Greater New York Hospital Association
United Hospital Fund

ANTIMICROBIAL STEWARDSHIP TOOLKIT

BEST PRACTICES FROM THE GNYHA/UHF ANTIMICROBIAL STEWARDSHIP COLLABORATIVE

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- North Shore University Hospital
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This chapter offers a list of process and outcomes measures that may be used to monitor and assess the impact of an antimicrobial stewardship program. Recommendations on how to make the "business case" for antimicrobial stewardship programs and how to sustain an effective stewardship program within an institution are included. Additionally, the relationship between antimicrobial stewardship programs and infection prevention strategies is discussed.

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CHAPTER I:
WHY ANTIMICROBIAL STEWARDSHIP?

A. INTRODUCTION AND BACKGROUND

Despite widespread efforts to control the spread of multidrug-resistant organisms (MDROs), the incidence of infections attributed to MDROs among hospital patients continues to rise. Infections caused by MDROs are associated with a significant deterioration in clinical outcomes, including an increased risk of death and significantly increased costs, mostly attributable to increased lengths of stay. In a study done by Cosgrove, cephalosporin-resistant *Enterobacter* infections increased mortality and length of stay, and resulted in an average attributable hospital charge of $29,379.[1] Further, antibiotic resistance is strongly correlated with antibiotic prescribing patterns. While antimicrobial usage has undoubtedly reduced mortalities caused by infections, resistance to these drugs has also increased.[2] Studies show that up to 50% of antimicrobial use is inappropriate, which may include:[3]

1. Use of antibacterial medications for the treatment of syndromes not caused by bacteria;
2. Treatment for culture results that reflect colonization or contamination rather than infection;
3. Administration of broad spectrum antibiotics where narrow spectrum agents are equally effective;
4. Prescription of antibacterial therapy courses that are longer than necessary; and
5. Prescription of antibacterial agents at inappropriate doses.

Consequently, unnecessary or inappropriate use of antibiotics has increased rates of serious diseases or complications such as *Clostridium difficile*– (*C. difficile*–) associated diseases.[4] To address these issues, health care institutions are beginning to rely on stewardship programs to manage antimicrobial usage with the goal of reducing the incidence of MDRO infections, improving patient outcomes, and reducing costs.

Antimicrobial stewardship is a rational, systematic approach to the use of antimicrobial agents in order to achieve optimal outcomes—those of the patient (achievement of cure, avoidance of toxicity, and other adverse effects) and of the larger population (avoidance of emergence or propagation of antimicrobial resistance). Through ongoing monitoring and, when necessary, a change in antimicrobial prescribing practices (e.g., optimal selection, dose, duration, and route of therapy) successful stewardship programs have improved patient care, decreased antimicrobial use and resistance, and reduced unnecessary pharmacy expenditures, in addition to other direct and indirect hospital costs. In fact, Antimicrobial Stewardship Programs (ASPs) have the potential to become financially self-supporting. Some programs demonstrated a 22% to 36% decrease in antimicrobial use, which correlated to an annual savings of $200,000 to $900,000.[5]

Some of the problems health care institutions currently face in implementing successful ASPs include communicating as a team about treatment plans and appropriate antibiotic selection. Additionally, the burden of controlling infection rates has traditionally been the sole responsibility of infection control practitioners. However, realizing an effective and sustainable ASP necessitates a culture change that shifts responsibility for controlling infection rates from one discipline to all members of the health care team. This can only be achieved through active, multidisciplinary participation: infectious disease-trained physicians, clinical pharmacists, clinical microbiologists, hospital epidemiologists, senior institutional leadership, and champion prescribing physicians.

1. Cosgrove, S.E., K.S. Kaye, G.M. Eliopoulous, et al. "Health and Economic Outcomes on the Emergence of Third-generation Cephalosporin Resistance in *Enterobacter* Species." *Archives of Internal Medicine* (2002) 162: 185–190.
2. MacDougall C and R.E. Polk, "Antimicrobial Stewardship Programs in Health Care Systems," *Clinical Microbiology Reviews* (Oct. 2005) 638–656.
3. Gerding D.N. "The Search for Good Antimicrobial Stewardship." *Journal on Quality Improvement* (August 2001) 27(8): 403–404.
4. Dellit T.H., R.C. Owens, J.E. McGowan, et al. "Infectious Disease Society of America and the Society for Healthcare Epidemiology of America: Guidelines for Developing an Institutional Program to Enhance Antimicrobial Stewardship." *Clinical Infectious Diseases* (Jan. 2007) 44: 159–177
5. See note 4.

B. OVERVIEW OF THE GNYHA/UHF ANTIMICROBIAL STEWARDSHIP PROJECT

Funded by the NewYork State Department of Health (DOH), from October 2009 to April 2010 the Greater New York Hospital Association (GNYHA), in partnership with the United Hospital Fund (UHF), assisted a small group of acute care and long term care (LTC) facilities in establishing ASPs within their institutions. Guided by a Steering Committee comprising expert infectious disease–trained physicians, clinical pharmacists, hospital epidemiologists, senior leadership, and representatives from DOH, as well as GNYHA affiliates the Continuing Care Leadership Coalition (CCLC) and The Health Economics and Outcomes Research Institute (THEORI), GNYHA/UHF developed this evidence-based toolkit to assist other health care facilities with implementing an effective and sustainable ASP.

Recruiting Participants

GNYHA identified three hospitals that had been successfully participating in the DOH-sponsored GNYHA/UHF *C. difficile* Collaborative and that also were in the early stages of implementing ASPs. These selected facilities included representation from academic (major teaching), smaller teaching, and community (with mostly voluntary physicians) hospitals. Additionally, selected facilities were required to each identify and partner with an LTC facility. Both acute care and LTC facilities were required to create a multidisciplinary team that included representation from infection control, clinical pharmacy, clinical microbiology, epidemiology, and facility leadership and operations.

Lessons Learned

Hospital and LTC facility teams produced impressive accomplishments in a relatively short period of time during the GNYHA/UHF Antimicrobial Stewardship Project. Not surprisingly, one of the most encouraging lessons learned was that teams succeed when consistently supported by active, committed senior leadership. Senior leadership involvement is essential to ensure that the ASP is sustainable, and that the team remains motivated to achieve the goals for the project. Further, when the team functioned well—with a consistent champion or team leader, such as an infectious disease–trained physician and/or a clinical pharmacist—team members communicated effectively and expressed enthusiasm to continue this work. When one or more well-respected clinical champions are committed to spearheading the ASP, it becomes easier to gain acceptance of the program from other clinicians. Along with these positive lessons learned, teams participating in the Antimicrobial Stewardship Project sometimes encountered challenges as they pursued implementation, as explained below.

Faculty-Specific Challenges

While the interaction and communication between the hospital and LTC facility teams was extremely effective, there were certain instances in which the contact between partnering facilities could have been improved. Specifically, the acute care and LTC providers frequently spoke about the same subject matter in different ways. For future initiatives similar to this one, GNYHA will consider the fact that acute care and LTC facilities may use different vocabulary and have different approaches to accomplishing their goals, and ways of communicating issues.

Staffing and Team Challenges

Participants encountered challenges to team dynamics and composition during this project. For example, one team relied heavily on one person to implement their program. This initiative is a team effort which, to be successful, needs administrative support and interdisciplinary involvement from infectious disease–trained physicians, clinical pharmacists, and other clinicians. The reliance on one individual to manage the program decreases the potential for a successful and/or sustainable ASP. Moreover, senior leadership support is critical to achieving buy-in and interdisciplinary team involvement.

Engaging prescribing physicians was challenging for some teams, but is a necessary component for success. Hospitals and LTC facilities that provided education about antimicrobial stewardship to physicians and that attained substantial support and commitment from clinical leadership and medical directors were able to effectively achieve their goals with prescribers.

OVERVIEW OF THE TOOLKIT

This toolkit is based on published guidelines and the experiences of the six facilities that participated in the GNYHA/UHF Antimicrobial Stewardship Project. As you will see through the examples provided, ASPs vary from facility to facility.[6] The resources included are intended to provide a basic framework that can be tailored to suit other institutions irrespective of the facility's size, academic teaching status, staffing model (voluntary vs. staff physician models), formulary, prescribing practices, patient population, level of implementation, or available resources. Although each institution is confronted with unique challenges, this toolkit is designed to provide individual institutions with a general guide to the implementation of a successful ASP. (*See Toolkit Map on Page 6.*)

Suggestions for Use

Please read this toolkit in its entirety prior to program development.

Limitations of the Toolkit

The six participating facilities may not be representative of "typical" facilities. The three hospitals had prior experience with the GNYHA/ UHF Collaborative model and were affiliated with the partnering LTC facilities. Also, the project's limited timeframe prohibited formal data collection, although some facilities implemented their own data collection strategies. While quantitative data is not available, this project appears to have significantly impacted the antimicrobial stewardship processes and operations at the participating facilities.

6. Weber S, et al. "The Cost of Antibiotic Resistance." *Joint Commission Resources*. 2009.

GNYHA/UHF ANTIMICROBIAL STEWARDSHIP TOOLKIT MAP

ASSESSMENT OF CURRENT PRACTICES

- Pharmacy: Review aggregate antibiotic use and patterns of use.
- Clinical microbiology: Review rates of resistance in common pathogens.
- Identify common clinical infectious disease syndromes.
- Identify whether an antibiogram is currently developed and disseminated to all departments and prescibers.
- Identify IT infrastructure (e.g., CPOE, computer-based surveillance for antibiotic use).
- Administer baseline survey to assess clinicians' baseline knowledge and perception of antimicrobial resistance, prescribing and stewardship.

ESTABLISH CORE TEAM

- Infectious disease–trained physician
- Clinical pharmacist
- Clinical microbiologist
- Infection control representative
- Epidemiologist
- IT Representative
- Senior leadership
- Identify group of champion prescribing physicians

PLANNING AND IMPLEMENTATION

- Identify 1 to 2 target areas for intervention.
  - ▶ Common clinical infectious syndromes treated at the facility (e.g., UTI, CAP, "fever")
  - ▶ Specific pathogens
  - ▶ Specific antimicrobial agents
- Strategize rollout.
  - ▶ Consider:
    - Hospital-wide vs. Unit
    - Resources
    - Timeline
  - ▶ Determine which strategies may be most feasible and effective for your institution (Figure A).
  - ▶ Develop materials to educate facility staff.

OUTCOMES AND BUSINESS CASE

- Identify data sources and develop ongoing data collection strategies.
- Consider usage, clinical, microbiologic, and costs.
- Present program's clinical outcomes and business case (e.g., impact on costs) to leadership.

FIGURE A - STRATEGIES

1. Develop or update antibiogram.
2. Develop guidelines (e.g., care path) for diagnosis, treatment, and duration of antibiotic therapy and other interventions to treat infections.
3. Identify dose optimization strategies.
4. Provide guidelines for parenteral to oral conversion.
5. Create formulary decisions, including antibiotic restrictions.
6. Develop policy/guidelines to streamline/de-escalate therapy.
7. Develop antimicrobial order forms with algorithms for common entities.
8. Provide continuous prospective review with feedback and interventions.
9. Communicate recommendations via chart stickers, notes, or face-to-face.

FIGURE B - SCENARIOS AND STRATEGIES USED

- Overtreatment of asymptomatic bacteriuria—Strategies 2, 7, 8 and 9
- Patients on broad-spectrum antibiotics—Strategies 2, 6, 8, and 9

CHAPTER II:
GETTING STARTED

A. ASSESSING CURRENT PRACTICES

Starting an ASP requires multiple steps.[7] Prior to starting an ASP, an institution should assess its current practices to understand the prescribing environment and scope of the antimicrobial resistance issue. (See Appendices A1 and A2). An institution should consider the following elements:

Baseline Data

1. Pharmacy
   a. Aggregate antibiotic use [e.g., units purchased quarterly/monthly or the amount of drugs dispensed to individual patients in defined daily dose (DDD), etc.] (See Appendix C.)
   b. Patterns of use
2. Clinical microbiology
   a. Rates of resistance in common pathogens
   b. *C. difficile* rates
3. Administrative
   a. Length of stay for specific infectious disease(s)/condition(s)
4. What are the common clinical infectious disease syndromes?
5. What is the prescribing climate and what are staff perceptions of the need for an ASP?
   a. Administer baseline survey to assess clinicians' perception of an ASP, his or her—as well as the institution's—antibiotic prescribing practices, and the scope of the institution's antimicrobial resistance problem. (See Appendix B.)

Infrastructure

1. Is an antibiogram regularly developed and disseminated to all departments and prescribers?
2. Which staff member does the institution currently have or need related to developing an ASP?
3. What is the IT infrastructure (e.g., CPOE, computer-based surveillance for antibiotic use)? Can this infrastructure support an ASP?
4. Are all patients on infection surveillance reports reviewed in a timely manner?

ESTABLISHING A TEAM

Implementing and maintaining an effective ASP requires a dedicated multidisciplinary team and involves ongoing communication and collaboration among multiple disciplines and across departments.

The Antimicrobial Stewardship Core Team

The core team is responsible for developing, implementing, and managing the ASP. Practitioners should meet on a regular basis to guide program activities. Recognizing that available resources will vary between acute care and LTC facilities, the core team should consist of—but not be limited to—the following individuals:

THE ANTIMICROBIAL STEWARDSHIP CORE TEAM

HOSPITAL	LONG TERM CARE FACILITY
Infectious Disease–trained Physician	Infectious Disease Physician Consultant
Clinical Pharmacist	Infection Control Representative
Clinical Microbiologist	Medical Director
Infection Control Representative	Director of Nursing
Hospital Epidemiologist	Director of Quality
IT	IT
Senior Administrator	Administrator
	Other (e.g., pharmacy consultant, representative from outsourced pharmacy company)

7. Drew, RH. "Antimicrobial Stewardship Programs: How to Start and Steer a Successful Program." *Journal of Managed Care Pharmacy* (2009) 15(2) (Suppl): S18–S23.

At least one infectious disease–trained physician should be dedicated to the ASP. This physician actively participates in the core team and supervises the development, implementation, and management of the program. The physician not only reviews, recommends, and/or authorizes various antimicrobials, but also oversees the development of therapeutic guidelines, antimicrobial restriction policies, and other measures.[8] Involving clinical pharmacists with infectious disease training, if available within the facility, in the core team is also crucial to the program's success, as they can identify, flag for review, or provide antibiotic therapeutic recommendations.

As studies note that the daily activities of an established program are time intensive; a reasonable antimicrobial review schedule should be established based on available resources. Additionally, daily program responsibilities may be shared among the infectious disease-trained physician(s), infectious disease fellows (if available), and/or clinical pharmacist(s). Adequate scheduling and compensation should be provided to support their contributions to the program.[9] Additionally, while many of the programs have been developed in tertiary care hospitals, it is community hospitals and their affiliated voluntary medical staff that are responsible for the bulk of antibiotic use. It is essential that an ASP be developed in these facilities. To do this, the voluntary infectious disease–trained physicians need to be integrated into the system with full administration support. This means reimbursement for time spent in both implementing ASP and for oversight. Without local support, future control of antibiotic cost and resistance will be difficult to control.

Studies also indicate that, if possible, the core team's efforts would be optimized with the inclusion of "infection control representatives, a hospital epidemiologist, a clinical microbiologist, who can provide surveillance data on antimicrobial resistance, as well as an information specialist, who can provide necessary support for computer surveillance and implementation of recommendations."[10]

While senior administrators are not expected to manage the ASP on a day-to-day basis, their support is vital to the success and life of the program. Antimicrobial Stewardship must be a priority for hospital and LTC administration and medical directors.

The Subcommittee

Obtaining physician buy-in is crucial to the success and sustainability of an ASP. The core team should establish and regularly communicate or interact with a subcommittee that may include directors of various departments, such as the intensive care unit(s) in a hospital or the department of nursing in an LTC facility. The core team should also identify a group of prescribing physicians that understand and can serve as program champions.

8. See note 2.
9. See note 2.
10. See note 4.

TOOLS: Assessment of Current Practices Survey (APPENDIX A1 (HOSPITAL) AND A2 (LTC))

As you begin to evaluate your institution's current antimicrobial environment, use this current practices assessment form to systematically organize information.

Clinician Pre/Post-Perception Survey (APPENDIX B)

Some studies show that therapeutic guidelines available to physicians "vary widely and often conflict with what is considered best practice at an institution."[11] Additionally, while most clinicians are aware of the issues surrounding antimicrobial resistance, the degree of antimicrobial resistance and the impact of antibiotic prescribing patterns on resistance is frequently underestimated.[12] Thus, this survey was designed to serve two purposes: 1) to assess the prescribing clinicians and pharmacists' perception and knowledge at baseline and after the interventions have been implemented; and 2) to educate clinicians about antimicrobial resistance, antibiotic prescribing practices, and ASPs. Depending on your implementation strategy, this survey may be administered on a hospital-wide or unit-by-unit basis.The results of the survey may provide important information about barriers that may be encountered by the ASP and topics for which educational interventions are needed.

Antibiotic Tracking Sheet (APPENDIX C)

This form may assist in identifying current antibiotic prescribing and management practices within a facility and may also be used to assess any changes in trends once interventions have been implemented. In the pilot project, LTC facilities used this form to track all antibiotics that have been prescribed to a resident.This form has also been used as a communication tool to assist in the continuum of care as patients transfer from one facility to another.

11. See note 2.
12. See note 2.

CHAPTER III:
ANTIMICROBIAL STEWARDSHIP STRATEGIES

A. PLANNING AND IMPLEMENTATION

Facility staff often will inadvertently set themselves up for failure by trying to do too much at one time. Without well-established goals and an implementation strategy, "established" programs can become ineffective and overwhelming. To roll out a program in an organized fashion, it is recommended that the facility staff identify one to two target areas for intervention based on findings from the assessment of current practices and on resource availability. Target areas are often recurrent problems and may include, but are not limited to:

1. Common clinical infectious syndromes treated at the facility (e.g., UTI, CAP, "fever")
2. Specific pathogens
3. Specific antimicrobial agents

Once the target area(s) have been identified, determine which evidence-based strategies may be most effective in addressing the issue(s) and begin planning the implementation process.

A few items to consider and include in your plan:

1. Implement the program unit-by-unit or hospital-wide
2. Impact on available resources (e.g., staff and funds)
3. Realistic and manageable timeframe

B. STRATEGIES

In 2005, the Infectious Diseases Society of America and the Society for Healthcare Epidemiology of America (IDSA/SHEA) published guidelines for developing an ASP. The guidelines discussed two proactive core strategies and several supplemental strategies, which are described below. An ASP may involve any number or combination of these strategies, so when considering some of the elements mentioned above, an institution should individualize strategies as appropriate.

CORE STRATEGIES[13]	SUPPLEMENTAL STRATEGIES
Prospective audit with intervention and feedback	Education
	Guidelines and clinical pathways
	Antimicrobial cycling
	Antimicrobial order forms
Formulary restriction and preauthorization	Combination therapy
	Streamlining or de-escalation of therapy
	Dose optimization
	Parenteral to oral conversion
	Health care information technology

13. See note 4.

Based on the IDSA/SHEA guidelines, the list below was created to illustrate how an institution may be able to prioritize and tailor strategies as appropriate to meet its needs and to significantly impact its target area. (See Appendices D1 and D2.)

ACUTE CARE FACILITY	LONG TERM CARE FACILITY
1. Create a plan and materials that could be used to continuously educate and communicate with hospital staff (See Appendices E, F, and G).	1. Develop or refine surveillance system.
2. Develop and distribute an antibiogram.	2. Discuss development and use of an antibiogram.
3. Develop guidelines (e.g., care path) for diagnosis, treatment, and duration of antibiotic therapy and other interventions to treat infections.	3. Develop guidelines (e.g., care path) for diagnosis, treatment, and duration of antibiotic therapy and other interventions to treat infections.
4. Identify dose optimization strategies.	4. Develop criteria for identifying resistance trends and infection outbreaks.
5. Provide guidelines for parenteral to oral conversion.	
6. Create formulary decisions, including antibiotic restrictions.	
7. Develop policy or guidelines to streamline or de-escalate therapy.	
8. Develop antimicrobial order forms with algorithms for common entities.	
9. Provide continuous prospective review with feedback and interventions.	
10. Communicate recommendations via chart stickers, notes, or face-to-face (See Appendices H, I, J, and K).	

In addition to the strategies above, a few advanced approaches to consider are tailoring or customizing support systems that are available at the facility to support the ASP:

1. EMR (mostly applicable to hospitals)
2. CPOE (mostly applicable to hospitals)
3. Computer-based surveillance

TOOLS: Sample Models (APPENDIX D1 [HOSPITAL] AND D2 [LTC])

Since implementing an ASP is not a "one size fits all" approach, this table provides a snapshot of the various methods each of the participating and a few of the Steering Committee facilities used based on their available resources, including staffing models, support systems, etc.

Marketing Brochure (APPENDIX E)

"Physician acceptance is extremely important during the design and implementation of the ASP."[14] Therefore, early involvement and ongoing communication with physicians about the program may assist in achieving added physician buy-in. The marketing brochure briefly describes the general concepts of an ASP and provides important information about the institution's specific program. This brochure should be customized by the institution.

Clinician-oriented PowerPoint Presentation with Teaching Guide (APPENDIX F)

Knowledge about ASP may vary among staff; thus, the core antimicrobial stewardship team should provide the staff with general information and the positive effects of an ASP as well as the institution's specific need for an ASP prior to implementation. This comprehensive presentation provides a brief overview of the following topics:

1. Antimicrobial use, misuse, and resistance
2. General concepts and strategies of an ASP
3. Institution-specific data and information about its ASP (customizable slides)

The presentation also includes a teaching guide for the presenter, which highlights the purpose and the key points of each slide.

Pre-/Post-Assessment (Clinician Specific) (APPENDIX G)

Most clinicians are aware that there are issues surrounding antimicrobial resistance, but front-line practitioners who are the primary prescribers of antibiotics on a day-to-day basis may not be familiar with the facility's stewardship initiatives. Likewise, they may not be aware of how their prescribing practices conflict with the goals of the program. Education is a necessary component for changing behavior to improve antibiotic use. This survey provides questions on a variety of topics that incorporates basic principles of Antibiotic Stewardship. It is intended for you to tailor according to your facility's demographics and education initiatives. The survey can help identify areas where education is needed or for assessing the success of the interventions that have been implemented.

14. See note 7.

TOOLS CONTINUED:

Sample Recommendation Chart Stickers – IV:PO (APPENDIX H)

(Developed by Good Samaritan Hospital Medical Center)

One method used to continuously review and provide feedback or interventions to the prescribing physician is to place recommendations and/or reminders in the patient's chart. This particular sticker may be used for automatic parenteral to oral (IV:PO) antibiotic conversions. Once the ASP's infectious disease–trained physician reviews the case with the clinical pharmacist and approves the IV:PO conversion, a pharmacist can then place this sticker in the patient's chart to communicate the new order intervention/recommendation to the treating clinician and nurse. Note:This method would not apply for facilities that utilize electronic medical records.

Sample Recommendation Chart Stickers – No Infection (APPENDIX I)

(Developed by Good Samaritan Hospital Medical Center)

Another sample chart sticker that may used to communicate antibiotic recommendations is for cases where there is no infection. If an ASP's infectious disease-trained physician reviews a case in conjunction with the clinical pharmacist and finds that there is no evidence of an infection or no documented indications for the current antibiotic treatment, the clinical pharmacist may place this sticker in the patient's chart to communicate the recommendation to the treating clinician. This is not an actual order; the clinician must accept or reject the intervention. Note: This method would not apply for facilities that use electronic medical records.

Sample Antimicrobial Stewardship Program Initial Request (APPENDIX J)

This is a form that may be useful to the member(s) of the stewardship team who are responsible for providing initial approvals of antimicrobial prescriptions or initial chart reviews of patients receiving one or more targeted antimicrobials. The primary purpose of the form is to assist the team with day-to-day management of the program, including consistent collection and documentation of relevant clinical data and interventions made by the team at the level of the individual patient, identification of patients for whom additional follow-up is needed, and a tool by which appropriate hand-offs from one team member to another can be made when necessary. In addition, the data from these forms can be aggregated over time to document the activities and interventions made by the Antimicrobial Stewardship Program. (See Appendix L.) This may be one way to demonstrate the value of ASP to the facility's administration and others.

Antimicrobial Stewardship Program Follow-Up (APPENDIX K)

This is a form that may be useful to member(s) of the stewardship team when a patient who was previously reviewed by the team is being re-evaluated to determine if an initially approved or recommended antibiotic regimen remains appropriate. For example, some programs re-evaluate patients initially prescribed an empiric broad-spectrum antimicrobial two to three days after the initial approval or prescription. This is done to determine if the results of the work-up (blood tests, cultures, imaging, etc.) suggest the need to alter the initially prescribed regimen (e.g., narrow spectrum of therapy, discontinue antibiotic therapy, or add coverage for an identified organism for which the initially prescribed regimen was not adequate). As with the "Initial Request" form, the information collected on the "Follow-Up" forms may be aggregated over time to document the activities and interventions made by the Antimicrobial Stewardship team as one way to demonstrate the benefit of the program.

CHAPTER IV:
SUSTAINING AN EFFECTIVE ANTIMICROBIAL STEWARDSHIP PROGRAM

A. DATA COLLECTION

Due to the limited timeframe, data was not formally collected during the GNYHA/UHF Antimicrobial Stewardship Project. While quantitative data is not available, this project appears to have significantly impacted the Antimicrobial Stewardship processes and operations at the participating facilities. Additionally, some participating facilities were able to identify data sources and implement their own data collection strategies for both process and outcomes measurement, which is encouraged for any ASP.

Process and outcomes measures to consider include:[15]

Programmatic

1. Number and type of interventions and/or recommendations made by the ASP (See Appendix L)
2. Rates of clinician acceptance or implementation of ASP recommendations

Usage

1. Quantity of total antimicrobial use (e.g., in defined daily doses, days of therapy, or grams)
2. Quantity of targeted antimicrobial use (e.g., in defined daily doses, days of therapy, or grams)
3. Duration of therapy
4. Percentage of oral vs. intravenous drug administration for agents with both oral and intravenous formulations
5. Antimicrobial drug expenditures (demonstrate cost savings/neutrality)

Clinical

1. All-cause mortality
2. Infection-related mortality
3. Duration of hospitalization
4. Rates of readmission
5. Clinical cure (with or without precise definitions)

Microbiologic

1. Percent of organisms resistant to certain antimicrobial
2. Percent of multi-drug resistant organisms
3. Number of infections due to specified organisms
4. Rate of isolation of resistant organisms

Costs

1. Rates of clinician acceptance or implementation of ASP recommendations

B. MAKING THE BUSINESS CASE FOR AN ANTIMICROBIAL STEWARDSHIP PROGRAM

Although the primary goals of an ASP are related to improvement in patient-related outcomes, the ASP can also result in cost-savings (or cost-avoidance) for health care facilities. Facility administrators may require the ASP to provide data related to the costs of the program (e.g., personnel, information technology resources) and the cost-savings generated by the ASP. Although there is currently no validated method of documenting the savings generated by an ASP available, this document attempts to provide some guidance and suggestions to assist in making a "business case" for an ASP.

1. Calculation of *anticipated savings* may be based on current use and practices and estimates of the impact of proposed interventions. Such calculations may be useful in obtaining initial support for the development of an ASP.
2. Calculation of *actual savings* can be based on the results of specific patient-level interventions or on aggregate data for the entire hospital/facility from pre- and post-intervention periods. Such calculations may be one method of demonstrating the value of the ASP and justifying requests for additional financial support (e.g., personnel resources) for the program.

15. See note 2.

Some interventions and changes that are initiated by the ASP can achieve cost-savings that are relatively easy to measure. These items have often been used to estimate the cost-savings generated by the ASP.

1. IV:PO conversions
    a. Examples of opportunities for IV:PO conversion include:
        i. Conversion from the intravenous formulation of a drug to its oral formulation, which has bioavailability that is essentially equivalent to that of the intravenous formulation (e.g., fluoroquinolones, linezolid, fluconazole, voriconazole).
        ii. Conversion from empiric intravenous antimicrobial agent(s) to oral antimicrobial agent(s) when a patient is clinically improving (e.g., community-acquired pneumonia).
    b. Methods of calculating cost savings
        i. Anticipated cost-savings may be estimated by assessing historical use of agents listed above to determine the proportion of treatment days during which intravenous therapy was used when oral therapy would have been appropriate.
        ii. Actual cost savings can be calculated by tracking IV:PO conversions that were initiated by the ASP (See Appendix M) or estimated by comparing the IV:PO ratio for the pre-intervention period to that of the post-intervention period.
2. Reductions in use of high-cost antimicrobials:
    a. Interventions, such as formulary restriction and prior authorization, which result in decreased use of high-cost antimicrobials with preferential use of similarly effective but less expensive agents can lead to substantial savings. These high-cost antimicrobials include many antifungal agents, new agents for treating resistant gram-positive organisms (e.g., daptomycin), and some broad-spectrum antimicrobials. Assessments of historical data regarding the appropriateness of using these agents can allow for estimates of the cost savings that would be anticipated with the introduction of an ASP. Actual cost savings can be calculated following the introduction of the intervention(s).
3. Reductions in performing therapeutic drug monitoring (TDM) lab tests
    a. In addition to the expense of the antimicrobial agents themselves, some agents, such as vancomycin and the aminoglycosides, are associated with additional expenses related to TDM. However, this monitoring is often performed at inappropriate times or more frequently than necessary, resulting in unnecessary laboratory costs. One local hospital determined that 60% of all vancomycin and aminoglycoside TDM tests were obtained for inappropriate indications. The ASP may reduce unnecessary testing through several mechanisms, including: clinician education programs, patient-specific testing recommendations, and dose optimization efforts leading to reduced needs for dose adjustment and retesting.
        i. Anticipated cost-savings were calculated by subtracting the cost of tests (cost of a single test multiplied by the number of tests) that were likely to have been avoided by the introduction of an ASP from the actual cost of all tests that were performed. A range of cost-savings estimates was provided based on variable rates of clinician acceptance of ASP recommendations.
        ii. Estimated actual cost savings can be calculated by comparing the cost of TDM (number of tests performed multiplied by the cost of the test[s]) in the post-intervention period to a comparable time period during the pre-intervention period.
4. Reduction in overall antimicrobial use
    a. Some ASPs have reported substantial reductions in facility-wide use of antimicrobial agents. The amount of antibiotics used over time (including periods before and after introduction of the ASP) can be monitored. This monitoring may include all antimicrobial agents or a select group of antimicrobial

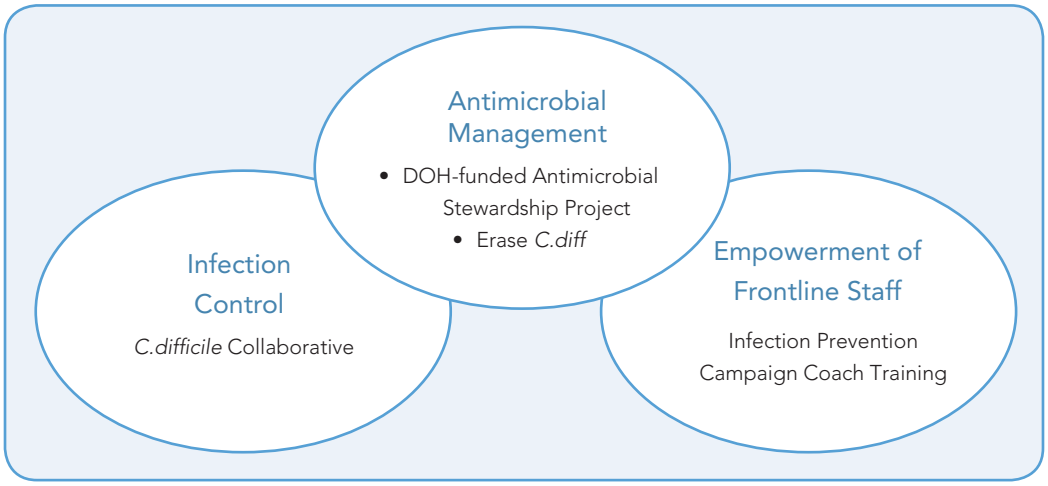
agents, such as the most commonly used, broadspectrum agents. There are some difficulties, however, in calculating and comparing the costs of or expenditures for antimicrobial agents over time. For example, costs of an individual agent may change over time for a variety of reasons (e.g., a medication becomes available in a generic form, a manufacturer "bundles" multiple drugs together in a contract resulting in increased or decreased costs of some of these or other drugs). Thus, antibiotic expenditures may not be directly correlated with the amount of antibiotic used.

The ASP can also result in important clinical outcomes that may also be associated with cost-savings, but for which determination of exact costs avoided is difficult. These difficulties are due to several issues, such as the inability to directly attribute an outcome to the ASP (due to confounding factors such as infection control initiatives or changes in staffing or patient populations) and inability to assign specific costs to some outcomes. However, some ASPs may choose to provide some estimate of savings associated with these clinical outcomes, such as:

1. Reduced length of hospital stay (e.g., through IV:PO to oral conversions and optimized treatment regimens).
2. Reduced incidence of *C. difficile* (e.g., through reductions in inappropriate use of antimicrobials, reductions in use of unnecessarily broadspectrum antimicrobials, and reductions in inappropriately long duration of therapy).
3. Reductions in rates of antibiotic resistance among health care facility–associated pathogens (e.g., through reductions in inappropriate use of antimicrobials, reductions in use of unnecessarily broadspectrum antimicrobials, and reductions in inappropriately long duration of therapy).
4. Reduced incidence of toxicity (e.g., reduced incidence of renal dysfunction through dose optimization of aminoglycosides).

Antimicrobial Stewardship Programs Go Hand-in-Hand With Infection Prevention Strategies

In addition to implementing an ASP, an institution must also develop and maintain comprehensive infection prevention practices to effectively address and prevent the transmission of MDROs. These practices should include regular staff compliance with hand hygiene (observed per facility's policy), proper contact precautions and PPE, appropriate patient placement, and proper environmental cleaning.[16]



16. GNYHA/UHF *C. difficile* Collaborative Bundle Monitoring Checklist.

TOOLS: Process Measurement – Recommendation Tracking Tool (APPENDIX L)

The Recommendation Tracking Tool is designed to help monitor a facility's ASP recommendations and to assess the impact of the ASP on the institution's antibiotic prescribing practices.The form is designed to accept one calendar year of data. On a daily basis, enter the number of patients and the number of interventions recommended/implemented, and the form will then automatically calculate the total number and percent of the recommended interventions implemented. A facility can also review Antimicrobial Stewardship activity on a monthly basis using the summary data table, which examines the types of interventions implemented. It also provides a yearly summary.

Theoretical Monthly Savings of an Antimicrobial Stewardship Program (APPENDIX M)

The purpose of this tool is to exemplify how actual cost savings can be calculated by tracking parenteral to oral (IV:PO) conversions that were initiated by the ASP or estimated by comparing the IV:PO ratio for the pre- to post-intervention period.

Administrator-oriented PowerPoint Presentation with Teaching Guide (APPENDIX N)

The purpose of this presentation is to provide senior leadership at health care institutions with a guide to understand how they can begin AND sustain an effective ASP. The presentation is split in the following sections:

- Introducing Antimicrobial Stewardship: What is the impact of health care–acquired infections and antimicrobial resistance on clinical and economic outcomes? What is antibiotic resistance? Why is Antimicrobial Stewardship important?
- Setting up the case to implement Antimicrobial Stewardship: What are the goals of Antimicrobial Stewardship and the options for implementing it? What team members/disciplines should be involved?
- Implementing Antimicrobial Stewardship: What strategies can the "C-Suite" take on to implement Antimicrobial Stewardship? What does it take to implement a successful program? What are some preliminary steps to take to implement Antimicrobial Stewardship?

CHAPTER V:
ADDITIONAL RESOURCES

The Centers for Disease Control and Prevention. Campaign to Prevent Antimicrobial Resistance in Healthcare Settings. http://www.cdc.gov/drugresistance/healthcare/default.htm

Dellit T.H., et al. "Infectious Diseases Society of America and the Society for Healthcare Epidemiology of America Guidelines for Developing an Institutional Program to Enhance Antimicrobial Stewardship." *Clinical Infectious Diseases* (2007) 44: 159–77.

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Shlaes D.M., et al. "Society for Healthcare Epidemiology of America and Infectious Diseases Society of America Joint Committee on the Prevention of Antimicrobial Resistance: Guidelines for the Prevention of Antimicrobial Resistance in Hospitals." *Infection Control Hospital Epidemiology* (1997) 18: 275–291.

Smith P.W., P.G. Rusnak. "Infection Prevention and Control in the Long-term Care Facility." *Infection Control Hospital Epidemiology* (1997) 18: 831–849.

Weber S, et al. "Why Every Health Care Executive Should Know: The Cost of Antibiotic Resistance." *The Joint Commission Resources* (2009).

CHAPTER VI:
APPENDICES

Appendix A1 (Hospital)	Assessment of Current Practices Survey
Appendix A2 (Long Term Care)	Assessment of Current Practices Survey
Appendix B	Clinician Pre-/Post-Perception Survey
Appendix C	Antibiotic Tracking Sheet
Appendix D1 (Hospital)	Sample Models
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Appendix G	Pre-/Post-Assessment (Clinician Specific)
Appendix H	Sample Recommendation Chart Stickers – IV:PO
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Appendix J	Sample Antimicrobial Stewardship Program Initial Request
Appendix K	Antimicrobial Stewardship Program Follow-Up
Appendix L	Process Measurement – Recommendation Tracking Tool
Appendix M	Theoretical Monthly Savings of an Antimicrobial Stewardship Program
Appendix N	Administrator-Oriented PowerPoint Presentation with Teaching Guide

Electronic Versions of Appendices are available at http://www.gnyha.org/antimicrobial/toolkit.

APPENDIX A1 (HOSPITAL): ASSESSMENT OF CURRENT PRACTICES SURVEY

ASSESSMENT OF CURRENT PRACTICES SURVEY

ASSESSMENT OF CURRENT PRACTICES

This questionnaire was developed to better understand your current antimicrobial practices and your experience with antimicrobial stewardship.

FACILITY NAME: _____ **DATE:** _____

ACUTE CARE FACILITY		
1. Is your pharmacy open 24/7?	Yes ☐	No ☐
a. *If no*, what are the pharmacy's hours:		
b. Please describe the off-hours coverage plan:		
c. Antimicrobial use data is provided in (Please check all that apply):	☐ Amount used (i.e., grams or milligrams) ☐ Defined Daily Doses (DDD) ☐ Dollars spent ☐ Other (*please specify*_____)	
2. Do you have an in-house microbiology lab?	Yes ☐	No ☐
a. *If no*, where are the microbiology services performed?		
b. How frequently is susceptibility/resistance information reported to the institution?		
c. How are you able to access the data?		
d. Are you able to obtain unit-specific data on an as-needed basis?	Yes ☐	No ☐
3. Is an antibiogram developed for your facility? (an aggregation of sensitivity of organisms)	Yes ☐	No ☐
a. *If yes*, how often? (Monthly, quarterly, annually)		
b. Does your facility have unit-specific antibiograms?	Yes ☐	No ☐
4. Are you currently utilizing computer-based surveillance for antibiotic use or health care–acquired infections?	Yes ☐	No ☐
a. *If yes*, please specify the system that is currently in-use.		
5. What are the top three common infectious clinical syndromes at your facility that are either known or estimated?	1. _____ 2. _____ 3. _____	

continued on next page

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ASSESSMENT OF CURRENT PRACTICES SURVEY *(continued)*

6.	How is information pertaining to infection surveillance reported (by syndrome, overall incidence within the facility)? *Please list all.*	
7.	What are the criteria used to identify resistance or infection trends requiring further intervention?	
8.	Which staff currently is or will be part of your core antimicrobial stewardship team? *Please check all that apply.*	☐ Infectious Disease–Trained Physician ☐ Clinical Pharmacist ☐ Clinical Microbiologist ☐ Infection Control Practitioner ☐ Hospital Epidemiologist ☐ Senior Leadership ☐ Information System Specialist ☐ Other (*Please specify*_____)
9.	Do you have computer physician/clinician order entry (CPOE)?	Yes ☐ No ☐
a.	***If yes***, does this include medications, such as antibiotics?	Yes ☐ No ☐
b.	***If yes***, does it include all areas of the hospital?	Yes ☐ No ☐
10.	What are/were the barriers to implementation at your facility? *Please check all that apply.*	☐ Financial considerations/ cost ☐ Opposition from prescribers ☐ Resistance from administration ☐ Other clinical initiatives are higher priority ☐ Personnel shortages ☐ None of the above ☐ Other (*Please specify*_____)

APPENDIX A2 (LONG TERM CARE): ASSESSMENT OF CURRENT PRACTICES SURVEY

ASSESSMENT OF CURRENT PRACTICES SURVEY

ASSESSMENT OF CURRENT PRACTICES

This questionnaire was developed to better understand your current antimicrobial practices and your experience with antimicrobial stewardship.

FACILITY NAME: _____ **DATE:** _____

LONG TERM CARE FACILITY		
1. Do you have an in-house phamacy?	Yes ☐	No ☐
a. *If yes*, Is your pharmacy open 24/7?	Yes ☐	No ☐
i. *If your pharmacy is not open 24/7*, what are the pharmacy's hours:		
ii. Please describe the off-hours coverage plan:		
b. Who is responsible for performing infection surveillance at the facility?		
c. Do you track antibiotic use data?	Yes ☐	No ☐
d. *If yes*, how is antimicrobial use data reported? *Please check all that apply.*	☐ Amount used (i.e., grams or milligrams) ☐ Defined Daily Dose (DDD) ☐ Dollars spent ☐ Other (*Please specify*_____)	
2. Do you have an in-house microbiology lab?	Yes ☐	No ☐
a. *If no*, where are the microbiology services performed?		
b. Can you obtain antimicrobial resistance data from the in-house or external microbiology lab?	Yes ☐	No ☐
c. How are you able to access the data?		
d. Are you able to obtain unit-specific data on an as-needed basis?	Yes ☐	No ☐
3. Is an antibiogram developed for your facility? (an aggregation of sensitivity of organisms)	Yes ☐	No ☐
a. *If yes*, how often (Monthly, quarterly, annually)?		
4. Are you currently utilizing computer based surveillance for antibiotic use or health care–acquired infections?	Yes ☐	No ☐

ASSESSMENT OF CURRENT PRACTICES SURVEY *(continued)*

	a. ***If yes***, please specify the system that is currently in use.		
5.	What are the top three common infectious clinical syndromes at your facility that are either known or estimated?	1. _____ 2. _____ 3. _____	
6.	Which staff currently is or will be part of your core antimicrobial stewardship team? *Please check all that apply.*	☐ Infectious Disease–Trained Physician ☐ Clinical Pharmacist ☐ Clinical Microbiologist ☐ Infection Control Practitioner ☐ Hospital Epidemiologist ☐ Senior Leadership ☐ Information System Specialist ☐ Other (*Please specify*_____)	
7.	Do you have Computer physician/clinician order entry (CPOE)?	Yes ☐	No ☐
	a. ***If yes***, does this include medications, such as antibiotics?	Yes ☐	No ☐
8.	What are/were the barriers to implementation at your facility? *Please check all that apply.*	☐ Financial considerations/ cost ☐ Opposition from prescribers ☐ Resistance from administration ☐ Other clinical initiatives are higher priority ☐ Personnel shortages ☐ None of the above ☐ Other (*Please specify*_____)	
	a. How frequently are reports pertaining to infection surveillance created (Monthly, quarterly, annually, on an as-needed basis)?		
	b. How is the information reported (by syndrome, overall incidence within the facility)? *Please list all.*		
	c. What are the criteria used to identify resistance or infection trends requiring further intervention?		

APPENDIX B:
CLINICIAN PRE-/POST-PERCEPTION SURVEY

ANTIMICROBIAL STEWARDSHIP SURVEY[1]

Please indicate your agreement or disagreement with the following statements about your institution.

ANTIMICROBIAL RESISTANCE: SCOPE OF THE PROBLEM AND KEY CONTRIBUTORS	Strongly Disagree	Disagree	Neither	Agree	Strongly Agree
1. Antibiotic resistance is a significant problem in this institution.	○	○	○	○	○
2. Patient rooms are cleaned according to hospital cleaning protocol once a multidrug resistant organism (MDRO) patient has been discharged.	○	○	○	○	○
3. Adherence to hand-hygiene protocols is excellent at this institution.	○	○	○	○	○
4. This institution does NOT do enough to control the development of resistant organisms through surveillance.	○	○	○	○	○
5. This institution does NOT provide adequate staff education regarding MDROs.	○	○	○	○	○
6. A patient is likely to develop a MDRO infection during their stay at this institution.	○	○	○	○	○

ANTIBIOTIC PRESCRIBING PRACTICES	Strongly Disagree	Disagree	Neither	Agree	Strongly Agree
7. Microbiology lab results are efficiently communicated to the treating physician.	○	○	○	○	○
8. I regularly refer to/consider the antibiotic susceptibility patterns at this institution (e.g., the institutional antibiogram) when empirically prescribing antibiotics.	○	○	○	○	○
9. If medically appropriate, intravenous antibiotics should be stepped down to an oral alternative after three days.	○	○	○	○	○
10. Restrictions on antibiotics impair my ability to provide good patient care.	○	○	○	○	○
11. Antibiotics are overused at this institution.	○	○	○	○	○
12. More judicious use of antibiotics would decrease antimicrobial resistance.	○	○	○	○	○

ANTIMICROBIAL STEWARDSHIP PROGRAMS (A formal program that monitors and manages the appropriate use of antibiotics.)	Strongly Disagree	Disagree	Neither	Agree	Strongly Agree
13. Antimicrobial stewardship programs improve patient care.	○	○	○	○	○
14. Antimicrobial stewardship programs reduce the problem of antimicrobial resistance.	○	○	○	○	○

1. Antimicrobial Stewardship Survey based on the AHRQ Hospital Survey on Patient Safety Culture. http://www.ahrq.gov/qual/patientsafetyculture/hospsurvindex.htm

Electronic Versions of Appendices are available at http://www.gnyha.org/antimicrobial/toolkit.

ANTIMICROBIAL STEWARDSHIP SURVEY *(continued)*

15. Antimicrobial stewardship programs impact this institution's infection rates.	○	○	○	○	○
16. This institution has an effective antimicrobial stewardship program.	○	○	○	○	○
17. My individual efforts at antimicrobial stewardship minimally impact this institution's resistance problem.	○	○	○	○	○
18. This institution does NOT provide adequate training on antimicrobial prescribing and use.	○	○	○	○	○
19. Additional staff education on antimicrobial prescribing is needed.	○	○	○	○	○
20. Prescribing physicians are the only disciplines who need to understand antimicrobial stewardship.	○	○	○	○	○

PREVALENCE OF ANTIMICROBIAL RESISTANCE (OPTIONAL)	
Please indicate the proportion of isolates of each organism listed below that is resistant to the antibiotic indicated at your institution.	
Staphylococcus aureus resistant to methicillin or oxacillin (i.e., MRSA)	%
Enterococcus faecium resistant to vancomycin (i.e., VRE)	%
Pseudomonas aeruginosa resistant to ciprofloxacin	%
Pseudomonas aeruginosa resistant to cefepime	%
Pseudomonas aeruginosa resistant to imipenem	%
Klebsiella pneumoniae resistant to ceftriaxone	%
Klebsiella pneumoniae resistant to imipenem	%
E. coli resistant to ceftriaxone	%
Acinetobacter baumannii resistant to imipenem	%

BACKGROUND INFORMATION

1. What is your primary work area or unit in this institution? (Please check ONE answer)

☐ Many different units/ No specific unit ☐ Medicine (non-surgical) ☐ Intensive care unit (any type) ☐ Radiology
☐ Surgery ☐ Psychiatry/mental health ☐ Obstetrics ☐ Rehabilitation
☐ Anesthesiology ☐ Pediatrics ☐ Pharmacy ☐ Emergency department
☐ Laboratory ☐ Other (please specify)

2. How long have you worked in this institution?

☐ Less than 1 year ☐ 6 to 10 years ☐ 16 to 20 years
☐ 1 to 5 years ☐ 11 to 15 years ☐ 21 years or more

3. What is your staff position in this institution?

☐ Attending/Staff physician ☐ Fellow ☐ Physician assistant ☐ Infection control practitioner
☐ Resident physician/Intern ☐ Pharmacist ☐ Nurse practitioner ☐ Other (please specify_____)

4. How long have you worked in your current specialty or profession?

☐ Less than 1 year ☐ 6 to 10 years ☐ 16 to 20 years
☐ 1 to 5 years ☐ 11 to 15 years ☐ 21 years or more

APPENDIX C:
ANTIBIOTIC TRACKING SHEET

ANTIBIOTIC TRACKING SHEET

Instructions: Please use this form to track all antibiotics that have been prescribed to a resident. Please note that this sheet represents all antibiotics that have been prescribed to ONE specific resident.

RESIDENT ID:	PRESCRIBING MD:	ADMISSION DATE: / /

ANTIBIOTIC #1:

DATE: (MM/DD/YY)		INDICATIONS FOR USE (Please check all that apply)			DIAGNOSTIC TESTS (Please check all tests that were performed)			
START	STOP	YES	NO		YES	NO		RESULTS
		Ⓨ	Ⓝ	FEVER	Ⓨ	Ⓝ	BLOOD CULTURE	
DOES THE PATIENT HAVE ANY OF THE FOLLOWING DEVICES?		Ⓨ	Ⓝ	URINARY TRACT SYMPTOMS	Ⓨ	Ⓝ	URINE CULTURE	
		Ⓨ	Ⓝ	RESPIRATORY SYMPTOMS	Ⓨ	Ⓝ	URINALYSIS	
Ⓨ Ⓝ	URINARY CATHETER	Ⓨ	Ⓝ	DIARRHEA	Ⓨ	Ⓝ	RESPIRATORY SPECIMEN CULTURE/TEST	
Ⓨ Ⓝ	CENTRAL LINE	Ⓨ	Ⓝ	SKIN/WOUND INFECTION	Ⓨ	Ⓝ	STOOL CULTURE/TEST	
Ⓨ Ⓝ	VENTILATOR	Ⓨ	Ⓝ	OTHER (PLEASE SPECIFY):	Ⓨ	Ⓝ	CHEST X-RAY	
LTC FACILITY ONLY: DID THIS PATIENT REQUIRE TRANSFER TO HOSPITAL?					Ⓨ	Ⓝ	CBC	
		Ⓨ	Ⓝ	IS THE PATIENT COLONIZED WITH RESISTANT ORGANISM?	Ⓨ	Ⓝ	WOUND CULTURE	
YES Ⓨ	NO Ⓝ				Ⓨ	Ⓝ	OTHER (PLEASE SPECIFY):	

ANTIBIOTIC #2:

DATE: (MM/DD/YY)		INDICATIONS FOR USE (Please check all that apply)			DIAGNOSTIC TESTS (Please check all tests that were performed)			
START	STOP	YES	NO		YES	NO		RESULTS
		Ⓨ	Ⓝ	FEVER	Ⓨ	Ⓝ	BLOOD CULTURE	
		Ⓨ	Ⓝ	URINARY TRACT SYMPTOMS	Ⓨ	Ⓝ	URINE CULTURE	
		Ⓨ	Ⓝ	RESPIRATORY SYMPTOMS	Ⓨ	Ⓝ	URINALYSIS	
		Ⓨ	Ⓝ	DIARRHEA	Ⓨ	Ⓝ	RESPIRATORY SPECIMEN CULTURE/TEST	
		Ⓨ	Ⓝ	SKIN/WOUND INFECTION	Ⓨ	Ⓝ	STOOL CULTURE/TEST	
		Ⓨ	Ⓝ	OTHER (PLEASE SPECIFY):	Ⓨ	Ⓝ	CHEST X-RAY	
					Ⓨ	Ⓝ	CBC	
					Ⓨ	Ⓝ	WOUND CULTURE	
					Ⓨ	Ⓝ	OTHER (PLEASE SPECIFY):	

ANTIBIOTIC #3:

DATE: (MM/DD/YY)		INDICATIONS FOR USE (Please check all that apply)			DIAGNOSTIC TESTS (Please check all tests that were performed)			
START	STOP	YES	NO		YES	NO		RESULTS
		Ⓨ	Ⓝ	FEVER	Ⓨ	Ⓝ	BLOOD CULTURE	
		Ⓨ	Ⓝ	URINARY TRACT SYMPTOMS	Ⓨ	Ⓝ	URINE CULTURE	
		Ⓨ	Ⓝ	RESPIRATORY SYMPTOMS	Ⓨ	Ⓝ	URINALYSIS	
		Ⓨ	Ⓝ	DIARRHEA	Ⓨ	Ⓝ	RESPIRATORY SPECIMEN CULTURE/TEST	
		Ⓨ	Ⓝ	SKIN/WOUND INFECTION	Ⓨ	Ⓝ	STOOL CULTURE/TEST	
		Ⓨ	Ⓝ	OTHER (PLEASE SPECIFY):	Ⓨ	Ⓝ	CHEST X-RAY	
					Ⓨ	Ⓝ	CBC	
					Ⓨ	Ⓝ	WOUND CULTURE	
					Ⓨ	Ⓝ	OTHER (PLEASE SPECIFY):	

ANTIBIOTIC #4:

DATE: (MM/DD/YY)		INDICATIONS FOR USE (Please check all that apply)			DIAGNOSTIC TESTS (Please check all tests that were performed)			
START	STOP	YES	NO		YES	NO		RESULTS
		Ⓨ	Ⓝ	FEVER	Ⓨ	Ⓝ	BLOOD CULTURE	
		Ⓨ	Ⓝ	URINARY TRACT SYMPTOMS	Ⓨ	Ⓝ	URINE CULTURE	
		Ⓨ	Ⓝ	RESPIRATORY SYMPTOMS	Ⓨ	Ⓝ	URINALYSIS	
		Ⓨ	Ⓝ	DIARRHEA	Ⓨ	Ⓝ	RESPIRATORY SPECIMEN CULTURE/TEST	
		Ⓨ	Ⓝ	SKIN/WOUND INFECTION	Ⓨ	Ⓝ	STOOL CULTURE/TEST	
		Ⓨ	Ⓝ	OTHER (PLEASE SPECIFY):	Ⓨ	Ⓝ	CHEST X-RAY	
					Ⓨ	Ⓝ	CBC	
					Ⓨ	Ⓝ	WOUND CULTURE	
					Ⓨ	Ⓝ	OTHER (PLEASE SPECIFY):	

Electronic Versions of Appendices are available at http://www.gnyha.org/antimicrobial/toolkit.

APPENDIX D1 (HOSPITAL): SAMPLE MODELS

SAMPLE MODELS (HOSPITAL)

COMPONENTS OF ANTIMICROBIAL STEWARDSHIP PROGRAMS AT GNYHA INSTITUTIONS				
	Hospital A	Hospital B	Hospital C	Hospital D
Teaching status	Major Teaching	Major Teaching	Major Teaching	Non-Major Teaching
Number of beds	845	1,373	1,000	477
Do you use any data mining software?	No	No	No	No
Have you considered using software?	Yes, but haven't due to expense.	Yes, but haven't due to expense.	Yes, but haven't due to expense.	Yes, but haven't due to expense.
How many pharmacists do you have dedicated to stewardship?	2.5	2 PharmD each 0.5 FTE (total 1 FTE)	2	1.8
How many ID physicians do you have dedicated to stewardship?	2	1	0.25	4 (1 week rotations)
What are your main areas of focus?	Follow-up interventions	Pre-approval and follow-up interventions	Pre-approval and follow-up interventions.	Pre-approval, auto-IV to Oral, d/c abx w/o evidence of infection and follow-up interventions.
What criteria do you use for selecting patients to be reviewed?	Patients on IV antibiotics** for >3 days.	Calls for approval of restricted antibiotics and orders written for restricted antibiotics.	Call for approval of restricted antibiotics or orders for restricted drugs that are written during the overnight shift.	The Antimicrobial Stewardship Committee has identified target antibiotics based on: bioavailability—IV to oral conversion, Pharmocokinetic profile – dose optimization, Disease State formulary restriction.
On average, how many patients do you review daily?	10	Approximately 40–50 patients/day	20 approvals, 80–100 follow-ups	50–60
What is your acceptance rate?	~ 90%	85–90%	95%	85%
How are weekends handled?	No stewardship activities on the weekends.*	ID fellows evenings & limited overnight—since 9/09 11 p.m. to 8 a.m., 1 dose of most restricted antibiotics with approval sought in a.m. Excludes drugs of last resort/very toxic (e.g. Linezolid, daptmycin, pentamidine) where approval required 24/7. Stewardship team does extensive follow-up on overnight releases in a.m.	Pharmacists do 1 weekend/month, ID fellows cover the rest.	No coverage*
How are off shifts handled?	No stewardship activities off shifts*	ID fellows	Can get 1 dose until next morning.	Can get 1 dose until next morning.

*Facility does not have active stewardship participation during the off shifts and weekends; however, does have restricted antibiotics which require ID approval.

**Aztreonam, piperacillin/tazobactam, cefepime, imipenem/cilastatin, ertapenem, meropenem, ciprofloxacin, moxifloxacin, ampicillin/sulbactam, vancomycin, linezolid, tygecycline

Electronic Versions of Appendices are available at http://www.gnyha.org/antimicrobial/toolkit.

APPENDIX D2 (LONG TERM CARE): SAMPLE MODELS

SAMPLE MODELS (LONG TERM CARE)

COMPONENTS OF ANTIMICROBIAL STEWARDSHIP PROGRAMS AT LONG TERM CARE FACILITIES			
	LTC 1	LTC 2	LTC 3
Ownership	Voluntary	Voluntary	Voluntary
Number of beds	240	191	240
How is pharmacy involved in your stewardship activities?	Currently not involved.	Core team member. Facility is a pharmacy rotation site with a full-time faculty member available on-site.	Available through affiliate hospital on part-time basis.
How accessible is an ID physician for consults?	Will come within 24 hours of requesting a consult.	Will come within 24 hours of requesting a consult.	Will come within 24 hours of requesting a consult.
Are physician assistants, nurse practitioners or hospitalists on staff for managing the daily care of residents?	Yes	Yes	Yes, through affiliated hospital
What are your main areas of focus?	Due to the low number of residents on antibiotics, all residents are currently reviewed.	Develop an antibiogram. Develop guideline for appropriate treatment of urinary tract infections (define, appropriate antimicrobial agent, proper dosage).	Develop and change policies and procedures for UTIs. Develop Antibiogram education for MDs
What are the criteria used to select patients to be reviewed?	Same as above	All patients started on antimicrobials for UTI.	All patients prescribed ABT narrowed down to diagnosis
On average, how many residents are reviewed per day?	3 to 4	On average, 25 patients/residents are reviewed weekly.	Average 5 to 10/day
On average, how many interventions do you make in a day?	1	An Excel spreadsheet is sent to the Medical Director weekly for review.	Average 3 to 5/day
What is your acceptance rate?	100%	65%	Close to 100%. Occasionally MDs use clinical judgment
How do you track trends and/or areas requiring further intervention?	Tracking tool	Infection Control tracks trends and reports the data quarterly to PICG.	Use of a spreadsheet

Electronic Versions of Appendices are available at http://www.gnyha.org/antimicrobial/toolkit.

APPENDIX E:
MARKETING BROCHURE

TO: *Targeted audience at institution*

FROM: *Antibiotic Stewardship Program point personnel*

Date:

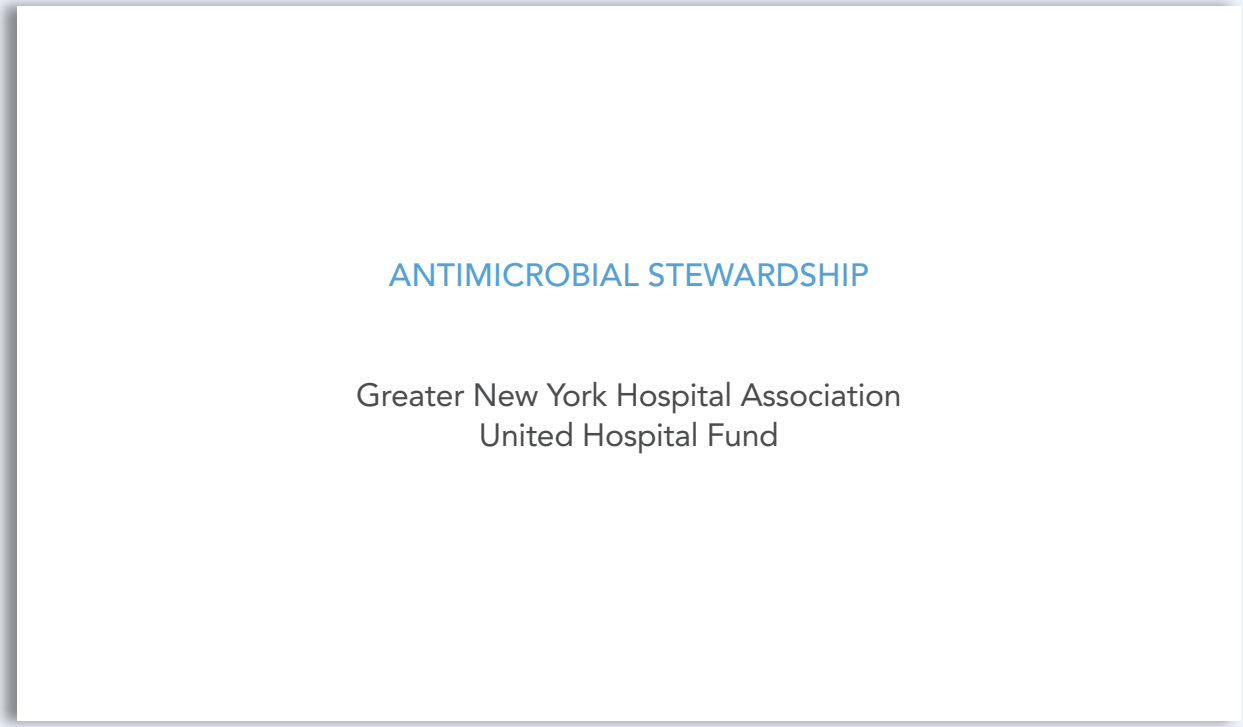
RE: Antibiotic Stewardship Program

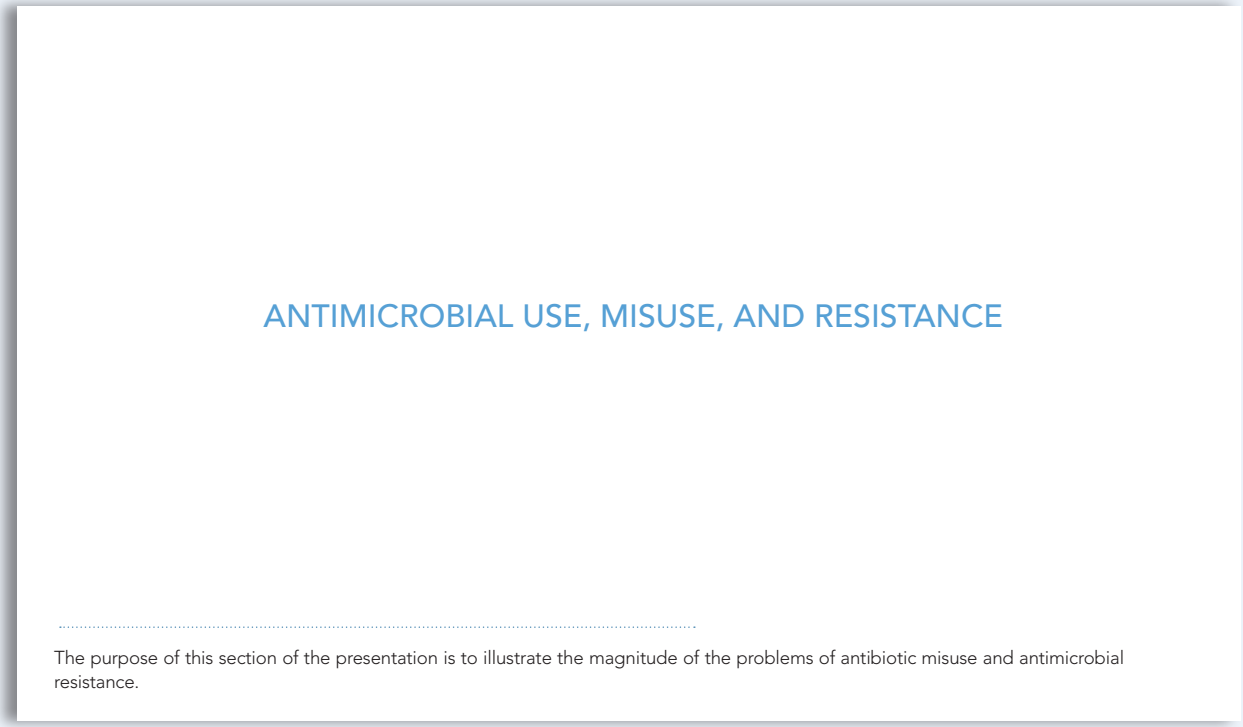
The incidence of infections attributed to multidrug-resistant organisms (MDROs) among hospital patients continues to rise despite widespread efforts to control their spread. Infections caused by MDROs are associated with worsened clinical outcomes, including an increased risk of death and significantly increased costs, mostly attributable to increased length of stay. In response to this emerging concern, *name of institution* has created an Antibiotic Stewardship Program (ASP) aimed at promoting rational antimicrobial prescribing with the goal of reducing the incidence of MDROs infections.

There is a strong correlation between antibiotic prescribing patterns and antibiotic resistance. The goal of the ASP is to optimize the selection, dose, duration, and route of therapy with the most appropriate drug for the patient's condition. The ASP is a coordinated effort between the Infection Control, Pharmacy and the Infectious Disease departments. A member from this multidisciplinary team will review patient charts in real time and may be contacting you with recommendations to tailor a patient's antibiotic regimen according to microbiologic data, local resistance patterns, evidence-based practices, national or institutional guidelines, and the patient's clinical condition. The recommendation may be to use an alternative therapy, de-escalate to an oral alternative, or to use no therapy, when necessary.

It is hoped that this core strategy of the ASP will improve outcomes for individual patients by optimizing treatment of infectious process(es) and minimizing resultant complications of therapy. In turn, improving outcomes for the larger population will reduce length of stay and mitigate antibiotic resistance by controlling antimicrobial selection pressure. The efforts of the ASP are essential to preserving the efficacy of the limited number of effective antibiotics at our disposal and improving patient care. Your participation in this important initiative is vital to the program's success. You may contact *institutional contact* with any further questions you may have regarding this program.

APPENDIX F:
CLINICIAN-ORIENTED POWERPOINT PRESENTATION WITH TEACHING GUIDE





Electronic Versions of Appendices are available at http://www.gnyha.org/antimicrobial/toolkit.

ANTIMICROBIAL USE (AND MISUSE) IN HOSPITALS

- Antimicrobial agents typically account for a large proportion of the pharmacy expenditures in a hospital.
- It has been estimated that 50% of antimicrobial use in hospitals is inappropriate.
- Inappropriate antibiotic use has been associated with propagation of antimicrobial resistance and other adverse effects.
- Appropriate use of antimicrobial agents may improve patient outcomes AND reduce hospital costs.

Purpose of slide: To introduce the major reasons for starting or expanding an antimicrobial stewardship program within the health care facility (i.e., to improve patient outcomes and reduce costs).

Key points:

1. Antimicrobials are one of the most commonly prescribed classes of pharmaceuticals in the hospital setting.
2. Much of the use of these agents is inappropriate.
3. Misuse of antibiotics can be harmful.

EXAMPLES OF INAPPROPRIATE USE OF ANTIMICROBIAL AGENTS

- Use of antibacterial agents for treatment of syndromes that are not caused by bacteria (e.g., "colds," acute bronchitis, most sore throats, "fever")
- Treatment for culture results that reflect colonization or contamination rather than infection (e.g., asymptomatic bacteriuria)
- Administration of an antibacterial with a broader-than-necessary spectrum of activity (e.g., failure to narrow spectrum based on culture results)
- Failure to consider likely pathogens and resistance patterns in selecting empiric antibiotic regimen

Purpose of slide: To give specific examples of inappropriate use of antimicrobial agents.

Key points:
People commonly think of the example of giving antibacterial therapy to patients with viral infections (e.g., a cold or acute bronchitis) as the primary form of antimicrobial misuse, but this slide demonstrates that there are many other forms of antimicrobial misuse, some of which are not nearly as obvious as the first example.

EXAMPLES OF INAPPROPRIATE USE OF ANTIMICROBIAL AGENTS

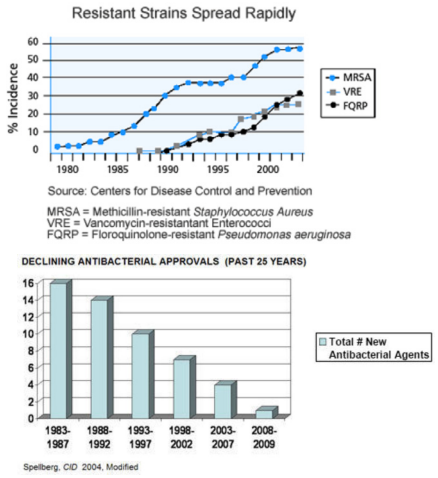
- Prescribing courses of antibacterial therapy that are longer than necessary
- Prescribing antibacterial agents at inappropriate doses (either too high or too low) or intervals
- Treating infectious processes with agents that do not provide activity against the causative agent(s)
- Using alternate agents (e.g., vancomycin) in patient's without documentation of a true penicillin allergy

Purpose of slide: To give specific examples of inappropriate use of antimicrobial agents (continued from previous slide).

ANTIMICROBIAL RESISTANCE

- The incidence of antimicrobial resistance among health care–associated pathogens has been steadily increasing over the past 2–3 decades.
- Development of new antimicrobial agents, however, has decreased.

IDSA white paper: *Bad bugs, no drugs.* July 2004.



Purpose of slide: To show the increasing problem of antimicrobial resistance and how it may be further compounded by the lack of development of new antimicrobial agents with activity against the increasing number of multidrug-resistant organisms (MDRO).

Key points:

1. The first bulleted point and the top figure are used to illustrate how the magnitude of the problem of antimicrobial resistance has grown over the past three decades and continues to grow. Antimicrobial resistance involves gram-positive organisms such as *S. aureus* and *Enterococcus* as well as gram-negative organisms such as *Pseudomonas* (as shown in this slide), *Acinetobacter, Klebsiella* species, *Enterobacter* species, and others.
2. The second bulleted point and the lower figure show that development of new antimicrobial agents is not keeping pace with the growing problem of antimicrobial resistance. The development of new antibiotics for treating infections caused by multidrug-resistant gram-negative organisms has been particularly limited.

IMPACT OF ANTIMICROBIAL RESISTANCE

- Antimicrobial-resistant infections have been associated with increased medical costs ($18,588–$29,069), excess hospital stay (6.4–12.7 days), and increased mortality (attributable mortality 6.5%) for infected patients. The excess mortality results in societal costs of $10.7–$15 million.[1]

1. Roberts, R.R., B. Hota, I. Ahmad, et al. *Clin Infect Dis* 2009; 49: 1175-84.

Purpose of slide: To show the clinical and societal impact of antimicrobial resistance.

Key points:

1. Infection with antimicrobial-resistant organisms has been associated with an increased risk of adverse patient outcomes (including increased length of hospitalization and higher rates of death).
2. In addition, treatment of these infections and their complications result in increased hospital costs.
3. Finally, the excess deaths due to these infections have major societal costs.

IMPACT OF ANTIMICROBIAL RESISTANCE

- Vancomycin-resistant *Enterococcus* infections: Bloodstream infections (BSI) associated with decreased survival (24% vs. 59%), increased LOS (34.8 vs. 16.7 days), and increased mortality as compared with infections caused by vancomycin-susceptible strains.[1, 2]
- Methicillin-resistant *S. aureus*: BSI and surgical-site infections have been associated with increased mortality and costs.[3-5]
- Cephalosporin-resistant *Enterobacter* infections: associated with increased mortality and length of stay; attributable cost of $29,379.[6]

1. Stosar V., L.R. Peterson, M. Postelnick, et al. *Archives of Internal Medicine* (1998) 158:522–527.
2. Salgado C.D., B.M. Farr, *Infection Control Hospital Epidemiology* (2003) 24:690–698.
3. Cosgrove S., G. Sakoulas, E. Perencevich, et al. *Clinical Infectious Diseases* (2003) 36: 53–9.
4. Engemann J., Y. Carmeli, S. Cosgrove, et al. *Clinical Infectious Diseases* (2003) 36:592–8.
5. Cosgrove S., Y. Oi, K. Kaye, et al. *Infection Control Hospital Epidemiology* (2005) 26:166–74.
6. Cosgrove S.E., K.S. Kaye, G.M. Eliopoulous, et al. *Archives of Internal Medicine* (2002) 162:185–190.

Purpose of slide: To give specific examples that show the increased morbidity and mortality associated with infection due to antimicrobial-resistant organisms compared to that seen in association with infection due to susceptible strains of the same type of bacteria.

Key points:

Each of these three examples refer to higher rates of adverse outcomes among persons infected with antimicrobial resistant strains of an organisms as compared to persons infected with susceptible strains of the same organism (for instance, methicillin-resistant *Staphylococcus aureus* (MRSA) compared with methicillin-susceptible *Staphylococcus aureus*).

WHY IS ANTIMICROBIAL RESISTANCE ASSOCIATED WITH ADVERSE OUTCOMES?

- Delays in initiating effective therapy.
- Less effective and/or more toxic antimicrobial therapy.
- Severity of underlying disease.
- It is probably not due to increased virulence.
    - Resistant strains have generally not been shown to be more virulent than susceptible strains of the same bacteria.
    - Community-associated MRSA may be a notable exception.

Purpose of slide: To provide possible explanations for the increased risk of adverse outcomes associated with infection due to antimicrobial-resistant organisms.

Key points:

1. The presence of antimicrobial resistance does not necessarily make an organism more virulent.
2. Other factors that may contribute to the higher rates of adverse outcomes seen among patients with infections due to resistant organisms include:
    - Delays in initiating effective therapy because the specific resistance pattern is not anticipated when an empiric antimicrobial regimen is selected.
    - Antimicrobial agents that are available to treat the resistant organism may not be as effective in treating infection as those antimicrobials to which the organism is resistant.
    - Patients with severe underlying medical conditions are at greater risk of acquiring and being infected with many antimicrobial-resistant organisms and these conditions may contribute to higher rates of adverse outcomes.

ANTIMICROBIAL STEWARDSHIP

The purpose of this section of the presentation is to introduce the concept of antimicrobial stewardship.

ANTIMICROBIAL STEWARDSHIP

- Antimicrobial stewardship is defined as a rational, systematic approach to the use of antimicrobial agents in order to achieve optimal outcomes.
- "Optimal outcomes" include those of the patient (achievement of cure, avoidance of toxicity and other adverse effects) and of the larger population (avoidance of emergence or propagation of antimicrobial resistance).

Purpose of slide: To define "antimicrobial stewardship" and to list the major outcomes that antimicrobial stewardship programs seek to achieve.

Key points:

1. The purpose of an antimicrobial stewardship program is to prove a rational and systematic approach to the use of antimicrobials.
2. The immediate goals of the program are focused on improving outcomes for individual patients, but over the longer term, it is anticipated that the benefits will extend to a larger population through avoiding the emergence or propagation of antimicrobial resistance.

ANTIMICROBIAL STEWARDSHIP PROGRAMS

- Monitor and, when necessary, change antimicrobial prescribing practices at a health care institution.
- Limit inappropriate antibiotic use while optimizing the selection, dose, duration, and route of therapy.
- Seek to:
  - Improve outcomes for individual patients
    - Optimize treatment of infectious process(es)
    - Minimize risk of complications of therapy
    - Reduce length of stay
  - Improve outcomes for the larger population
    - Reduce antimicrobial selection pressure to limit antimicrobial resistance
  - Reduce unnecessary pharmacy expenditures

Purpose of slide: To provide a general introduction to the approaches used by antimicrobial stewardship programs to achieve their goals.

Key points:

1. The first bulleted statement describes the general responsibilities of an antimicrobial stewardship program. Monitoring and change are critical aspects of the program.
2. The second bulleted statement highlights that antimicrobial stewardship programs are not only interested in reducing antimicrobial use, but also in ensuring that antimicrobials are used optimally. This is an important aspect of the program for clinicians within the facility to understand.
3. The third bulleted point lists some of the specific goals of antimicrobial stewardship programs. It is important to highlight that the patient-oriented outcomes are the primary goals of the stewardship program. Reducing pharmacy costs and expenditures is also important, but does not take priority over patient safety and improving patient outcomes.

ANTIMICROBIAL STEWARDSHIP PROGRAMS

- Are composed of a core group of team members that typically include:
  - Infectious Diseases Physician(s)
  - Clinical pharmacist with infectious diseases training
  - Clinical microbiologist
  - Information system specialist
  - Infection control professional
  - Hospital epidemiologist
- Require the support and collaboration of hospital administration, medical staff leadership, and local providers.

Purpose of slide: To describe some of the positive outcomes that have been associated with the introduction of antimicrobial stewardship programs.

Key points:

1. Antimicrobial stewardship is a multidiciplinary endeavor. The exact make-up of the team may vary from institution to institution, especially in smaller facilities and facilities that are not acute care hospitals (e.g., long term care facilities).
2. Clinical pharmacists and physicians typically do the bulk of the program's day-to-day activities of the program, but the other team members play key roles in developing and supporting the program.
3. Support from the facility's administration, as well as medical staff leadership (including local champions and peer leaders), is critical to the program's success.

IMPACT OF ANTIMICROBIAL STEWARDSHIP PROGRAMS

- Multidisciplinary antimicrobial stewardship programs have been associated with:
  - Decreased antimicrobial use (22%–36% reductions)
  - Reduced rates of antimicrobial resistance among health care–associated pathogens (e.g., *Pseudomonas, S. aureus*)
  - Reduced incidence of adverse outcomes associated with antibiotic use (e.g., *C. difficile* infection)
  - Significant reductions in pharmacy expenditures ($200K–$900K per year)

Martin C., I. Ofotokun, R. Rapp, et al. *American Journal Health-System Pharmacy* (2005) 62:732-8
Dellit T.H., et al. *Clinical Infectious Diseases* (2007) 44:159-77
Davey P., et al. *Cochrane Database Systematic Review* (2005) 19(4):CD003543

Purpose of slide: To describe some of the positive outcomes that have been associated with the introduction of antimicrobial stewardship programs.

Key points:

1. Antimicrobial stewardship programs have been shown to decrease antimicrobial use and to result in improved clinical outcomes for individual patients and reduced rates of resistance among health care–associated pathogens (which may lead to improved outcomes for other patients).
2. This reduced use of antimicrobials can also lead to substantial reductions in pharmacy expenditures, potentially resulting in the ability to invest those resources on other patient safety and quality improvement endeavors.

ANTIMICROBIAL STEWARDSHIP STRATEGIES

- Core strategies
  - Prospective audit with intervention and feedback
  - Formulary restriction and preauthorization
- Supplemental strategies
  - Education
    - Including availability of an up-to-date antibiogram
  - Guidelines and clinical pathways
  - Streamlining or de-escalation of therapy
  - Dose optimization
  - Parenteral to oral conversion
  - Computer-assisted decision support
  - Others

Dellit T.H., et al. *Clinical Infectious Diseases* (2007) 44: 159–77.

Purpose of slide: To list specific strategies that are used by antimicrobial stewardship programs use to reach their goals.

Key points:

1. Strategies are divided into core strategies and supplemental strategies.
2. Core strategies are those that have been shown to be effective in reducing rates of antimicrobial resistance, antimicrobial use, and/or costs and that are considered to be important, basic components of an antimicrobial stewardship program.
3. Supplemental strategies are additional strategies that may be incorporated into the stewardship program to further improve antimicrobial use.

CORE STRATEGIES

The purpose of this segment of the presentation is to describe the core strategies of most antimicrobial stewardship programs.

PROSPECTIVE AUDIT WITH INTERVENTION AND FEEDBACK

- This strategy is considered to be one of two "core" strategies of an antimicrobial stewardship program.
- With this strategy, antimicrobial prescriptions are audited on a prospective basis. Selection of prescriptions to be audited may be based on: the specific drug prescribed, the location of the patient, the disease process being treated.

Purpose of slide: To describe the core strategy referred to as "prospective audit with intervention and feedback."

Key points:

1. In many antimicrobial stewardship programs, the use of prospective audits is one of the main strategies used.
2. These audits allow the team to review antimicrobial use in "real-time" and thus give the team the opportunity to make changes in prescribed antimicrobial regimens to optimize treatment and reach the program's goals.

PROSPECTIVE AUDIT WITH INTERVENTION AND FEEDBACK

- The audit is performed by a physician and/or clinical pharmacist and addresses:
  - Appropriateness of selected agent based on microbiologic data, local resistance patterns, evidence-based practice with recommendation of alternative therapy, or no therapy, when necessary.
  - Potential errors (e.g., allergies, dosing errors, medication interactions)
- Feedback may occur through direct interaction with the prescribing clinician or through notes or stickers left in the chart or electronic medical record.
- This strategy has been associated with reductions in inappropriate use of antibiotics, *C. difficile* infection rates, and costs.

Purpose of slide: To describe the core strategy referred to as "prospective audit with intervention and feedback" (continued from previous slide).

Key points:

1. The prescription of certain pre-deteremined antimicrobials triggers a case review by the stewardship team. The review assesses multiple aspects of the patient's case (including culture and other test results, risk factors, type/location/severity of disease, the facility's antibiogram) to determine if use of the prescribed antimicrobial is appropriate. In addition, the review allows the team to identify any potential prescribing errors, such as drug allergies or interactions and dosing errors.
2. When the team determines that interventions are needed, communication with the prescribing clinician can occur through direct conversations or through stickers or notes left in the patient's medical record.
3. Prospective audits have been associated with reductions in the inappropriate use of antibiotics, lower rates of *C. difficile* infection, and lower antimicrobial expenditures.

FORMULARY RESTRICTION AND PREAUTHORIZATION

- These forms of "antimicrobial restriction" are core strategies of an antimicrobial stewardship program and are considered to be the most effective approach to controlling the use of antimicrobial agents.
  - Formulary restriction refers to limiting a facility's antimicrobial formulary based on factors such as efficacy, toxicity, cost, and redundancy.
  - Preauthorization refers to a requirement to provide justification for using an antimicrobial agent before the drug is released from the pharmacy.

Purpose of slide: To describe the core strategy referred to as "formulary restriction and preauthorization."

Key points:

1. Formulary restriction and preauthorization can be very effective in controlling the use of antimicrobial agents.
2. Formulary restriction is usually the role of the facility's Pharmacy and Therapeutics Committee. Formulary restriction limits a facility's antimicrobial formulary based on factors such as efficacy, toxicity, cost, and redundancy. For example, many health care facilities have only one "respiratory fluoroquinolone" such as levofloxacin, moxifloxacin, or gatifloxacin, on their formulary. These medications have similar spectrum of activity and thus having more than one agent on formulary produces redundancy.
3. Preauthorization refers to a requirement to provide justification for use of an antimicrobial agent prior to release of the drug from the pharmacy. This authorization is typically provided by the stewardship team and provides the team the opportunity to prevent administration of even a single dose of inappropriate therapy.

FORMULARY RESTRICTION AND PREAUTHORIZATION

- Studies have associated antimicrobial restriction with interruption of *C. difficile* outbreaks, increased rates of clinical cure, increased antimicrobial susceptibility among gram-negative pathogens, and with substantial cost-savings.
- Preauthorization has been most effective in reducing antimicrobial use when a dedicated stewardship team is responsible for providing the preauthorization (as compared with infectious disease fellows).

Purpose of slide: To describe the core strategy referred to as "formulary restriction and preauthorization" (continued from previous slide).

Key points:

1. Antimicrobial restriction (through formulary restriction and preauthorization) has been associated with achieving a number of the goals of antimicrobial stewardship programs.
2. Preauthorization is most effective when the authorizations are provided by a dedicated stewardship team. Studies have shown that preauthorization programs are less effective in reducing antimicrobial use when Infectious Disease fellows are responsible for providing the authorizations.

SUPPLEMENTAL STRATEGIES

The purpose of this segment of the presentation is to describe additional strategies or methods that may be employed by an antimicrobial stewardship program to reach its stated outcomes.

EDUCATION

- Education for prescribing clinicians may be a useful component of a stewardship program, but is most likely to be effective when combined with an active intervention (e.g., restriction or prospective audits).
- Educational topics should be targeted toward the audience, but may include:
  - General principles of antimicrobial therapy
  - Interpretation of antibiotic susceptibility reports and hospital antibiograms
  - Diagnostic and treatment guidelines and pathways
  - Discussion of misconceptions of penicillin allergy

Purpose of slide: To describe the supplemental strategy referred to as "education."

Key points:

1. Education is perhaps the most frequently employed intervention of a stewardship program, and is a critical component of efforts to improve antimicrobial prescribing practices.
2. Education alone, however, has not been demonstrated to result in a sustained improvement in antimicrobial use, so education is usually used in combination with other strategies.
3. Educational topics should be geared toward the target audience and may focus on particularly problematic issues that have been identified within the facility. Several topics that are commonly included in educational efforts are listed here.

GUIDELINES AND CLINICAL PATHWAYS

- Development of evidence-based guidelines and clinical pathways by a multidisciplinary team can improve antimicrobial utilization.
  - These guidelines should be based on local epidemiology and antimicrobial resistance patterns and reflect the hospital's formulary.
  - Guidelines may also include recommendations for diagnostic testing, admission criteria, nursing care, and discharge planning.

Purpose of slide: To describe the supplemental strategy referred to as "guidelines and clinical pathways."

Key points:

1. Developing clinical pathways provides clinicians with an algorithm or recommendations for the care of patients with a specific clinical condition, such as community-acquired pneumonia.
2. These guidelines ideally incorporate evidence-based recommendations from professional societies and/or public health authorities, as well as facility-specific factors such as the antimicrobial formulary and local resistance data.
3. In addition to recommendations for empiric antimicrobial therapy, these guidelines may also include approaches to diagnostic testing, admission criteria, nursing care, and discharge planning to fully optimize the patient's care.

STREAMLINING OR DE-ESCALATING OF THERAPY

- Empiric antimicrobial regimens are often broad in spectrum to maximize the chance of providing activity against the infecting organism.
- This strategy refers to narrowing the spectrum of an empiric antimicrobial regimen and can include:
  - Adjusting an empiric antibiotic regimen on the basis of culture results and other data.
  - Discontinuing empiric therapy if testing subsequently fails to demonstrate evidence of an infectious process.
- De-escalation limits exposure to broad spectrum antimicrobial therapy and reduces the cost of therapy.

Briceland L.L., et al. *Archives of Internal Medicine* (1988) 148:2019-22.
Glowacki R.C., et al. *Clinical Infectious Diseases* (2003) 37:59-64

Purpose of slide: To describe the supplemental strategy referred to as "streamlining" or "de-escalation of therapy."

Key points:

1. Streamlining or de-escalation refers to narrowing the spectrum of antimicrobial therapy.
2. Streamlining an empiric antibiotic regimen is typically done when additional information (such as culture results) becomes available. In some situations, antimicrobial therapy may be able to be completely discontinued.
3. The value of streamlining is that it limits exposure to unnecessarily broad spectrum antimicrobial therapy (which may then reduce the patient's risk of toxicity or complications of therapy, such as *C. difficile*) and reduces the cost of therapy.

DOSE OPTIMIZATION

- Dose optimization includes strategies to ensure that specific characteristics of the drug (e.g., concentration or time-dependent killing, toxicities), infectious agent (minimum inhibitory concentration [MIC]), patient (e.g., weight, renal function), and site of infection are taken into account.
- Such strategies may improve rates of cure and minimize risk of toxicity. These strategies include:
  - Prolonged or continuous dosing of beta-lactams
  - Once-daily dosing of aminoglycosides
  - Appropriate dosing of vancomycin
  - Weight-based dosing of certain antimicrobials
  - Dose-adjustments for patients with renal dysfunction who are receiving antimicrobials that are cleared by the kidney

Purpose of slide: To describe the supplemental strategy referred to as "dose optimization."

Key points:

1. Dose optimization techniques focus on ensuring that patients receive the appropriate dose of prescribed antimicrobial agents.
2. Factors that must be considered when dosing antimicrobials include: characteristics of the prescribed drug, characteristics of the infectious agent(s) being treated (e.g., the minimum inhibitory concentration), characteristics of the patient (such as weight and renal function), and site of infection (for instance some drugs require higher doses when treating infections of the brain and cerebrospinal fluid).
3. Dosing antibiotics appropriately may improve cure rates and minimize the risk of toxicity.
4. Examples of some specific dose optimization techniques include:
   - Prolonged or continuous dosing of beta-lactams (this is done to allow the serum level of the antibiotic to remain above the MIC of the infecting organism for a longer period of time, which may improve the ability of the antibiotic to kill the bacteria).
   - Once-daily dosing of aminoglycosides, such as gentamicin (this may reduce toxicity and simplifies administration and drug monitoring).
   - Appropriate dosing of vancomycin (vancomycin should be dosed based on the patient's weight AND renal function, goal "trough" vancomycin levels may vary depend on the site/type of infection).
   - Weight-based dosing of certain antimicrobials (the dose of some antimicrobials should be adjusted for patients with body weights that exceed a certain amount).
   - Dose adjustments for patients with renal dysfunction (some antibiotics are cleared from the system by the kidney and thus need to be given in lower doses or at less frequent intervals in patients with reduced renal function).

PARENTERAL TO ORAL CONVERSION

- This strategy refers to changing from intravenously administered antimicrobials to orally administered antimicrobials.
- This strategy is commonly used for those antimicrobial agents with which similar concentrations are achieved whether administered intravenously or orally (e.g., fluoroquinolones, azoles, metronidazole, clindamycin, oxazolidinones, and trimethoprim-sulfamethoxazole).

Purpose of slide: To describe the supplemental strategy referred to as "parenteral to oral conversion."

Key points:

1. This strategy refers to changing from intravenously administered to orally administered antimicrobials.
2. This strategy is commonly, and perhaps most easily, used for those antimicrobial agents with which similar concentrations are achieved whether administered intravenously or orally. Such agents include: fluoroquinolones (e.g., ciprofloxacin, levofloxacin), azoles (e.g., fluconazole, voriconazole), metronidazole, clindamycin, oxazolidinones (linezolid), and trimethoprim-sulfamethoxazole). In patients who are tolerating other oral medications and/or food and in whom there are not concerns about absorption from the GI tract, there is no benefit to administering the drug intravenously.

PARENTERAL TO ORAL CONVERSION

- This strategy may also be used to encourage conversion of other intravenous antibiotics to an oral regimen when appropriate.
  - Protocols for automatic conversion for patients meeting specific criteria have been successful (e.g., using the Pneumonia Severity Index for IV to oral therapy for patients with pneumonia).
- This strategy can reduce hospital length of stay and costs, and, potentially, eliminate risks associated with vascular access.

Purpose of slide: To describe the supplemental strategy referred to as "parenteral to oral conversion" (continued from previous slide).

Key points:

1. In addition to intervening on those agents for which parenteral and oral administration result in similar drug levels, parenteral to oral conversion programs can also identify and intervene in situations in which intravenous administration of other drugs is no longer necessary and can be replaced with an orally administered antibiotic regimen. For example, patients who are initially started on IV therapy for community-acquired pneumonia often remain on IV therapy longer than is clinically necessary. A stewardship program may attempt to identify such patients and prompt conversion to oral antibiotics.
2. Potential benefits of parenteral to oral conversion include reduced length of hospital stay, reduced costs, and elimination of risks associated with vascular access devices (if discontinuing intravenous antibiotics results in the ability to remove vascular access devices).

SUGGESTED READING

- Dellit T.H., et al. "Infectious Diseases Society of America and the Society for Healthcare Epidemiology of America Guidelines for Developing an Institutional Program to Enhance Antimicrobial Stewardship." *Clinical Infectious Diseases* (2007) 44: 159–77.

Purpose of slide: The article referenced on this slide provides an excellent review of antimicrobial stewardship strategies, as well as some of the evidence demonstrating the value of antimicrobial stewardship programs.

[ENTER FACILITY NAME HERE]
ANTIMICROBIAL STEWARDSHIP PROGRAM

OPTIONAL SLIDE: FOR USE BY INDIVIDUAL FACILITIES
The purpose of this segment of the presentation is to allow individual health care facilities to present specific details about their own stewardship program. These slides are meant to be customized by the facility.

[ENTER FACILITY NAME HERE]
ANTIMICROBIAL STEWARDSHIP PROGRAM

- Key contacts
  - X
  - X
  - X

OPTIONAL SLIDE: FOR USE BY INDIVIDUAL FACILITIES
Purpose of slide: To provide an opportunity to introduce the key members of the antimicrobial stewardship team and to provide the contact information for the program.

[ENTER FACILITY NAME HERE]
ANTIMICROBIAL STEWARDSHIP PROGRAM

- Goals
  - X
  - X
  - X

OPTIONAL SLIDE: FOR USE BY INDIVIDUAL FACILITIES
Purpose of slide: This slide can be used to highlight the goals of the antimicrobial stewardship program. This may include very specific short term goals as well as longer term goals.

[ENTER FACILITY NAME HERE]
ANTIMICROBIAL STEWARDSHIP PROGRAM

- Strategies
  - X
  - X
  - X

OPTIONAL SLIDE: FOR USE BY INDIVIDUAL FACILITIES
Purpose of slide: This slide can be used to outline the key strategies that the antimicrobial stewardship program will use to achieve its goals.

ACKNOWLEDGEMENTS

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APPENDIX G:
PRE-/POST-ASSESSMENT (CLINICIAN SPECIFIC)

PRE-/POST-ASSESSMENT

GENERAL QUESTIONS PERTAINING TO ANTIBIOTIC STEWARDSHIP	
QUESTION	ANSWER
Infectious disease–related hospital–acquired conditions that the Centers for Medicare and Medicaid Services considers preventable (never events) and for which reimbursement is limited include: a. Catheter-associated urinary infections b. Vascular catheter–associated infections c. Mediastinitis after coronary artery bypass graft (CABG) surgery d. Complicated intra-abdominal infections	1. A 2. A and B 3. A, B and C 4. All of the above
What can be considered the most important manner in which multi-drug resistant organisms (MDROs) increase costs?	1. The use of more expensive antibiotics. 2. The expense of personal protective equipment for isolation precautions. 3. An independent association with increased morbidity (including length of stay) and mortality. 4. The cost of follow up to demonstrate clearance of MDRO carriage.
Routine hospital-approved disinfectant products are sufficient to kill methicillin-resistant *Staph. aureus* (MRSA) in the health care environment.	1. True 2. False Although no special product is needed to eradicate vancomycin-resistant enterococci (VRE) or methicillin-resistant *Staph aureus* (MRSA) from surfaces or equipment in the hospital, good cleaning technique is essential.
If a health care worker wears gloves during patient contact, it is *not* necessary to perform hand hygiene afterwards.	1. True 2. False More than 16% of health care workers who wear gloves during contact with patients colonized or infected with MDROs become contaminated with the pathogen even after limited patient contact. Gloves can have microscopic holes that may allow pathogens to reach the skin and hand contamination can occur during glove removal.

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If a patient is colonized or infected with an MDRO, he/she should be placed on contact precautions and health care workers should wear gowns and gloves only when in direct physical contact with the patient.	1. True 2. False According to the most recent CDC standards, any health care worker entering the room of a patient colonized or infected with an MDRO MUST WEAR gowns and gloves.
Antibiotics differ from antihypertensive agents in that antibiotics:	1. Are more costly. 2. Are used to treat a symptomatic illness. 3. Are associated with more patient non-adherence. 4. Affect patients beyond the one for whom the drug is prescribed. The use of appropriate antibiotics for the infection being treated is important because inadequate treatment can promote the ability for the microbe to become resistant and the selection of resistant organisms. As populations of resistant microbes pass from one individual to another, it has detrimental impacts on the general population. In addition, inappropriate antibiotic use fosters the development of *C. difficile* infections, which is now being seen in lower-risk populations such as healthy postpartum women or community dwellers with no recent antimicrobial exposure.
QUESTIONS PERTAINING TO SURGICAL PROPHYLAXIS	
Appropriate antibiotic administration for surgical procedures is a core measure and available for public view on the CMS and The Joint Commission Web sites. Which of the following surgical prophylaxis regimens are appropriate as defined by the Surgical Care Improvement Project? a. Prophylactic antibiotics received within one hour after non-cardiac surgery end time. b. Prophylactic antibiotics discontinued within 24 hours after non-cardiac surgery end time (48 hours for Cardiac/CABG). c. Prophylactic antibiotics discontinued within 10 days after cardiac surgery end time. d. Prophylactic antibiotics received within one hour prior to surgical incision.	1. A 2. C 3. B and D 4. All of the above

Which of the following is NOT an established risk factor for surgical site infection?	1. Smoking 2. Diabetes mellitus 3. Previous surgical site infection unrelated to the site of current surgery 4. Shaving the surgical site with a razor
QUESTIONS PERTAINING TO ANTIBIOTIC PRESCRIBING	
An MRSA isolate from a patient's sputum has a minimal inhibitory concentration (MIC) of 2.0 mg/L for vancomycin. The patient has hospital-acquired pneumonia and is receiving vancomycin at a dose of 10 mg/kg every 12 hours resulting in trough vancomycin concentrations of 7 ug/ml. What is the best intervention?	1. Request an ID consult. 2. Change to q6h dosing of vancomycin, but keep the same total daily dose. 3. Add cefazolin. A MRSA isolate with a vancomycin MIC of >2 is associated with an increased risk of treatment failure. An ID consult should be considered in these instances. Alternate antimicrobial agents or achieving higher trough vancomycin concentrations may be appropriate treatment interventions.
Which of the following level determinations are <u>most often</u> recommended to monitor vancomycin therapy lasting several days?	1. Vancomycin "peak" concentration 2. Vancomycin "trough" concentration 3. Vancomycin levels are not required 4. None of the above
After changing the dose, what would be the recommended time to re-check a vancomycin trough concentration?	1. On the 3rd day 2. After 1 week 3. After the 3rd dose The timing for re-checking a vancomycin trough concentration after the dose has been changed is measured in doses instead of days. It is recommended to check a vancomycin trough concentration after the 3rd dose, as this is approximately when a steady state level is achieved. Blood samples used for measurement of vancomycin trough concentrations should be obtained 30 minutes or less before the next (e.g., 4th) dose.
Vancomycin trough concentrations between 15–20 mg/L are recommended for which of the following indication(s):	1. Endocarditis 2. Osteomyelitis 3. Hospital-acquired pneumonia 4. All of the above Minimum serum vancomycin trough concentrations should always be maintained >10mg/L to avoid the development of resistance. Vancomycin trough concentrations of 15–20 mg/L are recommended to improve penetration, increase the likelihood of optimal target serum concentrations, and improve clinical outcomes of complicated *S. aureus* infections such as bacteremia, endocarditis, osteomyelitis, meningitis, and hospital-acquired pneumonia.

The mechanism by which beta-lactams (such as penicillins and cephalosporins) kill bacteria is characterized as time-dependent killing. This means that the antibacterial effect depends on the percentage of time during the dosing interval that the antibiotic concentration remains above the minimum inhibitory concentration (MIC) for the organism. Based on this principle of requiring the concentration of the antibiotic to exceed the MIC of the organism for a substantial period of time, which dosing strategy would maximize bacterial kill in a patient with impaired renal function?	1. Administer current dose at an interval of every 8 hours but extend the infusion from 30 minutes to 3 hours. 2. Administer the current dose every 8 hours over a 30-minute infusion. Infusion of a beta lactam over an extended period may greatly increase the time above the MIC and hence efficacy, at a given dose. Longer exposure of the bacteria to a B-lactam drug concentration would maximize the bacterial killing rate.
The mechanism by which aminoglycosides and fluoroquinolones kill bacteria is characterized as concentration-dependent killing. This means that for these drugs, it is better for higher peak drug level concentrations to be achieved compared to the MIC. Based on the importance of achieving an antibiotic concentration substantially above the MIC, which dosing strategy would be most effective in a patient with impaired renal function?	1. Decrease the dose and extend the infusion duration from 30 minutes to 3 hours. 2. Administer the current dose but extend the dosing interval from every 8 to every 12 hours. For aminoglycosides and fluroquiolones, the ideal dosing regimen would maximize concentration, because the higher the concentration, the more extensive and faster is the degree of bacterial killing. Lowering the dose would actually impair the bactericidal effect of aminoglycosides or fluorquinolones.
Nitrofurantoin is contraindicated for use in persons with the following clinical conditions:	1. Patients with CrCl < 60 mL/min 2. Patients with impaired hepatic function 3. Both 1 and 2 Nitrofurantoin achieves subtherapeutic urine concentrations in patients with impaired renal function. Therefore, nitrofurantoin is not recommended in this population.
Based on the drug's oral bioavailability, it is recommended for a 3–7 day intravenous course to be administered prior to conversion to oral therapy for which of the following drugs in patients who are hemodynamically stable with a functioning GI tract? *Choices to the right can be changed based on the institution's IV to PO conversion initiatives.*	1. Fluconazole 2. Levofloxacin (Levaquin) 3. Linezolid (Zyvox) 4. IV therapy is not necessary for any of the above drugs. The antibiotic course can be initiated with oral therapy. The oral formulation of the above medications are well absorbed and provides blood and tissue levels that are virtually the same as those attained by IV administration. If a patient has a functioning GI tract, can tolerate oral medications, and is hemodynamically stable, therapy can be initiated with oral antibiotics.

Based on local resistance patterns, which would be the preferred empiric choice for treating suspected acute, uncomplicated, community-acquired lower urinary tract infection (i.e., cystitis)?	1. Cefuroxime 2. Cephalexin 3. Levofloxacin (Levaquin) 4. Trimethoprim/sulfamethoxazole (Bactrim) *The above choice can be modified according to local resistance data.* The most common organism isolated from urinary tract infections is *E. coli*. The most recent Infectious Disease Society of America's UTI guideline recommends trimethoprim-sulfa for empiric therapy of community-acquired uncomplicated cystitis except, in communities where resistance rates are >10-20%, in which case a fluoroquinolone is recommended.
A long term care facility resident is symptomatic for a urinary tract infection and the urine culture yields >100,000 colony forming units (CFU) of *E coli*. The antimicrobial susceptibilities are reported as: Bactrim S Levofloxacin S Ceftriaxone S Tobramycin S (Note: S=Susceptible) What would be the most appropriate antibiotic choice based on these results?	1. Trimethoprim-sulfamethoxazole (Bactrim) 2. Levofloxacin (Levaquin) 3. Ceftriaxone (Rocephin) 4. Tobramycin Although all the listed antibiotics could effectively treat this resident's urinary tract infection, Bactrim would be the drug of choice because it has the most narrow spectrum of activity of all the antibiotics reported. If the resident was started on levofloxacin prior to culture results becoming available, de-escalation after identification of a pathogen is recommended to reduce selective pressure on resistance.
After treating the above resident for five days, the patient is now asymptomatic. A repeat urine culture is sent one week after completion of therapy and it is positive for *E. coli* with the same susceptibilities as reported above. The best course of action would be which of the following:	1. Closely observe, but do not treat. 2. Place the patient on long-term prophylaxis after completing active treatment course. 3. Patient has a resistant organism and needs to be treated with a different antibiotic than what was used for the first course. A large proportion of nursing home or hospital patients are colonized with bacteria in the urine and routine screening for bacteriuria in asymptomatic patients or treating of asymptomatic bacteriuria is not recommended.

A long term care facility resident with a chronic indwelling urinary catheter has been successfully treated with three separate antibiotic courses within the last two months for symptomatic urinary tract infection. Because of the resident's history of multiple urinary tract infections, the prescriber wants to place the resident on long-standing antibiotic prophylaxis. Which of the following agents would be recommended?	1. Nitrofurantoin 2. Methenamine 3. Ciprofloxacin 4. Antibiotic prophylaxis is not recommended. Although antibiotic prophylaxis has been demonstrated to at least transiently reduce catheter-associated UTI, several of these studies have also demonstrated development of or selection for organisms resistant to the antibiotic used for prophylaxis. For this reason, prophylactic antibiotics are not routinely recommended to prevent UTI in catheterized patients.
A *non-catheterized* patient has a fever, no signs and symptoms of a urinary tract infection, and a negative urinalysis. A urine culture is sent and shows <30,000 CFU of *Klebsiella pneumoniae*. It is recommended to:	1. Treat with an antibiotic with the narrowest spectrum according to the culture report. 2. Do not treat and conduct additional work-up for other causes for the resident's symptoms. Urine samples with bacterial colony counts of ≤ 100,000 units/mL without accompanying signs and symptoms of a urinary tract infection are considered colonization and/or contaminants, and not an active infection. These patients should be monitored and/or a repeat culture should be collected using aseptic technique should be sent if an active infection is suspected.
A long term care facility resident with a recurrent symptomatic UTI has the accompanying urine culture results: *Klebsiella pneumoniae* Bactrim R Amoxicillin R Ciprofloxacin S Tobramycin S Cefepime S Ceftriaxone S (Note: R = Resistant; S = Susceptible) What would be the best treatment option based on the choices?	1. Oral ciprofloxacin 2. IM tobramycin 3. IM cefepime 4. IM ceftriaxone Ciprofloxacin achieves high urinary concentrations when given either by the oral or IV route and would be a reasonable treatment option based on the reported culture results. Nursing homes typically are not equipped to administer IV antibiotics, however IM administration should be reserved after other treatment choices have been considered due to their variable and unpredictable absorption.

A patient with *C. difficile* has been treated for 10 days with metronidazole. The patient is no longer experiencing diarrhea, but because the patient was treated for *C. difficile* last month, the physician wants to send a follow-up test to assure that the infection has cleared. The lab result shows that the resident still is positive for *C. difficile*. A reasonable treatment option would be:	1. Treat with a 4-week course of metronidazole. 2. Treat with a 2-week course of oral vancomycin. 3. Do not treat unless the patient becomes symptomatic. Testing for *C. difficile* or its toxins should be performed only on diarrheal (unformed) stool, unless ileus due to *C. difficile* is suspected. Testing "for cure" in patients whose clinical illness has resolved is not clinically useful, as *C. difficile* may be detectable for weeks or months after an active infection has clinically resolved. Treatment with metronidazole or oral vancomycin of asymptomatic patients who are colonized with *C. difficile* in an attempt to rid the patient of the organism generally does not work and should not be attempted.
A patient is admitted to the hospital with his third recurrence of *C. difficile* infection within the last two months. What treatment course for *C. difficile* is recommended in current guidelines to increase the likelihood of cure?	1. Treat with a course of oral vancomycin and metronidazole x14d. 2. Treat with IV vancomycin x14d. 3. Oral metronidazole x 2 months. 4. Pulse/taper therapy with oral vancomycin. For patients with multiple relapses of *C. difficile*, pulse dosing with oral vancomycin or a vancomycin taper (e.g., 125 mg PO four times a day x 10 d, then 125 mg twice daily x 2 wks, then 125 mg/d x 2 wks then 125 every 2–3 days x 2–8 weeks) would be preferred of the regimens listed.

A nursing home resident has completed a 10-day course of levofloxacin (Levaquin) for suspected pneumonia. She is now afebrile but has a persistent cough and some residual malaise. The original infiltrate on chest x-ray is improving. A sputum culture shows polymicrobial organisms with no predominant pathogen. A reasonable treatment option would be:	1. Observe off of antibiotics and consider additional evaluation of the source of cough and lethargy if they fail to improve (e.g., ID consult to further assess the appropriate treatment course). 2. Prescribe IV levofloxacin for seven more days. 3. Give IM ceftriaxone x 10 days. Most of the patients' original signs and symptoms of acute bacterial infection have resolved, suggesting that she has received an appropriate course of treatment. The lingering cough and malaise may not represent ongoing, untreated infection. If there was evidence of persisting or worsening pulmonary infection, giving IV levofloxacin to a patient who already completed a course with oral levofloxacin would likely not add any additional benefit if there were not concerns about absorption from the GI tract. Due to the variable and unpredictable rate of absorption when antibiotics are given IM, administering drugs by this route should be reserved for after other options are exhausted. If the patient was having clinical progression, it would be advisable to obtain additional evaluation and consider an altered treatment regimen (e.g., an ID consult or referral to the hospital, depending on severity of illness).
A swab of what appears to be an infected sacral ulcer is sent for culture. The following result is reported: *S. epidermidis* / *Pseudomonas aeruginosa* Vancomycin S / R Ceftazidime R / S Rocephin S / R Tobramycin S / S A reasonable treatment option would be:	1. IM Vancomycin and Ceftazidime 2. IM Ceftazidime and Rocephin 3. Debride ulcer and take a culture from deep within the wound or sample the exudates that is draining from deep within the wound. 4. IM Tobramycin Organisms isolated from superficial swab cultures taken from infected wounds are often colonizers and may not represent the actual cause of the infection. Bacterial contamination is also a possibility. Cultures taken from deep within the wound are more indicative of the bacteria invading the tissue. Nursing homes are typically not equipped to obtain adequate wound cultures through tissue biopsy or needled aspiration. If this is the case, it is best to base empiric antibiotic choices on your institution's antibiogram and the most common infecting organism identified through properly cultured wounds rather than individual swab cultures. Evaluation by a surgeon may also be beneficial.

APPENDIX H:
SAMPLE RECOMMENDATION CHART STICKERS – IV TO PO

SAMPLE RECOMMENDATION CHART STICKERS – IV TO PO

IV to Oral Antimicrobial Interchange Program

Date________ Time_______ Patient Name ____________________

This patient currently has orders for:

____

The P&T Committee and Medical Board have approved an IV to oral conversion for patients meeting specific clinical criteria. Your patient's therapy has been changed to:

____

Completed by: ___________________________R.Ph.

IV to Oral Antimicrobial Interchange Program

Date________ Time_______ Patient Name ____________________

This patient currently has orders for:

____

The P&T Committee and Medical Board have approved an IV to oral conversion for patients meeting specific clinical criteria. Your patient's therapy has been changed to:

____

Completed by: ___________________________R.Ph.

IV to Oral Antimicrobial Interchange Program

Date________ Time_______ Patient Name ____________________

This patient currently has orders for:

____

The P&T Committee and Medical Board have approved an IV to oral conversion for patients meeting specific clinical criteria. Your patient's therapy has been changed to:

____

Completed by: ___________________________R.Ph.

IV to Oral Antimicrobial Interchange Program

Date________ Time_______ Patient Name ____________________

This patient currently has orders for:

____

The P&T Committee and Medical Board have approved an IV to oral conversion for patients meeting specific clinical criteria. Your patient's therapy has been changed to:

____

Completed by: ___________________________R.Ph.

IV to Oral Antimicrobial Interchange Program

Date________ Time_______ Patient Name ____________________

This patient currently has orders for:

____

The P&T Committee and Medical Board have approved an IV to oral conversion for patients meeting specific clinical criteria. Your patient's therapy has been changed to:

____

Completed by: ___________________________R.Ph.

IV to Oral Antimicrobial Interchange Program

Date________ Time_______ Patient Name ____________________

This patient currently has orders for:

____

The P&T Committee and Medical Board have approved an IV to oral conversion for patients meeting specific clinical criteria. Your patient's therapy has been changed to:

____

Completed by: ___________________________R.Ph.

IV to Oral Antimicrobial Interchange Program

Date________ Time_______ Patient Name ____________________

This patient currently has orders for:

____

The P&T Committee and Medical Board have approved an IV to oral conversion for patients meeting specific clinical criteria. Your patient's therapy has been changed to:

____

Completed by: ___________________________R.Ph.

IV to Oral Antimicrobial Interchange Program

Date________ Time_______ Patient Name ____________________

This patient currently has orders for:

____

The P&T Committee and Medical Board have approved an IV to oral conversion for patients meeting specific clinical criteria. Your patient's therapy has been changed to:

____

Completed by: ___________________________R.Ph.

APPENDIX I:
SAMPLE RECOMMENDATION CHART STICKERS – NO INFECTION

Antimicrobial Surveillance Program

Date _________ Patient Name ________________________

This patient currently has orders for:

____

Antibiotic therapy has been evaluated by Antibiotic Review Group:

☐ There are no obvious signs of infection ___________

☐ Indication for current regimen not documented ________

☐ Infection resistant to antibiotic (see lab report) ________

I authorize the above antibiotic(s) to be discontinued. New therapies may be written on Physician Order Form.

Physician Signature: ______________________ ID # ______

Antimicrobial Surveillance Program

Date _________ Patient Name ________________________

This patient currently has orders for:

____

Antibiotic therapy has been evaluated by Antibiotic Review Group:

☐ There are no obvious signs of infection ___________

☐ Indication for current regimen not documented ________

☐ Infection resistant to antibiotic (see lab report) ________

I authorize the above antibiotic(s) to be discontinued. New therapies may be written on Physician Order Form.

Physician Signature: ______________________ ID # ______

Antimicrobial Surveillance Program

Date _________ Patient Name ________________________

This patient currently has orders for:

____

Antibiotic therapy has been evaluated by Antibiotic Review Group:

☐ There are no obvious signs of infection ___________

☐ Indication for current regimen not documented ________

☐ Infection resistant to antibiotic (see lab report) ________

I authorize the above antibiotic(s) to be discontinued. New therapies may be written on Physician Order Form.

Physician Signature: ______________________ ID # ______

Antimicrobial Surveillance Program

Date _________ Patient Name ________________________

This patient currently has orders for:

____

Antibiotic therapy has been evaluated by Antibiotic Review Group:

☐ There are no obvious signs of infection ___________

☐ Indication for current regimen not documented ________

☐ Infection resistant to antibiotic (see lab report) ________

I authorize the above antibiotic(s) to be discontinued. New therapies may be written on Physician Order Form.

Physician Signature: ______________________ ID # ______

Antimicrobial Surveillance Program

Date _________ Patient Name ________________________

This patient currently has orders for:

____

Antibiotic therapy has been evaluated by Antibiotic Review Group:

☐ There are no obvious signs of infection ___________

☐ Indication for current regimen not documented ________

☐ Infection resistant to antibiotic (see lab report) ________

I authorize the above antibiotic(s) to be discontinued. New therapies may be written on Physician Order Form.

Physician Signature: ______________________ ID # ______

Antimicrobial Surveillance Program

Date _________ Patient Name ________________________

This patient currently has orders for:

____

Antibiotic therapy has been evaluated by Antibiotic Review Group:

☐ There are no obvious signs of infection ___________

☐ Indication for current regimen not documented ________

☐ Infection resistant to antibiotic (see lab report) ________

I authorize the above antibiotic(s) to be discontinued. New therapies may be written on Physician Order Form.

Physician Signature: ______________________ ID # ______

Antimicrobial Surveillance Program

Date _________ Patient Name ________________________

This patient currently has orders for:

____

Antibiotic therapy has been evaluated by Antibiotic Review Group:

☐ There are no obvious signs of infection ___________

☐ Indication for current regimen not documented ________

☐ Infection resistant to antibiotic (see lab report) ________

I authorize the above antibiotic(s) to be discontinued. New therapies may be written on Physician Order Form.

Physician Signature: ______________________ ID # ______

Antimicrobial Surveillance Program

Date _________ Patient Name ________________________

This patient currently has orders for:

____

Antibiotic therapy has been evaluated by Antibiotic Review Group:

☐ There are no obvious signs of infection ___________

☐ Indication for current regimen not documented ________

☐ Infection resistant to antibiotic (see lab report) ________

I authorize the above antibiotic(s) to be discontinued. New therapies may be written on Physician Order Form.

Physician Signature: ______________________ ID # ______

Electronic Versions of Appendices are available at http://www.gnyha.org/antimicrobial/toolkit.

APPENDIX J:
SAMPLE ANTIMICROBIAL STEWARDSHIP PROGRAM INITIAL REQUEST

ANTIMICROBIAL ASSISTANCE PROGRAM INITIAL REQUEST

Date of approval request:_____ Service:_____ Attending:_____
Contact person and beeper #:_____ Location:_____ Admit date:_____
Patient:_____ MR#:_____ DOB:_____ Gender:_____
Allergies:_____ Scr:_____ Wt(kg):_____
Underlying Diagnosis_____

INFECTIOUS DX (CIRCLE)
Abscess:_____
Bacteremia_____
Bronchitis
Cellulitis (superficial)_____
Cellulitis (deep)_____
Central line
Cholangitis/cholecystitis
C-diff
Diabetic foot infection
Endocarditis
Endometritis
Esophagitis
Fever and Neutropenia
Fungal infection_____
HIV
Meningitis
Mucositis-thrush
Osteomyelitis
Peritonitis
Pneumonia – CAP
Pneumonia – HAP/VAP
Pneumonia – aspiration
Pre-op prophylaxis
Pyelonephritis
Unknown
UTI
UTI-foley
UTI-nephrostomy
UTI-uretral stent
Sepsis
Sinusitis
Surgical wound infection
Transplant_____
Vaginitis
Other_____

Requested(s) ABX: _____
_____
_____

Pertinent Labs:

Pertinent Micro:

Other ABX:

Recommended ABX(s): _____
_____
_____

Notes:

approved abx not needed dose-adjustment alternative agent ID consult
allergy duplicate therapy IV-PO drug interactions kinetic consult

FOLLOW-UP? (CIRCLE) NO YES DATE_____

blood cx sputum cx urine cx other cx_____ CXR/CHEST CT other radiology
levels renal fxn IV to PO appropriate team response?
Other_____

Electronic Versions of Appendices are available at http://www.gnyha.org/antimicrobial/toolkit.

APPENDIX K:
ANTIMICROBIAL STEWARDSHIP PROGRAM FOLLOW-UP

ANTIMICROBIAL MANGAGMENT PROGRAM FOLLOW-UPS

Date of follow-up_____

Available for F/U: yes no ⇨ pt. D/C pt expired ABX D/C ID CONSULT

Continued therapy with this agent(s) is: (circle one)

1. JUSTIFIED (no further intervention)
2. JUSTIFIED WITH INTERVENTION
3. UNJUSTIFIED

If therapy is UNJUSTIFIED, reason:

1. Organism is not susceptible to agent.
2. Organism susceptible to narrower spectrum/ lower generation agent.
3. Organism is a contaminant.
4. Overlapping spectrum.
5. Prolonged surgical prophylaxis.
6. No drug allergy or mild side effects.
7. Empiric therapy begun awaiting culture results, BUT no organism isolated after 72 hours.
8. Other_____

RECOMMENDATIONS

IF JUSTIFIED WITH INTERVENTION, recommend:

1. IV to PO
2. Dosage change:_____
3. Duration change:_____
4. Add additional abx:_____
5. Streamline regimen/dc other abx
6. Obtain cultures
7. Check levels
8. Monitoring:_____
9. Other:_____

IF UNJUSTIFIED, recommend:

1. Alternative antibiotic regimen:
   _____
   _____
2. Discontinuation of antibiotic:
   _____
   _____
3. ID consult
4. Other:
   _____
   _____

RESPONSE OF PROVIDER

☐ Agrees to make change
☐ Needs to discuss before making change
☐ Unable to reach provider
Person contacted:_____
Pager #_____

Will not make change because:
☐ Attending insists on current therapy:
_____
☐ Team does not agree with recommendation:
_____
☐ Other:
_____

Electronic Versions of Appendices are available at http://www.gnyha.org/antimicrobial/toolkit.

APPENDIX L:
PROCESS MEASUREMENT – RECOMMENDATION TRACKING TOOL

INSTRUCTIONS

Overview

This file is designed to help monitor your antimicrobial stewardship program recommendations as well as track any drug interaction allergies. It is designed to accept one calendar year of data. You must not combine different calendar years in the "Data_Entry" tab or the formulas embedded in this file will not provide the intended results.

Step 1 : (Data_Entry Tab) (see Table 1, page 72)

On a daily basis, enter the number of patients and the number of interventions recommended/implemented. Data can only be entered in the white cells. The grey cells do not require manual data entry because they will automatically calculate the total number and percent of the recommended interventions implemented on a daily basis.

The labels have descriptions embedded in the cells and are designated by small red triangles in the top right hand corner of the cell. To view a description simply place the cursor over a cell with a red triangle and a box will pop up. The box will automatically disappear when you move the cursor off that cell.

Also, please note that the "Drug Interaction Allergy" (DIA) category is not considered an antibiotic stewardship intervention. It was added to the form to allow for the tracking of this important allergy, of note, its calculation differs from the other recommendation fields. The percent calculation for DIA uses total patients seen as the denominator compared to the other fields' denominator, which is number of recommendations made. In the summary section (on the far right) the "Drug Interaction Allergy" field is not calculated in the same manner as the recommendation summary fields. The denominator for the "Drug Interaction Allergy" percentage are the total patients seen compared to the recommendations performed fields are calculated as a percentage of the number of recommendation made.

Step 2 : (Summary_Table Tab) (see Table 2, page 72)

On a monthly basis, review your antimicrobial stewardship activity. The summary data table will help you examine the types of interventions implemented on a monthly basis. It also provides a yearly summary. There is no data entry required on this tab.

Appendix L: Process Measurement – Recommendation Tracking Tool *cont.*

Table 1

*Calculated using total patients as the denominator
**Does not include "Drug Interaction Allergy"

EXAMPLE USING FICTIONAL DATA: ENTER DATA IN THE WHITE CELLS (HIGHLIGHTED BY THE BLUE RECTANGLE)				RECOMMENDED INTERVENTIONS PERFORMED							SUMMARY RECOMMENDATIONS PERFORMED**				
											PERCENT	OBSERVATIONS		PERCENT	
Date	Total Number of Patients	Number of Recommendations Made	Drug Interaction Allergy	Discontinue Redundant Coverage	Add Appropriate Cover for Culture	Narrow Spectrum of Activity	Discontinued with Antibiotic Prescription	IV to PO Switch Made	Dosing Changed	ID Consult Suggested	Drug Interaction Allergy*	Recommended Interventions Performed	Recommended Interventions not Performed	Recommended Interventions Performed	Recommended Interventions not Performed
1/1/09	2	1	1	1							50%	1	0	100%	-
1/2/09	4	4	1	1	2	1					25%	4	0	100%	-
1/3/09	5	5	2	2	1						40%	3	2	60%	40%
1/4/09	8	4	3	3							38%	3	1	75%	25%
1/5/09	6	6	3	3							50%	3	3	50%	50%
2/6/09	7	5						3	1	1		5	0	100%	-
2/7/09	8	8			4		4					8	0	100%	-

Table 2

EXAMPLE USING FICTIONAL DATA: YEAR = 2009				RECOMMENDED INTERVENTIONS PERFORMED OBSERVATIONS								RECOMMENDED INTERVENTIONS PERFORMED PERCENT							RECOMMENDATION SUMMARY** OBSERVATIONS		RECOMMENDATION SUMMARY** PERCENT	
Month	Total Number of Patients	Number of Recommendations Made	Drug Interaction Allergy	Discontinue Redundant Coverage	Add Appropriate Cover for Culture	Narrow Spectrum of Activity	Discontinued with Antibiotic Prescription	IV to PO Switch Made	Dosing Changed	ID Consult Suggested	Drug Interaction Allergy*	Duplicative Antibiotic	Appropriate Cover for Culture	Narrow Spectrum of Activity	Discontinued with Antibiotic Prescription	IV to PO Switch Made	Dosing Changed	ID Consult Suggested	Recommended Interventions Performed	Recommended Interventions not Performed	Recommended Interventions Performed	Recommended Interventions not Performed
January	25	20	10	10	7	1	-	-	-	-	40%	71%	50%	7%	0%	0%	0%	0%	14	6	70%	30%
February	17	15	-	-	-	-	4	3	1	1	0%	0%	0%	0%	31%	23%	8%	8%	13	-	87%	0%
Annual Totals	42	35	10	10	7	1	4	3	1	1	24%	37%	26%	4%	15%	11%	4%	4%	27	6	77%	17%

Electronic Versions of Appendices are available at http://www.gnyha.org/antimicrobial/toolkit.

APPENDIX M:
THEORETICAL MONTHLY SAVINGS OF AN ANTIMICROBIAL STEWARDSHIP PROGRAM

THEORETICAL MONTHLY SAVINGS OF STEWARDSHIP PROGRAM								
ASSUMING LOS REDUCED ONE DAY BY INTERVENTION								
	DOSE	UNITS	DAYS	PATIENTS	TOTAL UNITS	COST/ DOSE	MONTHLY COSTS	
LEVOFLOXACIN IV	500	1	7	50	350	12.91	4518.5	
						IV DRUG COSTS	4518.5	
INTERVENTIONS	500	1	3	50	150	12.91	1936.5	
LEVOFLOXACIN PO	500	1	3	50	150	2.38	357	
						DRUG SAVINGS	2225	
CEFTRIAXONE	1	1	7	50	350	8.5	2975	
INTERVENTION	1	1	3	50	150	8.5	1275	
CEFPODIXIME	200	2	3	50	300	2.93	879	
						SAVINGS MONTH	821	
PIP-TAZO standard	3.375	4	7	50	1400	11	15400	
PIP-TAZO extended	3.375	3	7	50	1050	11	11550	
						SAVINGS	3850	
			THEORETICAL			ANTIBIOTIC COSTS MONTH		22893.5
						POST INTERVENTION COSTS		15997.5
						SAVINGS MONTH		6896

Electronic Versions of Appendices are available at http://www.gnyha.org/antimicrobial/toolkit.

APPENDIX N:
ADMINISTRATOR-ORIENTED POWERPOINT PRESENTATION WITH TEACHING GUIDE

ANTIMICROBIAL STEWARDSHIP ROLE OF THE "C-SUITE"

Insert Date
Insert Facility Logo

The purpose of this presentation is to provide senior leadership at health care institutions with a guide to understand how they can begin AND sustain an effective antimicrobial stewardship program. The presentation is split into the following sections:

- Introducing antimicrobial stewardship: What is the impact of hospital-acquired infections and antimicrobial resistance on clinical and economic outcomes? What is antibiotic resistance? Why is antimicrobial stewardship important?
- Setting up the case to implement antimicrobial stewardship: What are the goals of antimicrobial stewardship and the options for implementing it? What team members/disciplines should be involved?
- Implementing antimicrobial stewardship: What strategies can the "C-Suite" take on to implement antimicrobial stewardship? What does it take to implement a successful program? What are some preliminary steps to take to implement antimicrobial stewardship?

PRESENTATION OBJECTIVES

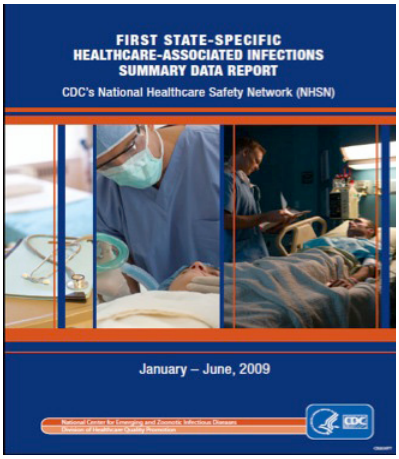
1. Summarize the impact of Hospital-Acquired Infections (HAIs) and antimicrobial resistance on clinical and economic outcomes.
2. Summarize the goals of antimicrobial stewardship programs (ASPs) in health systems and the role of health care practitioners in such programs.
3. Explain strategies essential for implementating antimicrobial stewardship initiatives.

The "C-Suite," with help from essential clinicians, should be in a position to describe the impact of hospital-acquired infections and antimicrobial resistance on clinical and economic outcomes, explain why antimicrobial stewardship is important, and understand important strategies to implement antimicrobial stewardship.

Electronic Versions of Appendices are available at http://www.gnyha.org/antimicrobial/toolkit.

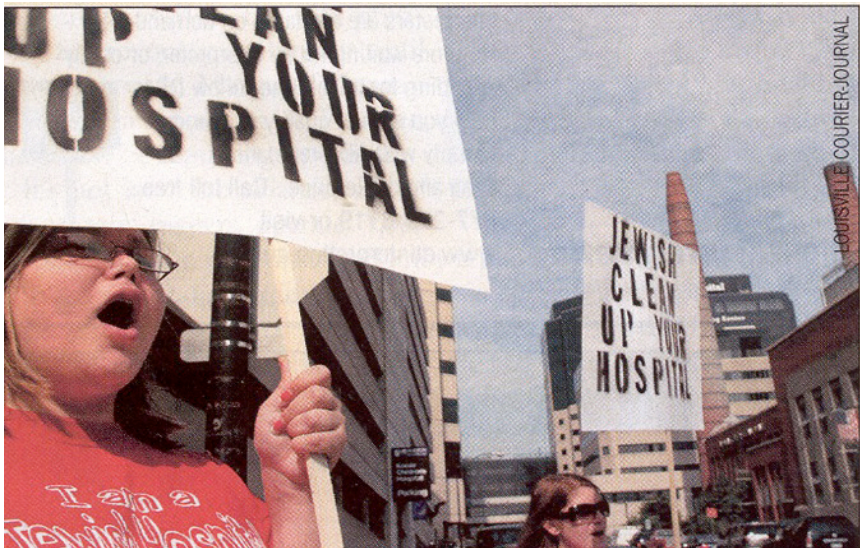
MAY 2010 HEADLINES

"99,000 Die Yearly From Preventable Hospital Infections"
"Hospital-Acquired Infection Rates Go Public"
"Study reveals *Clostridium difficile* spreads differently than hospitals thought"
"Hospital-Acquired Superbugs on the Rise"



These are some key, general points about hospital-acquired infections.
More and more public attention is being placed on hospital-acquired infections.
Health care facilities are being scrutinized because of their rates, and hospital-acquired infection rates are being publicly reported throughout the nation.

Slide can be updated as needed – and should reflect current events and trends.



Modern Healthcare, August 7, 2006, page 36 – Protesting MRSA Infections

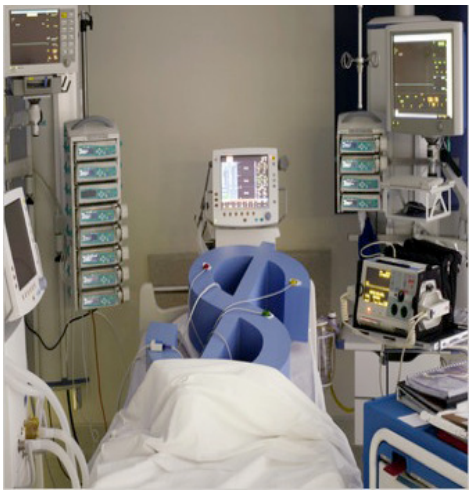
Key points: The public is very aware of hospital-acquired infections and are protesting, demanding that health care facilities address this issue.

Stress the fact that, with more and more quality-related public reporting requirements, CEOs can expect more questions from the general public, elected officials, board members, etc.

THE ECONOMICS OF HOSPITAL-ACQUIRED INFECTIONS

- Patients without infection:
  - Mortality = 2.0%
  - Length of stay = 4.7 days
  - Average Charge = $37,943
- Patients with hospital-acquired infection (HAI):
  - Mortality = 12.2%
  - Length of stay = 19.7 days
  - Average Charge = $191,872

Pennsylvania Health Care Cost Containment Council, January 2009



Purpose of Slide: These statistics offer a business case for focusing on hospital-acquired infection reduction efforts.

DIRECT AND INTANGIBLE COSTS OF HOSPITAL-ACQUIRED INFECTIONS

DIRECT COSTS	INTANGIBLE COSTS
Extra Treatment	Pain and Suffering
Extended Bed Stay	Extended Stay Away from Family
Extra Equipment	Increased Morbidity
Additional Personal Protective Equipment	Increased Mortality
Possible Primary Care Cost	Working Days Lost

Taylor, K., R. Plowman, J.A. Roberts. *The Challenge of Hospital Acquired Infection.* The Stationery Office, London (2001).

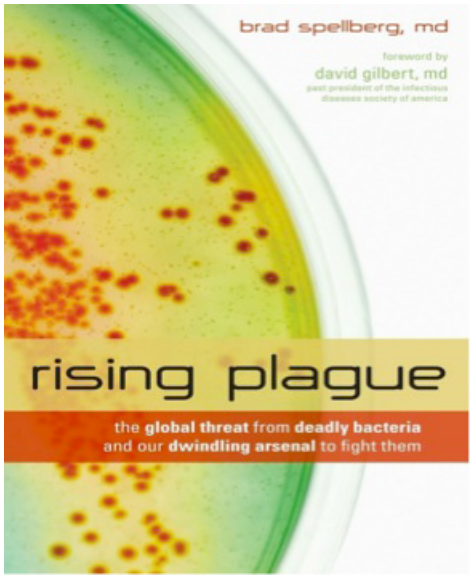
Key Points: Beyond the statistics shown on the previous page, there are both direct and indirect costs of hospital-acquired infections, and the intangible costs associated with these infections should be considered.

COSTS OF RESISTANCE

- "Resistance" is the tendency for a bacteria to develop a resistance to one or more antibiotics. This can occur when antibiotics are used repetitively.
- Resistant infections prolong length of hospital stay by 24% and increase costs by 29% vs. susceptible infections

  (Maudlin et al. *Antimicrobial Agent and Chemotherapy* (2010) 54:109–115
- Cost to U.S. of antibiotic resistance is 8 million additional hospital days and $21-34 billion/year (2009 dollars using CPI)

  (Roberts et al. *Clinical Infectious Diseases* (2009) 49:1175-84; & PRN Newswire —Antibiotic-Resistant Infections Cost the U.S.)



Purpose of Slide: This slide introduces the costs associated with antibiotic resistance and begins setting the stage for the importance of antimicrobial stewardship.

WHY TARGET ANTIBIOTIC USE?

- In the hospital setting, it is estimated that as much as 50% of antibiotic use is *unnecessary.*
  - Antibiotic misuse fosters the development and spread of antibiotic resistance.
- Antimicrobials account for up to 30% of hospital pharmacy budgets
- Successful ASPs have been shown to maintain care quality while reducing antimicrobial use by 22%–36% and saving as much as $200,000 to $900,000 annually per hospital.
  - Even small hospitals with limited staff and resources have instituted successful programs with annual savings exceeding $150,000.

Purpose of Slide: To introduce reasons for implementing an antimicrobial stewardship program within health care facilities (i.e., to improve patient outcomes and reduce costs).

Key points:
1. Antimicrobials are one of the most commonly prescribed classes of pharmaceuticals in the hospital setting.
2. Much of the use of these agents is inappropriate.
3. Misuse of antibiotics can be harmful.
4. There are potential cost savings related to appropriate use of antimicrobials.

RATIONALE FOR IMPLEMENTING A STEWARDSHIP PROGRAM

1. Patient care: *"The primary goal...is to optimize clinical outcomes while minimizing unintended consequences… including toxicity, selection of pathogenic organisms (such as C. difficile), and the emergence of resistance."*

2. Financial: *"Effective antimicrobial stewardship programs can be financially self-supporting and improve patient care…in both larger academic hospitals and smaller community hospitals."*

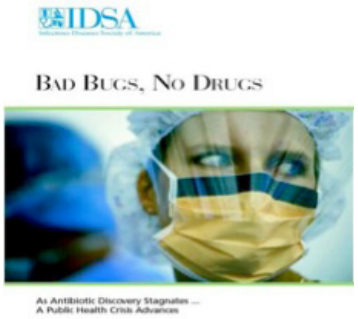
Guidelines for Developing an Institutional Program to Enhance Antimicrobial Stewardship: *Clinical Infectious Diseases* (2007) ;44:159–77

Purpose of Slide: Lay out the goals for implementing antimicrobial stewardship; there are clinical and financial reasons to pursue this.

ANTIBIOTIC STEWARDSHIP FUNDAMENTALS

Antibiotic Stewardship is:

"An ongoing effort…to optimize antimicrobial use in order to improve patient outcomes, ensure cost effective therapy, and reduce adverse results of antimicrobial use (including antimicrobial resistance)."



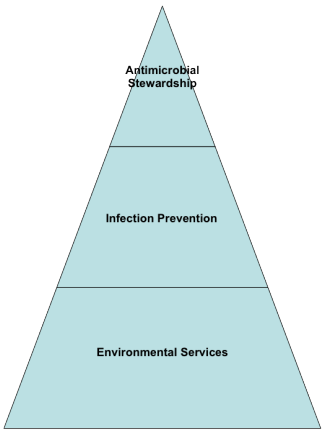
Axioms/Assumptions

- Antibiotic prescribing behaviors can be changed;
- Antibiotic use is a primary cause of resistance;
- A reduction in use will reduce or slow resistance; and
- Appropriate use can improve outcomes and costs.

MacDougall, C. and R.E. Polk. *Clinical Microbiology Reviews* (October 2005) 18(4):638–56.

IMPLEMENTING ANTIMICROBIAL STEWARDSHIP

- Infection prevention plus antimicrobial management.
- Determining appropriate antimicrobial selection, dosing, route, and duration.
- Despite the rewards of ASPs, a study by the Association for Professionals in Infection Control and Epidemiology found that fewer than 50% of hospitals surveyed have implemented them. Doing so should be a focus for every hospital.
- ASPs, like other aspects of infection prevention, must be part of an integrated, organization-wide, all-hands-on-deck effort. Programs require significant investment and engagement of hospital leaders.
    - Organizations that don't focus a part of every day on this effort will not succeed.



Purpose of Slide: To articulate why it is important to implement antimicrobial stewardship as part of your health care institution's infection prevention strategy.

Key points:
1. These three key components work hand-in-hand: environmental services, infection prevention, and antimicrobial stewardship. If you focus on one of the three, you will eventually see some reduction in hospital-acquired infections, but you get your biggest achievements and reductions by focusing on all three of these areas.
2. Hospital leadership is instrumental in aligning these three components and making every effort to involve clinical and support staff in these efforts.

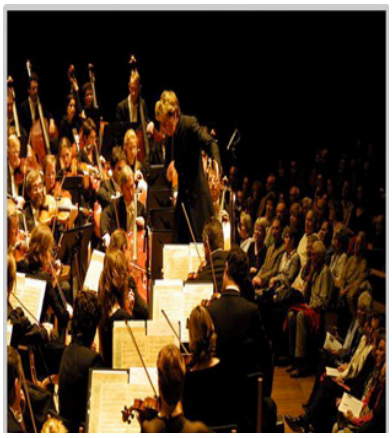
THE "A(SP) TEAM"

- "C-Suite"
- Administration "Champion"
- Infectious disease physician (Director or Co-director)
- Clinical pharmacist with infectious disease training (Co-director or core member)
- Other members of the team
    - Clinical microbiologist
    - Infection control professional
    - Hospital epidemiologist
    - Information system specialist

Key points: Essential Collaboration
Hospital administration/the "C-Suite:" Commitment and support is imperative
Medical staff
Infection Control Committee
Pharmacy and Therapeutics Committee
- Approve pathways
- Review budgetary issues
- Approve restriction policies and procedures
- Review yearly antibiogram

ORCHESTRATING THE EFFORT

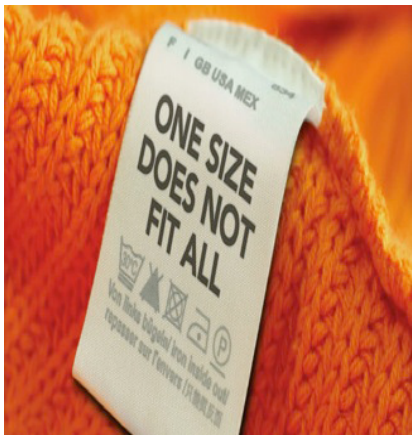
- "The support and collaboration of hospital administration, medical staff leadership, and local providers…is essential."
- "Antimicrobial stewardship programs [should] function under the auspices of quality assurance and patient safety. The infectious diseases physician and the head of pharmacy…should negotiate with hospital administration to obtain adequate authority, compensation, and expected outcomes for the program."



Guidelines for Developing an Institutional Program to Enhance Antimicrobial Stewardship: *Clinical Infectious Diseases* (2007); 44: 159–77.

STEWARDSHIP PROGRAM OPTIONS

- There is no one way to implement stewardship – programs can be tailored to an organization's needs and can be implemented at a system-wide or unit-by-unit level. Options include:
  - Formulary restrictions and preauthorization;
  - Antimicrobial stewardship programs;
  - Selective reduction of implicated agents;
  - Antimicrobial cycling;
  - Early discontinuation;
  - Prospective audit, intervention; and
  - Feedback.



Purpose of Slide: Ensure that the audience understands that there is not a "one size fits all" approach to antimicrobial stewardship. There are different strategies for implementation, and hospitals should decide what works best for their particular institution and culture.

WHERE TO BEGIN

- Assign to or Hire: Chief of Infectious Diseases and Director of Pharmacy
  - Develop initial budget proposal
  - Present to all levels of hospital administration
  - Include financial, clinical, and microbiology goals
- Form Antimicrobial Subcommittee to P&T
- Redesign hospital staffing model to accommodate program
  - Consider hiring PharmD and/or Infectious Disease providers or consultants if your hospital does not have these resources
- Develop practice guidelines/pathways
- Obtain prescriber buy-in and implement plan
- Have key ASP personnel report directly to the C-Suite to keep upper management engaged
- C-Suite should communicate regularly about successes and challenges
  - Helps recognize good performance and lets staff know leadership is committed

Purpose of Slide: To outline the necessary steps to initiate an antimicrobial stewardship program at your health care institution.

Key points:
1. As leadership, you must commit Infectious Disease physician AND Pharmacy support to get this program up and running. Without these essential personnel, the program will not be successful.
2. Prescribing providers are also very important. You should start trying to get their buy-in early in the process. The CMO should be involved in these efforts.
3. The "C-Suite" is essential at this early phase to achieve buy-in and support. Senior leadership's involvement throughout the implementation is important for sustainability also.

CHALLENGES OF AN ANTIMICROBIAL STEWARDSHIP PROGRAM

- Inadequate interest, understanding, and C-Suite $upport
- Inadequate laboratory resources or training to produce periodic antibiograms
- Physician "push back" related to monitoring and restricting antibiotic use, e.g., physician "autonomy" and perception that restriction policies are onerous; "gatekeeper" mentality
- Lack of pharmacists trained in infectious diseases to interact with physicians
- Lack of physician champions to lead program
- Up-front costs to initiate the program
- Reimbursement issues for MD-ID services
- Pharmacy and therapeutics committee that is not specifically committed to MDRO control
- Challenges in sustaining efforts

Source: Joint Commission on Accreditation of Healthcare Organizations©

Purpose of Slide: To lay out the challenges and lessons learned with implementing antimicrobial stewardship at health care institutions.

Key points:
1. Repeat the importance of the "C-Suite's" involvement.
2. Make sure audience understands the importance of the team dynamic involved in antimicrobial stewardship: there is a need for buy-in from senior leadership, pharmacy, infectious diseases, and prescribing providers.
3. Infectious Disease and Pharmacy must spearhead this initiative to make it successful.

CRITICAL SUCCESS FACTORS

- Collegial and educational relationship
- Daily review of antimicrobial orders by a consistent accountable team
- Support of hospital/medical leadership
- FTE's dedicated to program (Pharm.D. and M.D.)
- Development of criteria and guidelines for anti-infective use
- Formulary restriction
- Education of all prescribers to insure compliance
- Data collection and analysis to monitor antibiotic use and hospital-acquired infection rates (e.g., *C. difficile* rates)

IMPLEMENTING AN ANTIMICROBIAL STEWARDSHIP PROGRAM AT FACILITY'S NAME

Insert your institution's top priorities to begin here:
What can your health care institution do to begin an Antimicrobial Stewardship Program?

Purpose of Slide: Have a team of health care providers at your health care institution identify top priorities to begin implementing an antimicrobial stewardship program.

Key Point: Make sure that this strategy is tailored to your institution's culture and practices. Remember that antimicrobial stewardship is not a "one size fits all" approach.

IMPLEMENTING AN ANTIMICROBIAL STEWARDSHIP PROGRAM AT FACILITY'S NAME

Insert your institution's primary needs here:
What are your health care institution's primary needs related to an Antimicrobial Stewardship Program, e.g., do you need to hire new positions, etc.?

Purpose of Slide: Have a team of health care providers identify the primary needs to consider as the institution begins thinking about implementing an antimicrobial stewardship program. (Examples: Is there a need to identify an infectious disease resource? Is there a need to get voluntary physician prescribers involved early?)

Key Point: Make sure that these needs are tailored to your institution's culture and practices. Remember that Antimicrobial Stewardship is not a "one size fits all" approach.

SUMMARY AND KEY POINTS

- ASPs show great promise and offer new opportunities for patient care and cost impact.
- ASPs have the potential to reduce antimicrobial costs.
  - Limits overuse and inappropriate use of these agents.
  - Promotes active intravenous-to-oral (IV-to-PO) switch therapy.
- A well-designed ASP has the advantages of reducing:
  - Risk of drug-related adverse events and their associated costs.
  - Emergence of resistance.
  - Infections caused by resistant pathogens.
- Infections caused by resistant organisms are associated with:
  - Poorer clinical outcomes.
  - Prolonged hospital length of stay (LOS).
  - Higher overall costs compared to infections caused by susceptible organisms.
    John J.F., Jr., N.O. Fishman. Programmatic role of the infectious diseases physician in controlling antimicrobial costs in the hospital. *Clinical Infectious Diseases.* (1997) 24(3):471-85.
- Therefore, by promoting the appropriate use of antimicrobials, ASPs can have a broad impact on improving clinical outcomes while reducing overall health care costs.

GUIDELINE RESOURCES

- IDSA and SHEA
  - Dellit T.H., et al. "Infectious Diseases Society of America and the Society for Healthcare Epidemiology of America Guidelines for Developing an Institutional Program to Enhance Antimicrobial Stewardship." *Clinical Infectious Diseases* (2007) 44: 159–77.
- Centers for Disease Control and Prevention
  - Management of Multidrug-Resistant Organisms in Healthcare Settings; http://www.cdc.gov/ncidod/dhqp/pdf/ar/mdroGuideline2006.pdf
- ASM and SHEA
  - Moellering, R.C., et al. "Antimicrobial Resistance Prevention Initiative—An Update." *American Journal of Infection Control* (2007) 35: S1–23.

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