



BLUEPRINTS FOR SUCCESS

Models of effective antimicrobial stewardship programs

BY JANIENE BOHANNON, MS

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Approximately 20-50 percent of antibiotics prescribed in hospitals in the U.S. are either inappropriate or unnecessary.¹⁻⁶ It's no secret that the misuse of antibiotics contributes to the growing problem of antimicrobial resistance. This grave threat to public health not only impacts the U.S., but the entire world.⁷ The Centers for Disease Control and Prevention (CDC) reports that an estimated two million people in the U.S. are infected with antibiotic-resistant organisms each year, leading to 23,000 deaths.⁸ A growing body of research shows that antimicrobial-stewardship programs (ASPs) can optimize how infections are treated and reduce deleterious effects associated with antibiotic misuse, thereby improving patient safety and quality outcomes.⁹ Other benefits of ASPs include reduced *Clostridium difficile* infection cases, reduced treatment failures, increased infection cure rates, as well as cost savings for hospitals.¹⁰⁻¹¹

In its *Core Elements of Hospital Antibiotic Stewardship Programs* report, CDC notes that an effective ASP must include the following:¹²

1. **Leadership commitment:** Ensuring dedicated resources (human, financial, and information technology)
2. **Accountability:** A single leader who is responsible for the outcomes of the ASP
3. **Drug expertise:** A single pharmacist who is responsible for efforts to improve use of antibiotics
4. **Action:** Plan implementations based on facility needs
5. **Tracking:** Monitoring of patterns of antibiotic prescribing and resistance
6. **Reporting:** Reporting antibiotic use and resistance information to doctors, nurses, and other relevant staff on a regular basis
7. **Education:** Educating staff about optimal antibiotic use

The CDC report notes that infection preventionists (IPs) are key in supporting and enhancing the work of ASPs.¹² It stands to reason, because at its core, “Antimicrobial stewardship is an inter-professional effort and

involves optimal, prudent antimicrobial use for patients across the continuum of care: acute, inpatient, long-term care, and outpatient settings,¹³ IPs are uniquely situated to be part of interdisciplinary teams to oversee appropriate use of antibiotics to treat infection.

In 2012, IPs and healthcare epidemiologists partnered on an *American Journal of Infection Control* paper which stated that they can benefit ASPs by:¹³

- Providing support and guidance in approaches to surveillance for syndromes of interest;
- Implementing interventions to guide the delivery of evidence-based practices; and,
- Translating data and infection rates to healthcare workers, nursing units, and administrators.

Because *Prevention Strategist* seeks to help IPs translate the science of infection prevention into practice, we will be sharing profiles from healthcare organizations with successful ASPs starting with this issue. We hope that these profiles not only inform you, but inspire you to assess and champion positive changes in your ASP.

Mercy Philadelphia Hospital

Mercy Health System of Southeast Pennsylvania, a Member of Trinity Health System Philadelphia, Pennsylvania

BY LYNN KLEINA, PhD, MPH, CIC

Mercy Philadelphia Hospital—a 178-bed community, post-graduate resident teaching hospital—established its ASP in 2011. Championed by Clinical Pharmacist Thomas Turco, BS, the ASP was developed when the hospital had one full-time employed infectious disease physician. Now, the members of the Mercy Philadelphia Hospital ASP team include:

- Thomas Turco, BS-PharmD, clinical pharmacist
- Gul Madison, MD, infectious disease physician
- Lynn Kleina, PhD, MPH, CIC, infection control analyst
- James Hunter, MHA, RN, CIC, infection control manager

ROLES OF ASP TEAM MEMBERS

The Mercy Philadelphia Hospital ASP team members have multiple roles and expertise that include:

- Hospital epidemiologist
- Infection preventionist
- Infectious disease physician
- Pharmacist
- Microbiologist
- Registered nurse
- Information systems specialist

Mercy's ASP also brings in other individuals on an ad hoc consultative basis.

LEADERSHIP

Dr. Gul Madison—the second infectious disease (ID) physician since the ASP's inception—currently leads the ASP. The program continues to evolve and improve under her leadership. The program has been formalized to a greater extent including a

Resident/Intern & Pharmacy student teaching component.

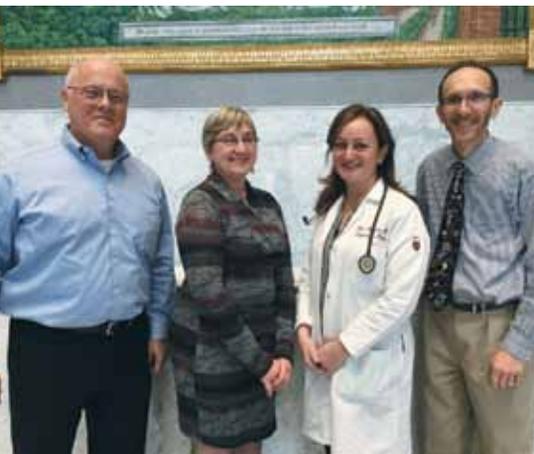
THE MAIN COMPONENTS OF MERCY HEALTH SYSTEM'S ANTIMICROBIAL STEWARDSHIP PROGRAM

The components of the ASP are documented as distinct interventions/components:

- Formulary restriction
- Preauthorization (approval programs)
- Prospective audit and feedback
- Education
- Guidelines and clinical pathways (clinical decision support)
- Parenteral to oral conversion protocol
- Dose optimization/automatic dose adjustment
- Streamlining/de-escalation of therapy
- Time-sensitive automatic stop orders
- Antimicrobial stewardship patient rounds
- Antimicrobial reconciliation at transitions in patient care
- Discontinue/No indication
- Indication clarification required in patient record
- Outpatient therapy recommendations
- ID Consult/ID On Board

THE INFECTION PREVENTIONISTS' ROLE IN THE ASP

The IPs have been involved since the program's inception. They provide data analysis, monitoring, and reporting of multidrug-resistant organisms (MDROs) including *Clostridium difficile* infection (CDI). They review the antibiogram for trend changes. The ASP team also creates methodology and rules in the data-mining system to capture information for data analysis. They document the interventions when the pharmacist is unavailable. Furthermore, reporting on stewardship is an essential component of the monthly infection control meeting agenda. The IPs also work to educate various



Pictured left to right: Jim Hunter, Infection Prevention & Control Manager; Lynn Kleina, Infection Prevention & Control Analyst; Dr. Gul Madison, Infectious Diseases; Tom Turco, Clinical Pharmacist

sections of the hospital system not directly involved with patient care about stewardship and work as a conduit of information across departments.

FUNDING

The stewardship program has no formal funding. Unlike research institutions, the Mercy Philadelphia Hospital ASP team members have other hospital duties as well. The Mercy Philadelphia Hospital ASP team uses existing tools such as a Web-based data-mining system that has both pharmacy and infection control modules. This allows the team to write and test new rules to refine data capture and acquire new information as requirements and mandates change.

The data-mining system went live in 2013 and has been the single most important component to make the program more efficient. It gives the ASP team the capability to capture all patients on antibiotics in the hospital in real time, and has the capability to document the interventions the team has made. It increased the ability to review antimicrobial cases by approximately fourfold per month.

FREQUENCY OF MEETINGS

The team meets biweekly for one hour, conducting antimicrobial stewardship rounds in real time.

ASP MEETINGS IN ACTION

The biweekly “meetings” are actually stewardship case reviews of patients currently receiving antimicrobial therapy. There are two customized lists created in the data-mining system gathered from the electronic health record. The first list is the stewardship list containing all the patients on broad spectrum antibiotics for more than three days, or on restricted, or high-cost, targeted antimicrobials (e.g., Carbapenems, Linezolid, Piperacillin/Tazobactam, Vancomycin). The second list contains every patient receiving any other type of antimicrobial in the hospital. The stewardship list is reviewed first, then the second list is reviewed as time permits. Pharmacy students attend all rounds.

Patients who are currently under the care of or consulted by the ID physician are included in the documentation. Chart reviews are performed on all non-ID

physician patients. Antibiotic indications, test results, and findings are reviewed. If there are recommendations, the attending or resident is called on the phone or text messaged in real time by the ID physician with the stewardship recommendations. If deemed necessary, an antimicrobial stewardship team note with recommendations is also entered in the electronic health record. All types of interventions are documented in the data-mining system.

The team meets at the same time on the same days of the week in a physician charting room on the same unit. This gives visibility to the team and allows physicians to consult/discuss their patient on an informal basis (“curb-side consults”) because they know where team members are located. Approximately bimonthly, the team meets with resident teams and interns and the focus is placed on their patients currently being treated with antibiotics. Once the residents’ patients [courses of antibiotics] are complete, the team returns to the standard stewardship rounding process.

MEASURING THE IMPACT OF THE PROGRAM

Currently our ASP team looks at process and outcome measures, but we are continually working to create better metrics. We started by looking at total and specifically targeted (e.g., Carbapenems, Linezolid, Piperacillin/Tazobactam, Vancomycin) antibiotic purchases per month as a proxy for usage. For example, in 2010, targeted antibiotic purchases were approximately \$407,000 per year. For 2015, the cost for the same group of antibiotics was less than \$63,000 per year. Currently we are developing metrics to capture days of therapy (DOT) as a better reflection of usage. Secondly, DOT also meets future Joint Commission requirements.¹ We also look at the prevalence of all CDI and opportunistic pathogens such as *Candida* before and after initiating the stewardship program. We continually review the efficiency of the overall program by documenting and analyzing the number and types of interventions over time and make adjustments accordingly.

GOALS OF THE ASP

Antimicrobial stewardship is a continuing process improvement program. Early goals

JUST RELEASED: CDC HEALTHCARE-ASSOCIATED INFECTION RESOURCES

CDC's March 2016 *Vital Signs* report urges healthcare personnel to 1) prevent infections related to surgery or placement of a catheter, 2) prevent spread of bacteria between patients, and 3) improve antibiotic use to better protect every patient every time from antibiotic-resistant bacteria.

www.cdc.gov/vitalsigns

For an infographic illustrating the recommendations, see www.cdc.gov/vitalsigns/protect-patients

The Antibiotic Resistance HAI Patient Safety Atlas is a new web app with interactive data on HAIs caused by antibiotic-resistant bacteria. The tool provides national, regional, and state map views of superbug/drug combinations showing percent resistance data from 2011-2014.

www.cdc.gov/hai/surveillance/ar-patient-safety-atlas

CDC's annual **National and State HAI Progress Report** provides data on national HAI metrics reported through the National Healthcare Safety Network.

www.cdc.gov/hai/progress-report

Read more about antimicrobial stewardship in



Improving antimicrobial stewardship in the neonatal ICU with computer decision support, Ferng, Yu-hui et al., *American Journal of Infection Control*, Volume 40, Issue 5, e131.

Knowledge, beliefs, and confidence regarding infections and antimicrobial stewardship: A survey of Veterans Affairs providers who care for older adults, Jump, Robin L.P. et al., *American Journal of Infection Control*, Volume 43, Issue 3, 298–300.

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Design and analysis of a pharmacist-enhanced antimicrobial stewardship program in Thailand, Apisarnthanarak, Anucha et al., *American Journal of Infection Control*, Volume 43, Issue 9, 956–959.

Retrospective cohort study of inappropriate piperacillin-tazobactam use for lower respiratory tract and skin and soft tissue infections: Opportunities for antimicrobial stewardship, Havey, Thomas C. et al., *American Journal of Infection Control*, Volume 43, Issue 9, 946–950.

Impact of an antimicrobial stewardship program with multidisciplinary cooperation in a community public teaching hospital in Taiwan, Lin, Yu-Shiuan et al., *American Journal of Infection Control*, Volume 41, Issue 11, 1069–1072.

were simple and relied on capturing “low hanging fruit” such as looking at restricted antibiotics or broad-spectrum drug usage. We have kept refining our goals. In the last year, the computerized physician order entry antibiotic indication list was improved to better match the drug chosen to the condition for which the patient was being treated. Policies have also been updated, and education has been added.

In 2014, the CDC published its *Core Elements of Hospital Antibiotic Stewardship Programs*. We have used this checklist to assess various aspects of the program and address and improve areas of shortfall. Our goal is to answer “yes” to every question on the checklist. We are also utilizing the proposed Joint Commission Standards for Antimicrobial Stewardship to modify and improve our program.

PROGRAM SUCCESSES

We have begun to see a decrease in the prevalence of opportunistic *Candida* infections, CDI, and some other MDROs in the hospital, and the expenditures on targeted antibiotics per year have decreased to less than 20 percent of pre-ASP inception.

Interventions and recommendations by the ASP team are now almost universally

accepted. Our ID physician, Dr. Madison, has a positive working relationship with other physicians, and the ASP interventions are viewed as an extra set of eyes assisting with patient care. This includes the house staff and the surgical teams.

FACTORS THAT MAKE THIS ASP EFFECTIVE

The team is extraordinarily creative with myriad skill sets and refuses to take no for an answer! We work well together with the common goal of improving patient care and safety. Within the Mercy Health System of Southeast Pennsylvania, we work with our sister hospitals to share best practices. Outside of Mercy, we utilize and incorporate ideas wherever we find them and have shared results across the Trinity Health System.

ONE FACTOR THAT COULD IMPROVE THIS ASP

We would love to have more formal time to spend on antimicrobial stewardship. The team would be able to increase the frequency of rounds, have more time to evaluate trends, create opportunities for further education, and develop a web-based stewardship training program for new providers based on guidelines and best practices.

Reference:

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Maine Medical Center

Portland, Maine

BY GWEN M. ROGERS, RN, MSB, DBA(C), CIC

LEADERSHIP

Maine Medical Center (MMC) – a 637-bed general medical and surgical major teaching, tertiary care, referral hospital – established its ASP in 1996. The ASP was championed by Patty Stogsdill, infectious diseases (ID) physician and medical director, and Rob Owens, ID pharmacist. Stogsdill currently leads the ASP, along with Minkey Wungwattana, ID pharmacist and director of the ASP, and Kristina Rokas, ID pharmacist and chair of Antimicrobial Stewardship Program Task Force and Advisory Board.

THE MAIN COMPONENTS OF MMC'S ANTIMICROBIAL STEWARDSHIP PROGRAM

- Formulary restriction
- Preauthorization (approval programs)
- Prospective audit and feedback
- Education
- Guidelines and clinical pathways (clinical decision support)
- Parenteral to oral conversion protocol
- Dose optimization/automatic dose adjustment
- Streamlining/de-escalation of therapy

MEMBERS AND STRUCTURE

Members of the ASP include:

- Hospital epidemiologist – August Valenti
- Director of epidemiology & infection prevention – Gwen Rogers
- Infectious disease physicians – Patricia Stogsdill and Jennifer Jubulis
- Pharmacists – Minkey Wungwattana, Kristina Rokas, Renee Fallon, Alexander Kappelman, Marizela Savic, Jean DeJace, Sarah Hendrick, Alexis Thayer, William Crall, Jonathan Bourque
- Microbiologists – Donna DuBois, Monica Ianos-Irimie, and Catherine Dragoni
- Infectious Disease Fellow – Christina DeMatteo
- Representatives from each specialty groups (e.g., surgery, pediatrics, critical



care, nephrology, oncology, hospitalist, resident)

The ASP at Main Medical Center is comprised of three distinct subgroups:

1. The ASP Task Force

The ASP Task Force is a small work group comprised of pharmacists, microbiologists, physicians, and nurse epidemiologists who meet and discuss stewardship action items. For example, an agenda item during a meeting may deal with the flagging of multidrug-resistant organisms (MDROs), such as ESBL, and how it would impact patient care from all fronts – drug selection, contact isolation, etc. Another recent topic has been blood culture contamination rates and measurement of the inappropriate treatment of such.

Pharmacists review the antibiogram and sensitivity of organism for appropriateness of antibiotic treatment. The microbiologists look at new and more efficient ways to get test results to the treating providers. ID physicians review antibiotic orders and make suggestions for better combinations. The nurse epidemiologists work within the service lines to provide education around proper use of precautions and cohorting.

Left to right: Christina DeMatteo, DO, infectious diseases fellow; Donna Piacitelli, assistant chief medical technologist, microbiology; Minkey Wungwattana, PharmD, BCPS (AQ-ID), director of ASP, clinical pharmacy specialist, infectious diseases; Kristina Rokas, PharmD, BCPS, chair of ASP committees, clinical pharmacy specialist, infectious diseases; Patricia Stogsdill, MD, FIDSA, medical director of ASP, infectious diseases specialist; Gwen Rogers, DBA(c), MSB, RN, CIC, director of epidemiology and infection prevention.

2. The Pharmacy and Therapeutics (P&T) Committee

The P&T Committee is made up of members of all types of disciplines (e.g., nursing, physicians, pharmacists) that meet to discuss the use of medications and pharmacy programs at the institution. Drugs that are deemed safe, effective, cost-effective, and useful for the patient population at MMC are reviewed by physicians and pharmacists and voted upon to add to the “formulary” or not added. A nurse epidemiologist also sits on the P&T Committee for discussion regarding patient immunization protocols, antibiotic choices that might impact *C. difficile* rates, etc.

3. The ASP Advisory Board

The Advisory Board is made up of physicians/providers from each specialty. For example, we have a physician from the following areas: nephrology, oncology, critical care, pediatrics, internal medicine, hospitalists, surgery, and infectious diseases, among others. Members of the ASP Task Force are also on the Advisory Board; this includes representation from infection prevention, microbiology, and informatics. A nurse epidemiologist represents infection prevention aspects of patient care.

THE INFECTION PREVENTIONISTS' ROLE IN THE ASP

The director of Epidemiology and Infection Prevention (the infection preventionist [IP]) is an active participant in the ASP Task Force, the P&T Committee, and the ASP Advisory Board. The IP promotes stewardship practices, whether directly as a representative from ASP or indirectly as an IP. She collaborates with the chair of the ASP Task Force on agenda items that need attention from pharmacy, microbiology, and infection prevention.

The IP attends bimonthly Infection Prevention Committee meetings and weekly infectious diseases conferences. The IP leads twice-per-month epidemiology rounds for nurse epidemiologists, ID fellows, ID attendings, and ID pharmacists to enhance collaboration between infection prevention and the ID community.

For example, it's important to perform periodic point prevalence studies to catch the emergence of MDROs before they become a major issue. The IP proposed the idea of performing CRE point prevalence

studies to the group, with the input from the microbiology lab as well as ID physicians and pharmacists. The IP conducted two point prevalence studies to track CRE emergence within MMC.

The IP also led collaborative discussions among the ASP group to develop appropriate guidelines for safe patient care and the flagging of MDROs of importance in the electronic medical record.

MMC does not speciate alpha strep down to the level required to make a decision about central line-associated bloodstream infection (CLABSI). The IP discussed this issue because it was impacting MMC's CLABSI rate within the National Healthcare Safety Network (NHSN). Based on input from the ASP team, we decided to send these specific cases out to a reference lab to allow for speciation and decision making within the CLABSI definition.

FREQUENCY OF MEETINGS

The ASP Task Force Subcommittee meets biweekly and the ASP Task Force Advisory Board meets bimonthly.

ASP leaders (Minkey, Patty, Kristina) meet on a quarterly basis to recap progress of the program, what each person is doing for the current initiatives, and short/long term goal discussion to ensure program remains on track.

ASP MEETINGS IN ACTION

- Meeting minutes from previous meeting
- Report/updates from individuals with assignments from old topics/prior agenda items
- Discussions of new agenda items and assigning responsibilities
- Brief discussion of future agenda items

FUNDING

The ASP is funded through the pharmacy budget.

MEASURING THE IMPACT OF THE PROGRAM

Members of the P&T Committee present progress reports on a biannual basis. Representatives track and present on the number of AS interventions and recommendations, as well as the acceptance rate by clinicians who received those recommendations. Additionally, they examine the financial impact in terms of annual cost of antimicrobials as well as

antibiotic usage (measured in days of therapy or defined daily doses).

ESTABLISHING GOALS OF THE ASP

The director of the ASP program and other members meet quarterly to discuss programs that are ongoing and updates on the progress of each initiative. Additionally, we map and outline the initiatives that have been presented by leadership or initiatives that the ASP program has a desire to accomplish.

PROGRAM SUCCESSSES

Some successes as a result of the ASP include:

- Implementation of rapid diagnostics (Nanosphere) for Gram-positive organisms; widespread use in the hospital
- Antibiotic desensitization order set
- Development of definitions for MDROs isolation algorithm
- Reduction in catheter-associated urinary tract infections and CLABSI
- Ongoing multidisciplinary efforts to reduce surgical site infection rates

When we initiated the program in 1996, we saved money by switching to less costly antibiotics. However, we reached a point where we could no longer save money by simply switching drugs. We have achieved further cost savings through non-antibiotic interventions such as obtaining an infectious diseases consult for bacteremia of certain organisms, obtaining repeat blood cultures, getting certain diagnostic tests earlier during the hospital admission, transitioning patients from IV to oral therapy to facilitate discharge, reviewing of microbiology to determine clinically relevant and non-clinically relevant results, etc.

MMC does active surveillance testing of all admissions and repeats it every seven days. Our rate of MRSA and *C. difficile* prevalence as measured by LabID event reporting to NHSN (hospital onset): SIR 0.33 for MRSA and SIR 0.49 for *C. difficile* (HO and HCA-CO).

FACTORS THAT MAKE THIS ASP EFFECTIVE

- Multidisciplinary approach with interest and buy in from many different departments

- Administration support for ASP initiatives
- Strong physician support from our Medical Director of ASP

Before the ASP was established, program leaders took a proactive approach by involving physicians in the structure and development of the program. Since 1996 (the year of the program's inception) and through different pharmacists who have taken on the ASP directorship position, physicians have overwhelmingly supported the ASP because of how it was created from the beginning.

ONE FACTOR THAT COULD IMPROVE THIS ASP

A dedicated informatics and information technology support is critical for the success of any antimicrobial stewardship program. IS/IT support for our program would be immensely helpful. 

Prevention Strategist thanks
Mary Lou Manning, PhD, CRNP, CIC, FAAN,
FNAP, for her contribution to this article.