardship Program: Option 1

- No key physician or pharmacist champion with time and interest to assist with program
- Combine with other institutions within the health system
  - Develop system-wide initiatives that could be approved at system P&T or stewardship committee
  - Antibiogram for each institution if not already available
- Initial stewardship activities
  - Begin with guidelines for use of formulary agents
  - Consider restriction status, given the environment at each individual hospital
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Stewardship Program: Option 2

- Centralized option not feasible
- Find a motivated hospitalist to lead the charge at your institution
  - Some hospitalists with ID training in practice
    - Perhaps ID physician from training institution is willing to mentor/provide oversight
- Initial stewardship activities
  - Guidelines for specific drugs or pathways to standardize treatment of common infectious diseases
  - Antibiotic if not already available
- Resources needed
  - Dedicated time for hospitalist to assist
  - Will need incremental registered pharmacist, with some training, to devote time toward this effort
  - Evaluate electronic software programs to increase efficiency (may be possible with large system)

Keys to Success for Hospital 2

- Finding appropriate provider leadership
  - Support from local hospital leadership important
  - Key decision is whether local provider without ID training would be respected for ID input vs opinion of larger health system mandate, which may not be accepted
  - Some training programs are proposing abbreviated training in ID/stewardship; perhaps hospital would be willing to support some of this training

Hospital 3

- Hospital make-up
  - 220-bed community hospital affiliated to large teaching hospital
  - 2 ICUs; total of 20 beds
  - Trainees staff most services, with hospitalist attending
  - ID physician: 2 dedicated ID physicians who take small number of trainees
  - Pharmacy: 10 full-time pharmacists, providing 24/7 service; 1 full-time equivalent pharmacist dedicated to clinical pharmacy activities
- Formulary structure
  - P&T committee and antibiotic subcommittee in partnership with academic medical center
- Microbiology laboratory: on-site at academic medical center
- Hospital leadership requesting stewardship program
Stewardship Program: Option 1

- Wrap efforts into the antibiotic subcommittee initiatives of the health system
- Physician and pharmacist from Hospital 3 join antibiotic subcommittee
- Initial stewardship activities
  - Start adapting policies of academic medical center for approval
  - Select strategy of restriction or prospective audit
- Resources needed
  - Dedicated pharmacist time (add on to responsibilities of clinical pharmacy resource vs incremental position)
  - ID training for pharmacist
  - Support for the ID physicians
  - Tools to track outcomes

Stewardship Program: Option 2

- Not able to integrate with academic center program or program does not exist
- Start separate committee
  - Partner with ID physician
  - Seek hospital-wide membership; unique to Hospital 3
- Initial stewardship activities
  - Create unique antibiogram, if not already in existence
  - Outline criteria for use of major drug classes or common disease states
- Resources
  - Very similar to Option 1

Keys to Success for Hospital 3

- Getting training for the pharmacist
  - ID residency would be ideal, but not realistic given current supply of programs
  - Seek out certificate programs conducted throughout the country, in some cases with remote options
  - Also, consider preceptorships with area institutions that can help to get less formalized experience, but lots of real-world knowledge
Centers for Disease Control and Prevention (CDC) Activities: Improving Use

- Develop a comprehensive Web-based resource to assist clinicians interested in implementing stewardship programs and interventions
  - Background information on antibiotic use and resistance
  - Resources for designing and implementing interventions
- Focus on developing an implementation framework that will make stewardship activities practical and feasible in any acute care setting
- Collaborating with the Institute for Healthcare Improvement (IHI) and SHEA to develop a Driver Diagram with practical antibiotic stewardship implementation strategies with the intent of promoting aspects of care in places where improvement is needed.

“Get Smart for Healthcare” Campaign by CDC

The Society for Healthcare Epidemiology of America
Resource Toolkit

To further assist with the implementation of ASPs, an online tool kit has been developed with this program which includes:

- Useful resources specifically designed for clinicians at nonteaching, community hospitals interested in implementing an ASP
- Practical tools, web links as well as general support materials

www.rockpointe.com/ASPtoolkit

What We Hope You’ve Taken From This Program

The Future is Now for ASP

- ASP = Improved Patient Safety and Outcomes
- ASP = Our stand against resistant organisms
- ASP = An improved $ bottom line

To Achieve Success

- Get provider and C-suite buy in
- Improve antibiotic use NOW
- Scale it up
- Measure outcomes
- Build on your data

Recommended Resources

- Decreased inappropriate use
- Decreased antimicrobial consumption
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Recommended Resources

- Adherence with guidelines

- Better patient outcomes from infection

- Reduced length of hospital stay

Improved ventilator-acquired pneumonia (VAP) outcomes