Objectives

• List reasons for developing antimicrobial stewardship programs (ASP): the whys

• Outline the goals of ASP: the whats

• Describe the role of various personnel in ASP: the whos

• Introduce common ASP strategies: the hows
Why is ASP needed?
Development of Antibiotic Resistance

• Resistant bacteria are selected when colonizing or infecting bacteria are exposed to antibiotics

• Longer exposure to antibiotics \(\rightarrow\) more likely to become colonized with resistant organisms

• Highest risk patients:
  – Immunocompromised
  – Hospitalized
  – Invasive devices
Where Does All This Resistance Come From?

- Changes in antibiotic use parallel changes in prevalence of resistant pathogens
- Resistance is more prevalent in healthcare- vs. community-acquired infections
- Most resistant pathogens arise in acute or long-term care facilities
- Hospitals/areas with highest rates of antibiotic use have the highest rates of resistance

Correlation between Penicillin Use and Prevalence of Penicillin Non-Susceptible S. pneumoniae

Evidence of Antibiotic Overuse in Acute Care Facility

• Inappropriate prescribing ranged from 20-50% in acute care settings

• Prospective, observational review of new antibiotic start over 2 weeks in 650-bed tertiary hospital

• Total of 1941 days of therapy (DOT) for 129 patients captured

• 30% (>500 DOT) considered unnecessary

<table>
<thead>
<tr>
<th>Reason for Unnecessary DOT</th>
<th>No. Pt (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Non-infectious or non-bacterial</td>
<td>187 (32)</td>
</tr>
<tr>
<td>Colonization or contamination</td>
<td>94 (16)</td>
</tr>
<tr>
<td>Longer duration than needed</td>
<td>192 (33)</td>
</tr>
<tr>
<td>Timely adjustment not made</td>
<td>20 (3)</td>
</tr>
<tr>
<td>Redundant coverage</td>
<td>60 (10)</td>
</tr>
<tr>
<td>Spectrum of activity not indicated</td>
<td>23 (4)</td>
</tr>
</tbody>
</table>

1. CDC. Core Elements of Hospital Antibiotic Stewardship Programs. Atlanta, GA: US DHHS, CDC; 2014.
Consequences of Antibiotic Overuse

Resistant Pathogens

Estimated minimum number of illnesses and deaths caused by antibiotic resistance*:

- At least 2,049,442 illnesses, 23,000 deaths

* bacteria and fungus included in this report

Clostridium difficile Infections

Estimated minimum number of illnesses and death due to Clostridium difficile (C. difficile), a unique bacterial infection that, although not significantly resistant to the drugs used to treat it, is directly related to antibiotic use and resistance:

- At least 250,000 illnesses, 14,000 deaths

- Estimated annual costs (in 2008 dollars)
  - $20 billion in excess direct healthcare costs
  - $35 billion in lost productivity

Limited New Antibiotic Options

Theuretzbacher U. Recent FDA Antibiotic Approvals: Good news and Bad News.
Available at: http://cddep.org/blog/posts/recent_fda_antibiotic_approvals_good_news_and_bad_news#sthash.adecdYpE.dpbs.
Drug@FDA: FDA Approved Drug Products. Available at: https://www.accessdata.fda.gov/scripts/cder/daf/index.cfm.

Target = ESKAPE
Enterococcus faecium
Staphylococcus aureus
Klebsiella pneumoniae
Acinetobacter baumannii
Pseudomonas aeruginosa
Enterobacter species
Antibiotic-Associated Adverse Drug Events (ADE)

• Review of national databases for ED visits due to ADE over 2 years
• >140,000 ED visit annually due to ADE from antibiotics
  ▪ Translate to 1 out of 5 ED visits
• Allergic reactions most common reason for seeking care (>100,000 annual visits)
• Penicillins (37%) and fluoroquinolones (14%) were most commonly implicated
• Conclusion: small reduction in unnecessary use can significantly decrease ADE risks

• 10-month review of patients who received ≥24 hrs of antibiotics at Johns Hopkins
• ~1500 patients (27%) included
  ▪ 20% developed ADE
• 287 regimens without clear indications
  ▪ 56 (20%) were associated with ADE
  ▪ Including 7 cases of Clostridium difficile infection
• ADE risks increase by 3% for every 10 DOT

Antibiotics Are Unique
Lose efficacy over time and must be continually replaced
Need to be used sparingly to prolong efficacy
Use of new drugs are actively discouraged for non-financial reasons
How I use them affects others

Antimicrobials are a shared natural resource which must be preserved for future generations
What Do We Do?

Options

1. Create new drugs
2. Learn to use what we have more wisely
3. Infection prevention will also help
What is an ASP?
What is Antimicrobial Stewardship?

• Rational, systematic approach to antibiotic use

• Using or implementing processes that are designed to optimize antibiotic use

• Includes interventions to guide clinicians:
  – When are antibiotics needed
  – Which antibiotic(s) should be used
  – Optimal dose, route, and duration of therapy
Goals of Stewardship

• Primary goals:
  – Improve quality of patient care
  – Improve public health
  – Stabilize or reduce rates of resistance

• Financial goals are always secondary

Correct drug
  Right dose
  Appropriate duration

Cure/prevent infection
  Minimize toxicity
  Prevent emergence of resistance

Joint Commission Requirement

New standards for hospitals, critical access hospitals, and nursing facilities (MM.09.01.01), effective 1/1/2017

1. Establish ASP as an organizational priority
2. Educate practitioners on resistance and ASP practices
3. Educate patients/families on appropriate antibiotic use
4. Create ASP that is multidisciplinary
5. Include 7 CDC core elements (LeAD A TReN: Leadership, Accountability, Drug expertise, Action, Tracking, Reporting, Education) in ASP
6. Use approved multidisciplinary management protocols
7. Collect, analyze, report data on ASP
8. Act on improvement opportunities identified by ASP

https://www.jointcommission.org/assets/1/6/New_Antimicrobial_Stewardship_Standard.pdf
CMS Requirement for Conditions of Participation

- Rules proposed on 6/16/2016; yet to be finalized
- 42 CFR 482.42
  
  ...require a hospital to develop and maintain an antibiotic stewardship program
  ... to improve hospital antibiotic prescribing practices
  ... curb patient risk for possibly deadly CDIs

- Goals and responsibilities
  - Document evidence-based antibiotic use
  - Demonstrate sustained improvements in proper antibiotic use
  - Use nationally recognized guidelines to monitor and improve antibiotic use
  - Competency-based training on ASP guidelines, policy, and procedure

ASP Core Elements for Hospital, Small and Critical Access Hospitals

Leadership Commitment
Accountability
- Single MD Expert

Drug Expertise
- Pharmacist

Action
Tracking
Reporting
Education

https://www.cdc.gov/getsmart/healthcare/implementation/core-elements.html
https://www.cdc.gov/getsmart/healthcare/implementation/core-elements-small-critical.html
## Comparison of ASP Core Element Documents

<table>
<thead>
<tr>
<th>Core Element</th>
<th>Hospital ASP</th>
<th>Small &amp; Critical Access Hospital ASP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Leadership Commitment</td>
<td>Formal statement, job descriptions, training support</td>
<td>Formal statement, approve ASP policy, integrate with QI, training support</td>
</tr>
<tr>
<td>Accountability</td>
<td>Single physician leader</td>
<td>C-suite physician accountable for outcomes</td>
</tr>
<tr>
<td>Drug Expertise</td>
<td>Pharmacist leader + other key support (e.g., micro, IP, IT, QI, RN)</td>
<td>Pharmacist leader, offer access to training, remote consultation</td>
</tr>
</tbody>
</table>
| Action             | Broad: time-out, audit-feedback  
Pharmacy: IV→PO, dose adjustment  
Infection: treatment guidelines (e.g., UTI) | Infection: UTI, CAP, SSTIs  
Drug: carbapenems, pip/tazo, IV vanco  
Pharmacist: IV→PO, dose adjustment  
RN: culture technique, monitor response |
| Tracking           | Process: compliance to guidelines, policies  
Use: DOT, DDD per 1000 patient-days  
Outcome: antibiotic resistance, CDI rates | Submit AU/AR data to NHSN  
Monitor UTI, CAP, SSTI guideline compliance  
Medication use evaluations for selected drugs |
| Reporting          | Process, use, outcome measures to frontline staff +/- NHSN                   | Regular report, provider-specific report, newsletters/emails                                           |
| Education          | Regularly to prescribers and staff                                           | Incorporate in orientation and re-credentialing process; focus on UTI, CAP, SSTI interventions         |

https://www.cdc.gov/getsmart/healthcare/implementation/core-elements.html  
https://www.cdc.gov/getsmart/healthcare/implementation/core-elements-small-critical.html
Antibiotic “Stewardess”
Not that Far off

Airline Stewardess
• Security and boarding to start your course
• Passport
• Sees the world at 35,000 ft
• Your safety is their priority
• Recent airplane crash in NY – “miracle” vs. flight crew attributed to careful systems in place and exercise by a skilled team

Antimicrobial Stewardship
• Approval for restricted antibiotics to start antibiotic course
• Antibiograms is a passport to our local micro
• See hospital’s use and resistance in aggregate (“35,000 ft” vs. just 1 patient at a time)
• Patient’s safety and outcome are our priority
• Developing systems using a specialized team to promote antibiotic use

Courtesy of Belinda Ostrowsky, MD, MPH, FSHEA, FIDSA. Circa 2010.
Who should be part of ASP?
The Stewardship Team

• Ideally anyone who prescribe, dispense, administer, or receive antibiotics

• Should be multidisciplinary

• Core members
  – Infectious diseases physician / physician with ASP training
  – Pharmacist with ID / ASP certificate training

• Additional members
  – Infection preventionists
  – Clinical microbiologists
  – Information system specialists
  – Members of Quality Improvement
  – Nurses
  – Hospital epidemiologists

Who is Available in the Real-World?

- Nationwide survey of ASP practices in hospitals between 2009 – 2010
- About 206 of 406 (51%) hospitals with some form of ASP

<table>
<thead>
<tr>
<th>ASP Composition</th>
<th>Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>ID physicians</td>
<td>71%</td>
</tr>
<tr>
<td>ID pharmacists</td>
<td>59%</td>
</tr>
<tr>
<td>Infection control professionals</td>
<td>51%</td>
</tr>
<tr>
<td>Clinical microbiologists</td>
<td>39%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Barriers to ASP</th>
<th>Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Staffing constraints</td>
<td>69%</td>
</tr>
<tr>
<td>Funding</td>
<td>50%</td>
</tr>
<tr>
<td>Insufficient buy-in</td>
<td>33%</td>
</tr>
<tr>
<td>Not a priority</td>
<td>22%</td>
</tr>
</tbody>
</table>

- ~65% of respondents with <300 beds

Who is Available in Community Hospitals?

• Survey of >1400 community hospitals
  ▪ 568 hospitals responded
  ▪ >80% with 25-300 beds

• ~16% with antimicrobial committee

<table>
<thead>
<tr>
<th>Point Person</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pharmacist</td>
<td>64.0%</td>
</tr>
<tr>
<td>Physician</td>
<td>5.2%</td>
</tr>
<tr>
<td>Nurse</td>
<td>1.7%</td>
</tr>
<tr>
<td>Other</td>
<td>0.4%</td>
</tr>
<tr>
<td>None identified</td>
<td>28.3%</td>
</tr>
</tbody>
</table>

Septimus EJ, Owens RC. Clin Infect Dis. 2011;53:S8-14
Nurses in Antimicrobial Stewardship Activities

<table>
<thead>
<tr>
<th>ASP Task</th>
<th>Core Elements</th>
<th>Example of Nurse’s Role</th>
</tr>
</thead>
<tbody>
<tr>
<td>Triage/Isolation</td>
<td>Accountability Drug Expertise Education</td>
<td>Initially assess source of infection Identifies appropriate precaution</td>
</tr>
<tr>
<td>Early / appropriate culture</td>
<td>Accountability Drug Expertise Tracking</td>
<td>Obtain cultures before antibiotics Monitor/report culture results</td>
</tr>
<tr>
<td>Adverse events monitoring</td>
<td>Action Tracking Education</td>
<td>Monitor/report adverse events</td>
</tr>
<tr>
<td>Antibiotic dosing</td>
<td>Drug expertise Action Tracking Education</td>
<td>Obtain appropriate drug levels</td>
</tr>
<tr>
<td>Transition of care to different acuity level</td>
<td>Action Tracking Education</td>
<td>Communicate clinical information (diagnosis, management) to LTCF/VNA</td>
</tr>
</tbody>
</table>

How to antibiotic stewardship?
Prescribing Process and Stewardship

Patient Evaluation

Drug Selection

Drug Ordering

Drug Dispensing

Education/Guidelines

Antibiotic Cycling

Formulary/Restrictions

Computer-Assisted Ordering

Review/Feedback Strategies

IDSA/SHEA Stewardship Strategies

General interventions

- Prospective audit and feedback
- Restriction / pre-authorization
- Practice guidelines
- Improvement of outcomes and antibiotic use based on syndrome
- Reduce use of *C difficile*-associated antibiotics
- Clinical decision support system
- Education / Encourage prescribers to review antibiotic regimens

Pharmacy-Based Strategies

- PK monitoring service
- IV to PO conversion
- Use of PK/PD-optimized alternate dosing regimen
- Allergy assessment
- Shortest effective duration of therapy

IDSA/SHEA Stewardship Strategies

Laboratory-Based Strategies
- Antibiograms based on sample source, location, age
- Selective susceptibility reporting
- Rapid testing for viral respiratory pathogens
- Rapid diagnostic for blood cultures
- Procalcitonin to reduce antibiotic use
- Fungal biomarkers to reduce antifungal use

Population-Based Strategies
- Guidelines for febrile neutropenia
- Antifungals in immunocompromised
- LTCF interventions
- Neonatal ICU
- Terminally ill patients

Prospective Audit and Feedback (PAF)

• Daily or scheduled review of target antibiotics
• Educational, evidence-based feedback provided to prescribers
• May establish targets for intervention (i.e., bug-drug mismatch, redundant therapy)
• Requires computer/technical support
<table>
<thead>
<tr>
<th>Advantages</th>
<th>Disadvantages</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prescriber autonomy maintained</td>
<td>Voluntary compliance</td>
</tr>
<tr>
<td>Decision based on more clinical data, enhancing clinician buy-in</td>
<td>Time/labor intensive; may require purchase of surveillance system</td>
</tr>
<tr>
<td>Educational opportunities</td>
<td>Requires broad-based knowledge</td>
</tr>
<tr>
<td>No delays in therapy</td>
<td>Some inappropriate antibiotic use still permitted</td>
</tr>
</tbody>
</table>
Restriction/Pre-Authorization

• Formulary restriction
  – Limit the number of drugs within a class on formulary
  – Reduce redundancy, confusion with regimen, and resource

• Specific agent restrictions
  – Restrict certain antibiotics based on spectrum of activity, safety, or cost concerns
  – Can obtain with prior approval or authorization
  – Requires providers to justify their rationale, especially outside pre-specified indications
  – Approval may be from ID team via formal consultations or from ASP
Restriction Pros and Cons

**Advantages**
- Direct control over use of antibiotic
- Requires less resources
- Way to minimize antibiotic use during drug shortages
- Decreases inappropriate antibiotic use

**Disadvantages**
- May delay therapy
- Antagonistic relationship due to provider’s loss of autonomy
- Ways to beat the system
- ID physicians often exempt
Clinical Guidelines Example

Clinical Pathways

Antimicrobial Catheter Lock Protocols
- Antibiotic and Ethanol Catheter Lock Order Sets
- Institutional Guidelines for Ethanol Lock Technique
  - Refer to Nursing Policies/Procedures VAD-11 (Ethanol Lock Technique for Treatment in Prevention of Infection of Intravascular Devices) for nursing policy and instructions for ethanol administration
- IDSA Guidelines for the Management of Intravascular Catheter-related Infections

Clostridium difficile Infection (CDI)
- Management Algorithm
- Environmental Services Cleaning Protocol
- SHEA/IDSA C. difficile Infection Guidelines

Invasive Candidiasis
- Institutional Guidelines for the Treatment of Invasive Candidiasis

Perinatal Group B Streptococcal Prevention
- Institutional Guidelines for the Prevention of Perinatal Group B Streptococcal Disease
- CDC Guidelines for the Prevention of Perinatal Group B Streptococcal Disease

Treatment Recommendations for CDI

- Mild-Moderate Infection: Diarrhea that does not meet criteria for severe or complicated
  - Metronidazole 500 mg PO q6h x 10 days
  - Avoid IV metronidazole as data suggests inferior to PO
  - Pediatric dosing: 30 mg/kg/day PO divided q6h x 10 days, not to exceed 4 g/day
Other General Strategies

• Antibiotic order requirements
  – Indication
  – Duration of therapy

• Antibiotic time-out
  – Review appropriateness of antibiotic therapy at specific time points
  – Often performed at 48-72 hours when more clinical and culture data are available

• Automatic stop orders
  – Surgical prophylaxis can usually be discontinued after surgery
Indication and Duration Example
Dose Optimization Example

- Extended infusion of piperacillin/tazobactam
- Alternate dosing protocols for β-lactams (e.g., cefepime, meropenem)
- Aminoglycoside dosing protocol for cystic fibrosis

**Table 5. Cefepime target attainment versus Pseudomonas aeruginosa**

<table>
<thead>
<tr>
<th>Regimen/infusion</th>
<th>Target %</th>
<th>0.25</th>
<th>0.5</th>
<th>1</th>
<th>2</th>
<th>4</th>
<th>8</th>
<th>16</th>
</tr>
</thead>
<tbody>
<tr>
<td>2g q12/0.5</td>
<td>67</td>
<td>100</td>
<td>98</td>
<td>97</td>
<td>95</td>
<td>79</td>
<td>45</td>
<td>--</td>
</tr>
<tr>
<td>2g q8/0.5</td>
<td>67</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>97</td>
<td>91</td>
<td>--</td>
</tr>
<tr>
<td>1g q8/0.5</td>
<td>67</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>99</td>
<td>97</td>
<td>89</td>
<td>--</td>
</tr>
</tbody>
</table>
IV to PO Conversion

• Considered the “low hanging fruit” of stewardship

• Target antimicrobials with high bioavailability:
  - Azithromycin
  - Fluoroquinolones
  - Clindamycin
  - Doxycycline
  - Fluconazole
  - Linezolid
  - Metronidazole

• Example drug cost savings:
  - Levofloxacin: $1 PO vs. $10 IV / day
  - Linezolid: $270 PO vs. $420 IV / day

• Can potentially save on costs of IV line care and/or IV line-related adverse events
## Antibiogram Example (Urinary)

<table>
<thead>
<tr>
<th>% Susceptible</th>
<th>E. coli (N=2014)</th>
<th>Klebsiella pneumoniae (N=405)</th>
<th>Proteus mirabilis (N=184)</th>
<th>Pseudomonas aeruginosa (N=134)</th>
<th>Enteric (Lactose-Fermenting) Gram-neg rods</th>
<th>Non-lactose Fermenting Gram-neg rods (oxidase neg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Amikacin</td>
<td>99.7</td>
<td>100</td>
<td>98.9</td>
<td>95.5</td>
<td>99.8</td>
<td>98.6</td>
</tr>
<tr>
<td>Ampicillin</td>
<td>58.5</td>
<td>4.4</td>
<td>84.8</td>
<td>XX</td>
<td>47.5</td>
<td>76.9</td>
</tr>
<tr>
<td>Ampicillin/sulbactam</td>
<td>61.5</td>
<td>84.9</td>
<td>92.9</td>
<td>XX</td>
<td>64.4</td>
<td>86.5</td>
</tr>
<tr>
<td>Cefepime</td>
<td>97.3</td>
<td>99.3</td>
<td>100</td>
<td>84.7</td>
<td>97.4</td>
<td>100</td>
</tr>
<tr>
<td>Cefuroxime (parenteral)</td>
<td>91.7</td>
<td>93.8</td>
<td>100</td>
<td>XX</td>
<td>89.3</td>
<td>91.3</td>
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<tr>
<td>Ceftriaxone</td>
<td>95.9</td>
<td>98.1</td>
<td>100</td>
<td>XX</td>
<td>94.3</td>
<td>98.4</td>
</tr>
<tr>
<td>Cephalothin</td>
<td>29.5</td>
<td>87.7</td>
<td>85.6</td>
<td>XX</td>
<td>37.3</td>
<td>71.2</td>
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<tr>
<td>Ciprofloxacin</td>
<td>79.6</td>
<td>97.5</td>
<td>69</td>
<td>68.9</td>
<td>82.6</td>
<td>67.8</td>
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<td>Levofoxacin</td>
<td>79.9</td>
<td>98.5</td>
<td>73.9</td>
<td>66.4</td>
<td>83.4</td>
<td>72.6</td>
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<tr>
<td>Ertapenem</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>XX</td>
<td>99.8</td>
<td>100</td>
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<tr>
<td>Gentamicin</td>
<td>92.9</td>
<td>99</td>
<td>91.3</td>
<td>75.4</td>
<td>94.2</td>
<td>90.4</td>
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<tr>
<td>Imipenem</td>
<td>99.8</td>
<td>99.8</td>
<td>23.4</td>
<td>76.7</td>
<td>99.3</td>
<td>22.6</td>
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<tr>
<td>Meropenem</td>
<td>99.9</td>
<td>100</td>
<td>100</td>
<td>76.1</td>
<td>99.8</td>
<td>99.5</td>
</tr>
<tr>
<td>Nitrofurantoin</td>
<td>97.7</td>
<td>43.3</td>
<td>0</td>
<td>XX</td>
<td>86.2</td>
<td>0.5</td>
</tr>
<tr>
<td>Piperacillin/tazobactam</td>
<td>97.8</td>
<td>98</td>
<td>99.5</td>
<td>86.8</td>
<td>96.7</td>
<td>99.5</td>
</tr>
<tr>
<td>Tobramycin</td>
<td>92.9</td>
<td>99.7</td>
<td>91.3</td>
<td>96</td>
<td>94.3</td>
<td>89.9</td>
</tr>
<tr>
<td>TMP/SMX (Bactrim)</td>
<td>77.8</td>
<td>90.4</td>
<td>78.3</td>
<td>XX</td>
<td>80.2</td>
<td>77.4</td>
</tr>
</tbody>
</table>

XX = not generally susceptible
Selecting a Strategy

• Should be based on
  – Size of facility
  – Availability of personnel / expertise (ID, micro, IT, etc)
  – Financial resources / manpower
  – Electronic ordering / clinical decision support systems
  – Goals

• Customize
  – One size will not fit all
How to Select Cases for ASP Review

- High cost / novel agents
- Broad-spectrum agents (e.g., carbapenems)
- High use agents
- High rates of adverse events (e.g., colistin)
- Site / type of infection (e.g., CLABSI, *C difficile*)
- Resistance profile (e.g., MRSA, CRE)
- Syndromic approach (e.g., asymptomatic bacteriuria)
- Unnecessary double coverage (e.g., anaerobes)
Metrics to Measure ASP Activities

Measurement for usage
- Days of therapy (DOT)
- Not defined daily dose (DDD)

Measurement for expenditure
- Costs based on administration or prescriptions
- Not based on purchasing data

Measurement for clinical outcomes
- Process measure: compliance to clinical pathways
- Outcome measure: length of stay, number of *C. difficile* infections

Other Metrics to Show ASP Efforts

• Time spent reviewing antibiotics

• Number of people educated about ASP, appropriate antibiotic use
  ▪ Prescribers
  ▪ Nurses
  ▪ Patients

• Number of internal and external outreach activities

• Other outcome measures
  ▪ Number of antibiotic-associated adverse drug events
  ▪ Antibiotic resistance rate over time
Summary

• Antimicrobial resistance is increasing and leads to increased morbidity and mortality for patients and overall healthcare costs

• ASPs are necessary
  – Unnecessary use of antibiotics is common
  – Antibiotic use is the key driver of resistance
  – Regulatory requirements

• Primary goal of ASPs is to improve patient care and public health

• Key recommendations for ASPs include
  – Establishing a multidisciplinary team
  – Implementing general interventions as well as pharmacy-, microbiology-, and population-based strategies
Assessment Question 1

Which of the following is not a consequence of antibiotic misuse?

A. Development of resistant pathogens
B. Secondary infections
C. Decreased length of stay and costs
D. Adverse drug reactions
Assessment Question 2

Which of the following is not a primary goal of antimicrobial stewardship programs?

A. Limit pharmacy spending on antibiotics
B. Improve public health
C. Prevent development of resistance
D. Improve patient care and outcomes
Assessment Question 3

Which of the following is an advantage of prospective audit and feedback as a stewardship strategy?

A. Educational opportunity for prescribers
B. Results in decreased antibiotic use
C. Does not cause delays in starting therapy
D. All of the above
Need More Nebraska ASAP?

For additional resources, visit

https://asap.nebraskamed.com