California Department of Public Health

Antimicrobial Stewardship Program Toolkit

Examples for Program Implementation

2015

California Department of Public Health
Antimicrobial Stewardship Program
Toolkit: *Examples for Program Implementation*

Background

Antimicrobial stewardship refers to coordinated interventions designed to promote and measure the appropriate use of antimicrobial agents. The major objectives of antimicrobial stewardship are to optimize clinical outcomes for patients while minimizing toxicity and other adverse events associated with antimicrobial use including *Clostridium difficile* diarrheal infections and the emergence of antimicrobial-resistant organisms. As such, antimicrobial stewardship is essential to healthcare quality, patient safety and public health.

CDPH ASP Definition

To provide California acute care hospitals with an understanding of antimicrobial stewardship programs (ASP) and to encourage implementation of stewardship practices, in December 2013 the California Healthcare-Associated Infections Advisory Committee (HAI-AC) recommended to CDPH an ASP definition including 11 elements:

Basic

1. An institution-specific antimicrobial stewardship policy and/or procedure has been adopted.
2. A physician-supervised multidisciplinary antimicrobial stewardship committee or workgroup has been convened.
3. ASP leadership support is provided by a physician or pharmacist with antimicrobial stewardship training from a recognized professional organization or post-graduate education.
4. ASP activities are routinely reported to hospital quality improvement committees.

Intermediate

5. An antibiogram is developed annually using Clinical Laboratory Standards Institute guidelines and distributed to medical staff, with follow-up education provided.
6. Institutional guidelines have been developed for the management of common infection syndromes (e.g. order sets, clinical pathways, empiric antimicrobial therapy guides).
7. Usage patterns of antibiotics determined to be of importance to the resistance ecology of the facility are monitored using defined daily dosing (DDD) or days of therapy (DOT).
8. Regular antimicrobial stewardship education is provided to medical staff and committees.

Advanced

9. The antimicrobial formulary is reviewed annually and changes are made based on the local antibiogram.
10. Prospective audits of antimicrobial prescriptions are performed and intervention/feedback is provided to prescribers.
11. Formulary restriction with preauthorization has been implemented.

California Legislative Requirements for ASP

In September 2014, California Senate Bill (SB) 1311 was signed into law, requiring all California general acute care hospitals to implement the following by July 1, 2015:

> *(a) Adopt and implement an antimicrobial stewardship policy in accordance with guidelines established by the federal government and professional organizations, including a process to evaluate the judicious use of antibiotics.*
>
> *(b) Develop a physician supervised multidisciplinary antimicrobial stewardship committee, subcommittee, or workgroup.*
>
> *(c) Appoint to the physician-supervised multidisciplinary antimicrobial stewardship committee, subcommittee, or workgroup, at least one physician or pharmacist who is knowledgeable about the subject of antimicrobial stewardship through prior training or attendance at continuing education programs, including programs offered by the federal Centers for Disease Control and Prevention, the Society for Healthcare Epidemiology of America, or similar recognized professional organizations.*
>
> *(d) Report antimicrobial stewardship program activities to each appropriate hospital committee undertaking clinical quality improvement activities.*

California is the first state in the nation to require general acute care hospitals to adopt and implement ASPs. The requirements of SB 1311 and the CDPH ASP definition's basic elements are in alignment.

Overview of the CDPH ASP Toolkit

To provide support to California hospitals for the implementation of ASP, including SB 1311 requirements, and to encourage implementation of more advanced ASP elements, the HAI-AC recommended that CDPH promulgate an ASP Toolkit showing examples of local program implementation.

Who Should Use the CDPH ASP Toolkit?

The CDPH ASP Toolkit can be used by physicians, pharmacists, infection preventionists, microbiologists, information technology specialists, and any other hospital leadership and support staff seeking guidance, resources, and practical examples for developing or implementing ASP practices.

How to Use the CDPH ASP Toolkit

The Toolkit is comprised of 11 sections, each addressing an element of the CDPH ASP definition. Each section includes a brief overview of the element, followed by references, documents and/or tools illustrating real-world examples of how some hospitals in California are implementing the element. Examples represent a range of hospital types, including academic, community, and pediatric settings. The examples are intended to serve as models or starting points for hospitals to consider when developing and/or enhancing their ASPs. Questions regarding a specific example should be directed to the contributor of that example; contributors are indicated with each example provided.

CDPH would like to thank those hospitals that have generously shared materials for producing this toolkit.

Additional examples and references that represent diverse practice settings and circumstances are being sought, so that this toolkit may be updated periodically. If you have a question, suggestion or example(s) to share, please contact the CDPH HAI program at HAIProgram@cdph.ca.gov.

California Department of Public Health
Antimicrobial Stewardship Program (ASP)
Toolkit: *Examples for Program Implementation*

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Antimicrobial Stewardship Program Element 1 (BASIC):

An institution-specific antimicrobial stewardship policy and/or procedure has been adopted.

Developing a formal antimicrobial stewardship program (ASP) policy and procedure is an invaluable process to undertake while initiating or institutionalizing an ASP. A formal ASP policy and procedure defines the goals and scope of the ASP, and takes into consideration the particular needs and unique aspects of the institution. The policy development process provides an opportunity to solicit input from physician stakeholders, allowing them a voice in the process so that their concerns and misconceptions can be addressed and their buy-in gained. Involving stakeholders from throughout the hospital provides publicity for the program so that few are surprised at the time of implementation. The ASP policy and procedure document, once approved and adopted by the medical leadership of the hospital, is an important step in institutionalizing the program, giving it standing among both supporters and naysayers.

Given the range in size and types of care provided among hospitals, there is no single template for an ASP. However, effective ASPs can be implemented in a wide variety of hospitals. The following ASP policy and procedure documents illustrate examples of how to frame the purpose and rationale of an ASP and define the scope of ASP activities.

References

CDC. Core Elements of Hospital Antibiotic Stewardship Programs. Atlanta, GA: US Department of Health and Human Services, CDC; 2014. Available at http://www.cdc.gov/getsmart/healthcare/implementation/core-elements.html.

Dellit TH, Owens RC, McGowan JE, Jr., 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. *Clin Infect Dis* 2007;44(2):159–177.

Example 1.1 Children's Hospital & Research Center Oakland ASP Policy/Procedure (1of 14)

Title: Antimicrobial Stewardship Program (ASP)	
Policy #: 10.00	**Page(s):** 14
Location: Infection Control	**Revision date(s):** 8/2011
Scope: Organization-wide	**Effective date:** 8/2010
Author(s): Brian Lee, MD	**Approval signature:** Medical Executive Committee
Owner/Responsible person: Infection Control Committee	**Title:** Antimicrobial Stewardship Program (ASP)

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For more information about this example contact Brian Lee, MD at blee@mail.cho.org

CDPH does not endorse the specific content or recommendations included in these examples. They are for illustrative purposes only.

Example 1.1 Children's Hospital & Research Center Oakland ASP Policy/Procedure (continued 2 of 14)

SECTION I. PURPOSE

To establish an organization-wide program called the Antimicrobial Stewardship Program (ASP) which promotes the appropriate use of antimicrobial agents at Children's Hospital & Research Center Oakland (CHRCO). The goal of the ASP is to optimize clinical outcomes while minimizing the unintended consequences of inappropriate antimicrobial use including:

1. The development of antibiotic resistance and antibiotic-resistant infections
2. The selection of other pathogenic organisms such as *Clostridium difficile*
3. Medication toxicity
4. Excess healthcare costs

Antimicrobial stewardship is an essential component of patient safety and quality of care. As such, the development of ASPs has been endorsed by a number of professional organizations, including the American Academy of Pediatrics and the Pediatric Infectious Disease Society.[1]

In addition, the establishment of an institutional ASP is a "best practice"[2,3] process that complies with the following mandates:

1. California Senate Bill California Senate Bill No. 739 (approved in September 2006) and Senate Bill No. 158 (approved in September 2008) which require that "...general acute care hospitals develop a process for evaluating the judicious use of antibiotics..."
2. The Joint Commission's 2010 National Patient Safety Goal (07.03.01): implement evidence-based practices to prevent health care-associated infections due to multidrug-resistant organisms in acute care hospitals (including but not limited to methicillin-resistant *Staphylococcus aureus* (MRSA), *C. difficile*, vancomycin-resistant *Enterococcus* (VRE), and multidrug-resistant gram-negative (MDR-GN) bacteria), including the following Elements of Performance:
    a. Measure and monitor multidrug-resistant organism prevention processes and outcomes, including the following: (Scoring category A)
        i. Multidrug-resistant organism infection rates using evidence-based metrics
        ii. Compliance with evidence-based guidelines or best practices
        iii. Evaluation of the education program provided to staff and licensed independent practitioners
    b. Implement policies and practices aimed at reducing the risk of transmitting multidrug-resistant organisms. These policies and practices meet regulatory requirements and are aligned with evidence-based standards (for example, the Centers for Disease Control and Prevention (CDC) and/or professional organization guidelines). (Scoring category C)

SECTION II. RATIONALE

Antimicrobial resistance has been on the rise in both the community and hospital settings. Antibiotic-resistant infections (ARI) in the hospital have been associated with increased morbidity and mortality for patients.[4,5] Currently >70,000 deaths annually in the U.S. are due to health care-acquired, drug-resistant infections. In fact, more people now die of MRSA in U.S. hospitals than of HIV/AIDS and tuberculosis combined.[6]

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Example 1.1 Children's Hospital & Research Center Oakland ASP Policy/Procedure (continued 3 of 14)

Despite the rise in ARI, the development of new antimicrobial agents has progressively declined over the past three decades. The lack of novel drugs with which to treat the growing threat of ARI has led to a global and national crisis. In fact, the World Health Organization has identified antibiotic resistance as one of the three greatest threats to human health, and antibiotic resistance is considered a major threat to both public health and national security by the Institute of Medicine, Interagency Task Force on Antimicrobial Resistance (which involves the CDC, Food and Drug Administration, National Institutes of Health, Agency for Healthcare Research and Quality, Centers for Medicare & Medicaid Services, Health Resources and Services Administration, Department of Agriculture, Department of Defense, Department of Veterans Affairs, and Environmental Protection Agency), and the Infectious Diseases Society of America.[7,8]

Because the inappropriate use of antimicrobial agents creates the selective pressure which drives the rates of resistance, there has been a growing recognition that antimicrobial effectiveness must be regarded as a limited resource that should be preserved through judicious use of our currently available drugs, i.e. antimicrobial stewardship.

SECTION III. ANTIMICROBIAL STEWARDSHIP PROGRAM CORE MEMBERS

The Director of the ASP must have expertise in pediatric infectious diseases and will be appointed by the hospital administration based on the recommendation of the Executive Committee of the Medical Staff (MEC) and the Director of the Division of Infectious Diseases. The Director of the ASP will also serve as the chair of the Antimicrobial Stewardship Committee (ASC), which is a subcommittee of the Infection Control Committee and a committee of the MEC.

The Antimicrobial Stewardship Committee (ASC) oversees the organization-wide effort to promote and evaluate the appropriate use of antimicrobial agents. The ASC is a multidisciplinary group that includes the following core members:

1. Director of the ASP (Pediatric infectious disease specialist)
2. At least (3) members of the Medical Staff with representation from the Pediatric Intensive Care Unit, Neonatology, Hospitalist Group, Emergency Medicine, Hematology/Oncology, Surgery, and/or Community Pediatrics
3. Chief resident
4. At least one (1) representative from Hospital Administration, Patient Safety, and/or Quality Assurance
5. Pharmacist with infectious disease training
6. Infection preventionist
7. Clinical microbiologist
8. Hospital epidemiologist
9. Information system specialist/data analyst

Responsibilities of the ASC include the following:

1. Develop and review policies and clinical guidelines related to appropriate use of antimicrobial agents (including drug choice, dose, route and duration).
2. Monitor compliance with policies and clinical guidelines.
3. Evaluate effectiveness of intervention efforts including monitoring of antimicrobial utilization and clinical outcomes.

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Example 1.1 Children's Hospital & Research Center Oakland ASP Policy/Procedure (continued 4 of 14)

4. Review trends in antibiotic resistance patterns. Develop a system for routine monitoring of antimicrobial resistance rates to detect significant increases or outbreaks and to identify areas where additional interventions or resources are needed.
5. Review current literature with respect to appropriate antimicrobial utilization on an ongoing basis and incorporate strategies into practice as indicated
6. Assure that policies and interventions are consistent with regulatory requirements and state law.

The ASC will meet no less than 4 times a year, except by approval of the Medical Staff and Hospital Administration. The ASC shall maintain a record of its proceedings and shall submit reports of its activities and recommendations to the Medical Executive Committee. The ASC will also forward periodic reports to the Infection Control Committee, Pharmacy and Therapeutics Committee, Patient Safety Committee and Best Practices Committee for review, action and quality improvement.

SECTION IV. COMPONENTS OF THE ANTIMICROBIAL STEWARDSHIP PROGRAM

1. Hospital formulary:

The Pharmacy & Therapeutics (P&T) Committee maintains a comprehensive list of antimicrobial agents that are included in the hospital formulary. This list is reviewed and updated annually in collaboration with the ASP. When new antimicrobial agents are under consideration for the hospital formulary, the ASP will provide recommendations to the P&T Committee. Requests for nonformulary antimicrobial agents will require preauthorization by the ASP or Infectious Diseases (ID) prior to release by Pharmacy.

2. Formulary restriction and preauthorization

Formulary restriction with preauthorization is an additional means of limiting inappropriate use of antimicrobials, particularly broad-spectrum agents, last-line agents, or agents with concerning toxicities. The list of restricted agents will be reviewed and updated annually by the P&T Committee in collaboration with the ASP (see Appendix A for current list). Use of restricted antimicrobial agents will require preauthorization by the ASP or ID prior to release by Pharmacy.

Formulary restriction:

a. The ASP will review the antimicrobial formulary list and the list of restricted agents annually and will provide recommendations to the P&T Committee regarding changes.
b. The P&T Committee will review and approve the antimicrobial formulary and the list of restricted agents annually.

Preauthorization Procedure:

a. Physicians will prescribe antimicrobial agents via the computerized order entry system.
b. Computerized order entry system will alert the prescribing physician and pharmacy when a restricted or nonformulary antimicrobial agent is ordered.
c. Prescribing physician must contact the ASP or on-call attending ID physician to justify use of "restricted" or "nonformulary" agents and to discuss possible alternatives.

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Example 1.1 Children's Hospital & Research Center Oakland ASP Policy/Procedure (continued 5 of 14)

d. The ASP or attending ID physician will contact Pharmacy and confirm the type of approval given:
   Category 1: Approval for a defined course of therapy.
   Category 2: Approval for 48 hours pending consultation. ASP or ID consultation will be required for agent to be continued beyond 48 hours.
   Category 3: Approval denied. An alternative regimen has been recommended by the ASP or attending ID physician and agreed upon by the prescribing physician.
e. Pharmacy will not release any restricted or nonformulary antimicrobial unless the ASP or attending ID physician provides Category 1 or 2 approval. Pharmacy will document the following in the pharmacy profile notes: approval category, name of ASP or attending ID physician, date/time.

3. Prospective audit with intervention and feedback:

Prospective audit of antimicrobial use with intervention and feedback to the prescriber has been demonstrated to improve appropriate antimicrobial use. This process allows the opportunity for one-on-one education for prescribing physicians. This program will be available 5-7 days a week on inpatients at CHRCO. Opportunities to optimize antimicrobial therapy will be prospectively identified via several approaches:

a. Review of daily antimicrobial usage logs and culture reports to identify
   - Inappropriate choice
     1. Use of nonformulary or restricted agents without prior approval
     2. Use of >2 antibiotic agents concurrently
     3. Inappropriately broad or narrow therapy
     4. Bug/drug mismatches
     5. Redundant coverage
   - Inappropriate dosing
   - Inappropriate route
   - Inappropriate duration
b. Review of daily antibiotic usage logs to identify targeted antibiotics that remain in use for >2 days. See Appendix B for the list of targeted antimicrobial agents. This list will be reviewed and updated annually by the ASP.

Procedure:

a. After identification of patients for whom there may be opportunities for antimicrobial optimization, ASP personnel will review the patient's medical record to assess the rationale behind the current treatment regimen, including antibiotic selection, dosing, route, and duration. Families will not be interviewed and patients will not be examined during this process.
b. ASP personnel will formulate recommendations based on the best-available evidence from the medical literature, including published consensus treatment guidelines and/or expert opinion.
c. If the current treatment plan is justified, then no intervention will be made.
d. If there is an opportunity for optimization, then ASP personnel will contact the attending physician by telephone or in person to discuss the ASP's recommendations.

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Example 1.1 Children's Hospital & Research Center Oakland ASP Policy/Procedure (continued 6 of 14)

e. If the ASP's recommendations are accepted or a mutually acceptable plan is agreed upon, then a brief note will be placed in the patient's chart outlining the recommendations and the rationale.
f. If the ASP's recommendations are not accepted and no agreement is reached, then documentation will NOT be placed in the medical record. The prescribing physician will be asked to consider an Infectious Disease Consultation.
g. When inappropriate antimicrobial use is continued despite the above discussions, the case will be referred to the peer review process. Appropriate use of antimicrobial agents is considered a measure of the quality of patient care, and inappropriate use will be noted in the prescribing physician's performance record.
h. If the patient's clinical situation is complex and/or requires interview of the family or examination of the patient in order to determine an appropriate recommendation, intervention by the ASP will be deemed inappropriate, and a recommendation will be made to obtain an Infectious Disease Consultation.

4. Antimicrobial stewardship consultation:

Physicians may directly request an antimicrobial stewardship consultation from the ASP when there is a focused question regarding antimicrobial selection, dose, route, and/or duration.

a. Upon request, the ASP personnel will review the patient's medical record to assess the clinical scenario. Families will not be interviewed and patients will not be examined during this process.
b. ASP personnel will formulate recommendations based on the best-available evidence from the medical literature, including published consensus treatment guidelines and/or expert opinion.
c. ASP personnel will contact the requesting physician by telephone or in person to discuss the ASP's recommendations.
d. If the ASP's recommendations are accepted or a mutually acceptable plan is agreed upon, then a brief note will be placed in the patient's medical record outlining the recommendations and the rationale.
e. If the ASP's recommendations are not accepted, then documentation will NOT be placed in the medical record. A recommendation will be made to consider an Infectious Disease Consultation.
f. If the patient's clinical situation is complex and/or requires interview of the family or examination of the patient in order to determine an appropriate recommendation, intervention by the ASP will be deemed inappropriate, and a recommendation will be made to obtain an Infectious Disease Consultation.

5. Clinical practice guidelines:

The development of hospital-specific clinical practice guidelines can standardize antibiotic usage and reinforce the principles of antimicrobial stewardship while optimizing patient care. This effort will be spearheaded by the ASP but will require close multidisciplinary collaboration and communication with the relevant disciplines to ensure that practices remains consistent with national guidelines, standards of care and/or expert opinion.

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Example 1.1 Children's Hospital & Research Center Oakland ASP Policy/Procedure (continued 7 of 14)

a. Development of a clinical practice guideline for a specific diagnosis may be initiated by the ASP or may be requested by specific divisions or departments.
b. ASP personnel in collaboration with representatives from the relevant divisions or departments will review the medical literature related to the topic and may survey other pediatric institutions regarding their practices. If other institutions have a clinical practice guideline available, this too may be reviewed by the ASP.
c. ASP personnel in collaboration with representatives from the relevant divisions or departments will develop a draft clinical practice guideline that takes into consideration the best-available evidence from the medical literature (including published consensus treatment guidelines and/or expert opinion) as well as hospital-specific antibiotic resistance patterns and patient population.
d. The draft guideline will be reviewed and approved by the ASP and the appropriate divisions/departments as well as the Best Practices Committee.
e. Once completed, clinical practice guidelines will be incorporated into the computerized physician order entry system.
f. Approved clinical practice guidelines will be reviewed and updated every 2 years (or more frequently if there is a significant change in practice due to a change in the standard of care, in available antimicrobial agents, or in antibiotic resistance patterns).

6. Physician education:

In conjunction with the active strategies described above, ongoing education of the medical staff is an essential element of the ASP and can have a significant impact on antimicrobial prescribing behavior. Education can provide a foundation of knowledge to clinicians that will enhance and increase acceptance of antimicrobial stewardship strategies. ASP personnel will regularly participate in educational activities to highlight the importance of antimicrobial stewardship and to provide clinicians with practical strategies for optimizing antimicrobial use for their patients. Educational components may include:

- Regular participation in patient rounds throughout the hospital
- Production and dissemination of annual hospital antibiogram with inclusion of general cost information on antimicrobial agents
- Grand Rounds for community pediatricians
- Noon conferences for resident physicians and hospital-based medical staff
- Periodic emails to medical staff with antibiotic stewardship tips
- Participation in or presentations to divisional/departmental meetings, QA and/or M&M conferences when questions arise related to appropriate antimicrobial use

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Example 1.1 Children's Hospital & Research Center Oakland ASP Policy/Procedure (continued 8 of 14)

SECTION V: PERFORMANCE MEASURES

Monitoring the impact of the ASP is an important component of quality improvement for the both the program and hospital. "Process" measures will be used to determine whether ASP interventions have had impact on the utilization of antimicrobials. "Outcome" measures will be used to determine if process changes have reduced or prevented the unintended consequences of antimicrobial use. The measurement strategies will be based on evidence-based guidelines and/or recommendations from professional organizations and regulatory agencies.

a. Process measures
   - Track utilization of targeted antimicrobials
   - Track utilization of antimicrobial agents for specific diagnoses

b. Outcome measures
   - Track trends in the antibiotic resistance patterns for target organisms (*Enterococcus* species, *S. aureus*, *Klebsiella* species, *Acinetobacter* species, *Pseudomonas aeruginosa*, & *E. coli*) hospital-wide and for high-risk units (5 South, 5 East, PICU, NICU)
   - Track incidence of health care-associated infections due to antibiotic-resistant target organisms hospital-wide and for high-risk units
   - Track incidence of health care-associated *C. difficile* infections hospital-wide and for high-risk units
   - Track relevant clinical outcome measures for specific diagnoses
   - Track incidence of adverse drug events related to antimicrobial agents
   - Track pharmacy drug acquisition costs for all antimicrobial agents and specific target agents

c. Other measures
   - Track number and types of interventions made by the ASP
   - Track compliance with ASP interventions
   - Track cost savings from ASP interventions

For more information about this example contact Brian Lee, MD at blee@mail.cho.org

Example 1.1 Children's Hospital & Research Center Oakland ASP Policy/Procedure (continued 9 of 14)

SECTION VI: REFERENCES

1. Dellit TH, Owens RC et al. Infectious Diseased 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.

2. Centers for Disease Control and Prevention. Campaign to Prevent Antimicrobial Resistance in Healthcare Settings: http://www.cdc.gov/drugresistance/healthcare/children/12steps_children.htm

3. Cohen SH, Gerding DN et al. Clinical Practice Guidelines for *Clostridium difficile* Infection in Adults: 2010 Update by the Society for Healthcare Epidemiology of America (SHEA) and the Infectious Diseases Society of America (IDSA). *Infection Control and Hospital Epidemiology* 2010;31:431-455.

4. Cosgrove SE. The Relationship between Antimicrobial Resistance and Patient Outcomes: Mortality, Length of Hospital Stay, and Health Care Costs. *Clinical Infectious Diseases* 2006;42:S82-9.

5. Roberts RR, Hota B et al. Hospital and Societal Costs of Antimicrobial-Resistant Infections in a Chicago Teaching Hospital: Implications for Antibiotic Stewardship. *Clinical Infectious Diseases* 2009;49:1175-84.

6. Boucher HW, Talbot GH et al. Bad Bugs, No Drugs: No ESKAPE! An Update from the Infectious Diseases Society of America. *Clinical Infectious Diseases* 2009;48:1-12.

7. Infectious Diseases Society of America. The 10 x '20 Initiative: Pursuing a Global Commitment to Develop 10 New Antibacterial Drugs by 2020. *Clinical Infectious Diseases* 2010;50:1081-1083.

8. Spellberg B, Guidos R et al. The Epidemic of Antibiotic-Resistant Infections: A Call to Action for the Medical Community from the Infectious Diseases Society of America. *Clinical Infectious Diseases* 2008;46:155-164.

Approval Process:

Date	Committee/Legal	
	Infection Control Committee	
	Medical Executive Committee	

Distribution:

For more information about this example contact Brian Lee, MD at blee@mail.cho.org

Example 1.1 Children's Hospital & Research Center Oakland ASP Policy/Procedure (continued 10 of 14)

Appendix A: Antimicrobial Formulary
(Restricted Agents and Approval Required in Italics)

Intravenous Antibiotics

Aminoglycoside
- *Amikacin (ASP/ID approval)*
- Gentamicin
- Tobramycin

Carbapenem
- *Ertapenem (ASP/ID approval)*
- *Meropenem (ASP/ID or Onc approval)*

Cephalosporin 1st generation
- Cefazolin

Cephalosporin 2nd generation
- Cefoxitin
- Cefuroxime

Cephalosporin 3rd generation
- Cefotaxime
- Ceftazidime
- Ceftriaxone

Cephalosporin 4th generation
- *Cefepime (ASP/ID or Onc approval)*

Fluoroquinolone
- *Ciprofloxacin (ASP/ID approval)*

Glycopeptide
- Vancomycin

Lincosamide
- Clindamycin

Macrolide
- Erythromycin

Monobactam
- *Aztreonam (ASP/ID approval)*

Nitroimidazole
- Metronidazole

Oxazolidinone
- *Linezolid (ASP/ID approval)*

Penicillin
- Ampicillin
- Ampicillin/Sulbactam
- Oxacillin
- Penicillin G
- Piperacillin
- *Piperacillin/Tazobactam (ASP/ID or Pulm approval)*
- *Ticarcillin/Clavulanate (ASP/ID or Pulm approval)*

Sulfonamide
- *TMP-SMX (ASP/ID approval for IV form)*

Tetracycline
- *Doxycycline (ASP/ID approval for IV form)*

For more information about this example contact Brian Lee, MD at blee@mail.cho.org

Example 1.1 Children's Hospital & Research Center Oakland ASP Policy/Procedure (continued 11 of 14)

Oral Antibiotics

Cephalosporin 1st generation
- Cephalexin

Cephalosporin 2nd generation

Cephalosporin 3rd generation
- Cefixime

Fluoroquinolone
- *Ciprofloxacin (ASP/ID or Pulm approval)*

Lincosamide
- Clindamycin

Macrolide
- Azithromycin
- Clarithromycin
- Erythromycin

Nitrofu
- Nitrofurantoin

Nitroimidazole
- Metronidazole

Penicillin
- Amoxicillin
- Amoxicillin/Clavulanate
- Dicloxacillin
- Penicillin VK

Sulfonamide
- TMP-SMX

Tetracycline
- Doxycycline

IV Antiviral
- Acyclovir
- *Foscarnet (ASP/ID approval)*
- *Ganciclovir (ASP/ID approval)*

PO Antiviral
- Acyclovir
- Amantadine
- Oseltamivir
- Rimantadine
- *Valganciclovir (ASP/ID approval)*

HIV meds
- Combivir (AZT/3TC)
- Zidovudine (AZT)
- Lamivudine (3TC)
- Lopinavir/ritonavir
- Nelfinavir

IV Antifungal
- Amphotericin B
- Liposomal Amphotericin (Ambisome)
- Fluconazole
- *Micafungin (ASP/ID or Onc approval)*
- *Voriconazole (ASP/ID or Onc approval)*

PO Antifungal
- Clotrimazole
- Fluconazole
- Griseofulvin
- Nystatin
- *Voriconazole (ASP/ID or Onc approval)*

Antimalarial meds
- Chloroquine
- Primaquine
- Quinidine gluconate (IV)
- Quinine sulfate (PO)

TB meds
- *Ethambutol (ASP/ID approval)*
- Isoniazid
- *Pyrazinamide (ASP/ID approval)*
- *Rifampin (ASP/ID approval)*

Misc
- Albendazole
- Pentamidine (IV)

For more information about this example contact Brian Lee, MD at blee@mail.cho.org

Example 1.1 Children's Hospital & Research Center Oakland ASP Policy/Procedure (continued 12 of 14)

Appendix B: Targeted Antimicrobial Agents

Ampicillin/sulbactam
Piperacillin
Piperacillin/tazobactam
Ticarcillin
Ticarcillin/clavulanate

Ceftriaxone
Cefotaxime
Ceftazidime
Cefepime

Meropenem

Vancomycin
Clindamycin

Gentamicin
Tobramycin

Ciprofloxacin

Acyclovir

Amphotericin B
Liposomal Amphotericin
Micafungin
Voriconazole

For more information about this example contact Brian Lee, MD at blee@mail.cho.org

Example 1.1 Children's Hospital & Research Center Oakland ASP Policy/Procedure (continued 13 of 14)

Appendix C: Table of Legislative and Regulatory Mandates

SB 739: Hospital Infectious Disease Control Program	
Sec 2 [1288.8]a.4	**Judicious Use of ABX:** CDPH to require that general acute care hospitals develop a process for evaluating the judicious use of antibiotics, the results of which shall be monitored jointly by appropriate representatives and committees involved in quality improvement activities.

SB 158: Hospital Infection Control	
Sec 6.a.3	**Judicious Use of ABX:** SB 739 language repeated

TJC NPSG.07.03.01: Implement evidence-based practices to prevent health care-associated infections due to multidrug-resistant organisms in acute care hospitals. Note: This requirement applies to, but is not limited to epidemiologically important organisms such as MRSA, *C. difficile*, VRE, and MDR-GN bacteria.		
	Elements of Performance	
1.	Conduct periodic risk assessments (in time frames defined by the hospital) for multidrug-resistant organism acquisition and transmission.	A
2. M	Based on the results of the risk assessment, educate staff and licensed independent practitioners about health-care associated infections, multidrug-resistant organisms, and prevention strategies at hire and thereafter.	C
3. M	Educate patients, and their families as needed, who are infected or colonized with a multidrug-resistant organism about health care-associated infection strategies.	C
4.	Implement a surveillance program for multidrug-resistant organisms based on the risk assessment.	A
5.	Measure and monitor multidrug-resistant organism prevention processes and outcomes, including the following: - Multidrug-resistant organism infection rates using evidence-based metrics - Compliance with evidence-based guidelines or best practices - Evaluation of the education program provided to staff and licensed independent practitioners	A
6.	Provide multidrug-resistant organism process and outcome measure data to key stakeholders, including leaders, licensed independent practitioners, nursing staff, and other clinicians.	A
7.	Implement policies and practices aimed at reducing the risk of transmitting multidrug-resistant organisms. These policies and practices meet regulatory requirements and are aligned with evidence-based standards (for example, the Centers for Disease Control and Prevention (CDC) and/or professional organization guidelines).	C
8.	When indicated by the risk assessment, implement a laboratory-based alert system that identifies new patients with multi-drug-resistant organisms.	A
9.	When indicated by the risk assessment, implement an alert system that identifies readmitted or transferred patients who are known to be positive for multi-drug-resistant organisms.	A
	M=indicates measure of success if needed **A=y/n req. 100% compliance** **C=frequency based req. 90% compliance**	

TJC NPSG.07.05.01: Implement evidence-based practices for preventing surgical site infections.		
	Elements of Performance	
1. M	Educate staff and LIPs involved in surgical procedures about SSI and the importance of prevention. Education occurs upon hire annually thereafter, and when involvement in surgical	C

For more information about this example contact Brian Lee, MD at blee@mail.cho.org

Example 1.1 Children's Hospital & Research Center Oakland ASP Policy/Procedure (continued 14 of 14)

	procedures is added to an individual's job responsibilities.	
2. M	Educate patients and their families, as needed, who are undergoing a surgical procedure about surgical site infection.	C
3. M	Implement policies and practices aimed at reducing the risk of SSI. These policies and practices meet regulatory requirements and are aligned with evidence-based guidelines (for example, CDC and professional organization guidelines).	C
4.	As part of the effort to reduce SSI: • Conduct periodic risk assessments for surgical site infection in a time frame determined by the hospital • Select SSI measures using best practices or evidence based guidelines • Evaluate the effectiveness of prevention efforts • Note: surveillance may be targeted to certain procedures based on hospital's risk assessment	A
5.	Measure SSI rates for the first 30 days following procedures that do not involve inserting implantable devices and for the first year following procedures involving implantable devices. Measurement strategies follow evidence-based guidelines. Note: surveillance may be targeted to certain procedures based on the hospital's risk assessment.	A
6.	Provide process and outcome measure results to key stakeholders.	A
7. M	Administer antimicrobial agents for prophylaxis for a particular procedure or disease according to evidence-based best practices.	C
8.	When hair removal is necessary, use clippers or depilatories. Shaving is an inappropriate hair removal method.	A
	M=measure of success if needed **A=y/n req. 100% compliance** **C=frequency based req. 90% compliance**	

For more information about this example contact Brian Lee, MD at blee@mail.cho.org

Example 1.2 Palomar Health ASP Policy/Procedure (1 of 3)

PALOMAR HEALTH
SPECIALIZING IN YOU

Procedure

Antibiotic Stewardship Program

49972 **In preparation** (Rev: 0)

Source: Clinical Pharmacy **Applies to Facilities:** **Applies to Departments:**

I. PURPOSE:

The purpose of this procedure is to outline the duties of the Antimicrobial Stewardship Program (ASP) medical director and ASP clinical pharmacist.

II. DEFINITIONS:

1. ASP Medical Director – Infectious Disease (ID) Physician responsible for overall direction of the program, education, and goal development. He/she will be available for direct or indirect discussion to assist physicians with antibiotic education, selection, or discontinuation.
2. Antibiotic Stewardship Program Clinical Pharmacist: Full-time Pharmacist on staff performs daily antimicrobial rounds, consults with physicians, and perform duties as assigned by ASP Medical Director and/or Director of Pharmacy.

III. STANDARDS OF PRACTICE:

A. **An antimicrobial stewardship program (ASP) measures and promotes the appropriate use of antimicrobials by selecting the appropriate agent, dose, duration, and route of administration in order to improve patient outcomes, while minimizing toxicity and the emergence of antimicrobial resistance.**

IV. STEPS OF PROCEDURE:

Duties of the ASP Clinical Pharmacist:

A. Review the Antibiotic Rounding Report each day.
   1. Monday through Friday the ASP clinical pharmacist will print the Antibiotic Rounding Report:
   2. Inpatient antimicrobial use will be compared to culture results. Those cases where a narrower spectrum agent could be used will be flagged and rounded on.
   3. In situations where the organism is resistant to current antimicrobial therapy, will require a phone call to the physician managing the patient's care.
   4. Antimicrobial orders will be reviewed for appropriateness, dose, frequency, and safety. Those cases where another agent would be more appropraiate or safer to use will be flagged and rounded on.
   5. Antimicrobial doses and frequency will be adjusted by the ASP clinical pharmacist as needed.
   6. The ASP clinical pharmacist will go to the floors, review patient charts, and leave recommendations in the form of clinical interventions.
   7. While on the floors, the ASP clinical pharmacist will discuss the patient's antimicrobial therapy with the physicians managing the patients care.
   8. The ASP clinical pharmacist will document all clinical interventions in Cerner. At the end of the month the clinical interventions are tallied and reported at the Antibiotic Sub-Committee meeting.

For more info about this example contact Olga DeTorres, PharmD at Olga.DeTorres@palomarhealth.org

Example 1.2 Palomar Health ASP Policy/Procedure (continued 2 of 3)

B. The ASP Medical Director and clinical pharmacist will develop criteria for use for all restricted antimicrobials:
   1. Criteria will be reviewed and approved the Antibiotic Sub-Committee and Pharmacy & Therapeutics Committee
   2. Criteria for use will be listed in the Restricted Antimicrobials Procedure.

C. Review all requests for restricted antimicrobials.
   1. During working hours the ASP clinical pharmacist will be contacted whenever this is a request for a restricted antimicrobial:
   2. The ASP clinical pharmacist will review the patient's medical chart to determine if patient meets the criteria for use. If the patients meets criteria, the staff pharmacist will be notified to verify the order and dispense the drug.
   3. If the patient fails to meet the criteria for use, the ASP clinical pharmacist will recommend an alternative antimicrobial.
   4. Whenever physicians refuse to change their orders, they will be asked to obtain an Infectious Disease consult in order for the drug to be continued. Only one dose will be dispensed when the antimicrobial is ordered during the daytime. Therapy will be continued until the next morning if the antimicrobial is ordered during the evening.

D. The ASP clinical pharmacist will review all requests for new antimicrobials or vaccine:
   1. A drug monograph will be completed and presented to the Antibiotic Sub-Committee and Pharmacy & Therapeutics Committee
   2. If a request is rejected, a letter will be sent to the physician who submitted the original request explaining why the antimicrobial or vaccine was not added to the formulary.

E. Perform Medication Use Evaluations:
   1. MUE criteria will be developed by the the ASP Medical Director and clinical pharmacist.
   2. The ASP clinical pharmacist or designee will collect and tabulate the data. A summary will be presented Antibiotic Sub-Committee meeting.
   3. The ASP Medical Director will recommend the steps needed to resolve the issues identified by the MUE.
   4. A repeat MUE is performed a year later to document that the issues have been resolved.

F. Track antimicrobial usage and expenditures:
   1. The Antimicrobial Purchases Cumulative report will be tabulated and presented quarterly to the Antibiotic Sub-Committee and Pharmacy & Therapeutics Committee
   2. The Restricted Antibiotic Report will be tabulated every two months and presented each Antibiotic Sub-Committee and Pharmacy & Therapeutics Committee meetings.
   3. The Infectious Disease Physician Prescribing report will be tabulated and presented quarterly to the Antibiotic Sub-Committee and Pharmacy & Therapeutics Committee
   4. The Defined Daily Dose report for Gram Positive, Gram Negative, Anti-Pseudomonal, and Antifungal agents will be tabulated and presented quarterly to the Antibiotic Sub-Committee and Pharmacy & Therapeutics Committee

G. Perform periodic review of antimicrobial susceptibility rates:
   1. The ASP clinical pharmacist and the microbiologists work together to create the yearly antibiogram for all Palomar Health facilities.
   2. The ASP Medical Director and clinical pharmacist will create empiric therapy guidelines based on antimicrobial susceptibility rates to be a part of the antibiogram.
   3. The ASP clinical pharmacist will provide lists of formulary parenteral and oral antibiotics with recommended doses and costs to be incorporated into the antibiogram.
   4. The ASP clinical pharmacist tracks the number of MRSA, VRE, ESBL, and CRE cases/1,000 PT Days and presents the report quarterly to the Antibiotic Sub-Committee.

H. Develop empiric treatment guidelines, protocols, and Power Plans to minimize the development of resistant organisms.

I. Develop antimicrobial dosing guidelines to improve patient outcomes.

For more info about this example contact Olga DeTorres, PharmD at Olga.DeTorres@palomarhealth.org

CDPH does not endorse the specific content or recommendations included in these examples. They are for illustrative purposes only.

Example 1.2 Palomar Health ASP Policy/Procedure (continued 3 of 3)

J. Review all serious adverse events caused by an antimicrobial or vaccine.
K. Create procedures to prevent adverse events by antimicrobials from occurring.
L. Provide physician and staff education.

Duties of the ASP Medical Director:

A. With input from the ASP clinical pharmacist, will develop criteria for use for restricted antimicrobials.
B. Develop MUE criteria with the ASP clinical pharmacist.
   1. After the MUE is completed, the ASP Medical Director will recommend the steps needed to resolve the issues identified by the MUE.
C. Create empiric therapy guidelines based on antimicrobial susceptibility rates that will be published in the antibiogram.
D. Develop empiric treatment guidelines and protocols to minimize the development of resistant organisms.
E. Provide physician and staff education:
   1. Give presentations at department meetings and Medical Grand Rounds on Antibiotic Stewardship issues.
   2. Will meet with physicians who refuse to comply with Antibiotic Stewardship procedures and guidelines and provide them with one-on-one education.
   3. Give lectures to the pharmacists on treatment of common infections
   4. Take pharmacy residents on rounds during their Infectious Disease rotation.

V. **PUBLICATION HISTORY:**

Revision Number	Effective Date	Document Owner at Publication	Version Notes
0 (this version)		Olga DeTorres, Clinical Pharm Specialist	

VI. REFERENCES:

Reference Type	Title	Notes

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https://www.lucidoc.com/cgi/doc-gw.pl?ref=pphealth:49972$0

For more info about this example contact Olga DeTorres, PharmD at Olga.DeTorres@palomarhealth.org

Example 1.3 Sutter Delta Hospital ASP Policy/Procedure (1 of 3)

☐ SAFH ☐ SAH x SDH ☐ SMCS ☐ SRMC ☐ SSMC	**PHARMACY POLICY & PROCEDURE MANUAL**	**Section/#:**
	Title: **ANTIMICROBIAL STEWARDSHIP**	**Initiated/Owned by:** Allan Yamashiro Director of Ancillary Services
	Effective Date: November 2013	**Next Review Date:** November 2016

POLICY

Antimicrobial medication use will be monitored by a pharmacist for appropriate use, dose, and duration of therapy based on evidence based practice to provide the best possible patient outcomes. Pharmacists will discuss with the prescriber any changes that are recommended to be made.

Pharmacists will document all recommendations made by the pharmacist.

PURPOSE

Antimicrobial stewardship is implemented to ensure the proper use of antimicrobial medications and provide the most optimal therapeutic and cost-effective care for our patients and to prevent resistance.

PROCEDURE

A. Each morning, a pharmacist will review the Core Measure Manager reports including:

   a. Active Antibiotics
   b. Antibiotics with Positive Cultures
   c. Cefeime/Vanco/Zosyn/Imipenem use greater than 7 days
   d. Non-ICU patients on Linezolid
   e. Patient on "Greater than 3 antibiotics greater than 3 days"
   f. Vancomycin Monitoring Report
   g. Aminoglycoside Monitoring Report
   h. IV to PO Conversion Report

B. Based on patient-specific data, such as renal function, cultures, evidence-based practices and local susceptibility patterns the pharmacist will evaluate whether the most appropriate antimicrobial is appropriate. The pharmacist uses the attached document (Attachment A) as a guide to evidence-based practices.

C. The pharmacist will make recommendations to medical provider.

Antimicrobial Stewardship
Page 1 of 3

For more info about this example contact Jeffrey Silvers, MD at Silverj@sutterhealth.org

Example 1.3 Sutter Delta Hospital ASP Policy/Procedure (continued 2 of 3)

D. Document recommendations in Healthprolink as an Antibiotic Stewardship recommendation.

E. Reviews of accepted and non-accepted recommendations will be conducted to evaluate patterns in prescribing. Findings will be summarized for the Pharmacy and Therapeutics committee with follow up recommendations that may include education, changes to review methods, and other process improvements.

F. Medical providers are encouraged to use order sets when prescribing antimicrobials to ensure compliance with evidenced-based protocols.

G. Pharmacists dose antimicrobials written as "Rx to dose", order labs and adjust dose and frequency as defined in the approved pharmacy protocols. Where protocols are not available, pharmacists use published drug information references.

H. Patient care process and outcomes will be monitored and reported to the Pharmacy and Therapeutics committee that may include:
   a. Mortality
   b. Length of stay
   c. Readmissions
   d. Antimicrobial cost
   e. Appropriateness of antimicrobial selection and compliance evidenced-based practices.

BACKGROUND:

California Senate Bill 739 mandated that, by January 1, 2008, California Department of Public Health require general acute care hospitals to monitor and evaluate the utilization of antibiotics and charge a quality improvement committee with the responsibility for oversight of the judicious use of these medications. The purpose of an antimicrobial stewardship program is to monitor and promote the appropriate use of antimicrobial medications. This is accomplished by using the correct antimicrobial agent at the correct dose for the correct duration of therapy and via the correct route of administration. These programs are designed to improve patient safety and outcomes with the most cost effective therapy, while reducing toxicity and preventing antimicrobial resistance.

For more info about this example contact Jeffrey Silvers, MD at Silverj@sutterhealth.org

CDPH does not endorse the specific content or recommendations included in these examples. They are for illustrative purposes only.

Example 1.3 Sutter Delta Hospital ASP Policy/Procedure (continued 3 of 3)

REFERENCE

1. Dellit, TH et al. Infectious Disease Society of America and the Society for Healthcare Epidemiology of America Guidelines for Developing and Institutional Program to Enhance Antimicrobial Stewardship. Clin Infect Dis 2007;44:159-77.
2. Patel P, MacDougall C. How to make Antimicrobial Stewardship Work: Practical Considerations for Hospitals of All Sizes. Hosp Pharm. 2010
3. California Department of Public Health: The California Antimicrobial Stewardship Program Initiative. http://www.cdph.ca.gov
4. http://www.dhcs.ca.gov/provgovpart/initiatives/nqi/Documents/SB739.pdf

For more info about this example contact Jeffrey Silvers, MD at Silverj@sutterhealth.org

CDPH does not endorse the specific content or recommendations included in these examples. They are for illustrative purposes only.

Antimicrobial Stewardship Program Element 2 (BASIC):

A physician-supervised multidisciplinary antimicrobial stewardship committee or workgroup has been convened.

The physician-supervised multidisciplinary antimicrobial stewardship program (ASP) committee oversees organization-wide efforts to promote and evaluate the appropriate use of antimicrobial agents. The composition and the function of the ASP committee should be defined in the ASP policy and procedure. Ideally, the committee membership should include physician stakeholders from throughout the hospital. By involving diverse stakeholders in the process, ASP activities and interventions can be tailored and targeted more effectively. Physicians play a valuable role as liaisons/champions to promote stewardship education and practices among their various services and disciplines.

ASP committees generally include the following core members, although the exact composition may vary depending on the facility's resources and local needs:

1. Physician or pharmacist with training in antimicrobial stewardship (as defined in Element 3)
2. At least two members of the Medical Staff representing different disciplines or service lines
3. Infection preventionist
4. At least one representative from hospital administration, patient safety, and/or quality assurance
5. Clinical microbiologist
6. Hospital epidemiologist
7. Information technology specialist/data analyst

The following example illustrates the composition and charge for ASP committee members.

References

CDC. Core Elements of Hospital Antibiotic Stewardship Programs. Atlanta, GA: US Department of Health and Human Services, CDC; 2014. Available at http://www.cdc.gov/getsmart/healthcare/implementation/core-elements.html.

Rohde JM, Jacobsen D, Rosenberg DJ. Role of the Hospitalist in Antimicrobial Stewardship: A Review of Work Completed and Description of a Multisite Collaborative. *Clin Ther* 2013 Jun;35(6):751-7.

Moody J, Cosgrove SE, Olmsted R, et al. Antimicrobial stewardship: a collaborative partnership between infection preventionists and health care epidemiologists. *Am J Infect Control* 2012;40(2):94-95.

Example 2.1 Palomar Health ASP Subcommittee (1 of 2)

Reviewed for annual review. No changes needed.

PALOMAR HEALTH
SPECIALIZING IN YOU

Procedure

Antibiotic Sub-Committee

37812 **In preparation** (Rev: 3)

Source:	Applies to Facilities:	Applies to Departments:
Clinical Pharmacy	Palomar Medical Center Downtown Palomar Medical Center West Pomerado Hospital Escondido Surgery Center	Pharmacy All Clinical Departments

I. PURPOSE:

A. To define the role of the Antibiotic Sub-Committee.

II. DEFINITIONS:

A. n/a

III. STANDARDS OF PRACTICE:

A. Performed by: n/a

B. The Antibiotic Sub-Committee is a medical staff committee that reports to the Pharmacy and Therapeutics & Nutrition Committee (P & T) which in turn reports to the Quality Management Committee. This is a combined Palomar Health Committee.

C. The Antibiotic Sub-Committee monitors antimicrobial usage and sets standards to encourage the judious use of antimicrobials.

D. The Antibiotic Sub-Committee makes recommendations to the Pharmacy & Therapeutics Committee concerning the hospitals' antimicrobial and vaccine formulary. The committee will review, revise, and recommend the antimicrobial formulary as may be required.

E. The chair of the committee is an Infectious Disease specialist. The committee is comprised of the Infectious Disease clinical pharmacist, a microbiologist, infection preventionists, and representatives from a cross section of medical specialties in the hospital.

F. The membership of the Antibiotic Sub-Committee is appointed by department heads. New members are appointed as members leave or accept other duties. The committee will review antimicrobial usage within each hospital through ongoing monitoring and audits as may be required.

G. The Antibiotic Sub-Committee will review reports of antimicrobial adverse reactions in both institutions.

H. The Antibiotic Sub-Committee will develop guidelines for use for all new antimicrobials added to the formulary.

I. The Antibiotic Sub-Committee will review and approve all order sets which contain antimicrobials.

IV. STEPS OF PROCEDURE

A. Equipment: n/a

V. PUBLICATION HISTORY:

Revision Number	Effective Date	Document Owner at Publication	Version Notes
3 (this version)		Olga DeTorres, Clinical Pharm Specialist	Change PPH to Palomar Health throughout document.
2 (Changes)	03/08/2012	Olga DeTorres, Clinical Pharm Specialist	P&T approved in 1/12 QMC approved in 2/12

For more info about this example contact Olga DeTorres, PharmD at Olga.DeTorres@palomarhealth.org

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Example 2.1 Palomar Health ASP Subcommittee (continued 2 of 2)

Reviewed for annual review. No changes needed.

			Antibiotic Committee approved in 1/12 Formatted by ms
1 (Changes)	01/05/2012	Olga DeTorres, Clinical Pharm Specialist	Modified procedure to define committee's role in relation to the P & T Committee.
0 (Changes)	11/30/2010	Olga DeTorres, Clinical Pharm Specialist	New procedure to define the responsibilities of the Antibiotic Sub-Committee.

VI.

Authorized Signer(s):
(unsigned) Jeremy Lee, PharmD, BCPS, Manager Clinical Pharmacy Services
(unsigned) Cedric Terrell, Director Pharmacy Services
(unsigned) Cttee: Medical Executive, PMC
(unsigned) Cttee: Medical Executive, Pom
(unsigned) David A Tam, MD, FACHE, Chief Administrative Officer, POM

VI. REFERENCES:

Reference Type	Title	Notes

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https://www.lucidoc.com/cgi/doc-gw.pl?ref=pphealth:37812$3

For more info about this example contact Olga Detorres, PharmD at Olga.DeTorres@palomarhealth.org

Antimicrobial Stewardship Program Element 3 (BASIC):

ASP leadership support is provided by a physician or pharmacist with antimicrobial stewardship training from a recognized professional organization or post-graduate education.

Formal training in antimicrobial stewardship benefits ASP leaders, who must possess medical infectious disease and microbiology knowledge and understand how to start and maintain an ASP, including how to implement change and measure success of a program.

Because antimicrobial stewardship education is not generally provided in the typical medical or pharmacy school curriculum, physician and/or pharmacist leaders of the ASP committee need to receive additional training. This can be accomplished by completing one of several continuing education training programs offered by the federal Centers for Disease Control and Prevention, the Society for Healthcare Epidemiology of America, and/or other recognized professional organization. The training requirement may also be met if the physician and/or pharmacist has received post-graduate training with a concentration in antimicrobial stewardship typical of infectious disease pharmacist training.

Examples of antimicrobial stewardship education and training courses

http://www.shea-online.org/Education/2015AntimicrobialStewardshipConference.aspx

http://www.pids.org/meetings-and-events/asp-conference.html

http://www.idac.org/

https://www.coursera.org/course/antimicrobial

http://mad-id.org/antimicrobial-stewardship-programs/

http://www.sidp.org/page-1442823

References

Cosgrove SE, Hermsen ED, Rybak MJ, et al. Guidance for the Knowledge and Skills Required for Antimicrobial Stewardship Leaders. *Infect Control Hosp Epidemiol* 2014;35(12):1444–1451.

Antimicrobial Stewardship Program Element 4 (BASIC):

ASP activities are routinely reported to hospital quality improvement committees.

Dissemination of information about the activities of ASP is an important means of promoting stewardship across the hospital, and emphasizes to key stakeholders the role and value of ASPs in promoting quality and safe patient care.

Engaging hospital committees involved in quality improvement (QI) regarding planning, implementing, and evaluating the ASP's activities helps promote ongoing evaluation and improvement of the program. Discussing problem areas and challenges with experts can foster creative solutions from interested stakeholders. Examples of hospital QI committees include (but are not limited to) Infection Control, Pharmacy & Therapeutics, and Patient Safety.

The following examples demonstrate ASP reports to hospital QI committees. Example 3.2 also provides an example of a tool that can be utilized to evaluate and report the status of multiple ASPs for regional oversight.

References

Nagel JL, Stevenson JG, Eiland EH, and Kaye KS. Demonstrating the Value of Antimicrobial Stewardship Programs to Hospital Administrators. *Clin Infect Dis* 2014:59(Suppl3):S146–153.

Example 4.1 Palomar Health ASP Activities Reported to QI Committee (1 of 1)

ASP Activities Routinely Reported to Hospital Quality Improvement Committees

1. Medication Use Evaluations –
   MUEs can be focused on an antimicrobial, infection, or surgical procedure.
   Helps identify areas for potential improvement.

2. Monthly Clinical Interventions –
   Provides a snapshot of physician acceptance of the hospital's ASP.
   Report is broken down by type of intervention
   Acceptance Rate = Total number accepted divided by total number of interventions made

3. Monthly Restricted Antibiotic Report –
   Provides a snapshot of physician resistance to hospital antimicrobial restriction policies.

   List of inappropriate requests for restricted antimicrobials, whether an intervention was made, and did the physician switch patient to another agent. Physicians who are repeat offenders are counseled.

   Second page of report lists all appropriate requests for restricted antimicrobials that did not require an Infectious Disease consult.

4. Infectious Disease Prescribing – Quarterly Report

   For each antimicrobial, a tally of the number of times each ID physician prescribed it.
   ID Physicians who prescribe agents more frequently, e.g. $\geq$ 2 fold greater than the others are counseled.

5. Antimicrobial Expenditures - Quarterly Report

   It helps track expenditures of antimicrobials that the ASP is targeting.
   The savings incurred help support the cost of an ASP.
   Helps identify areas for potential improvement.
   % of Total Drug Budget & Antimicrobial Expenditure/Patient Day is included in the report

6. Defined Daily Doses or Days of Therapy/1,000 Patient Days – Quarterly Report
   It helps track usage of antimicrobials that the ASP is targeting.
   Helps track ASP successes as well as identify areas for potential improvement.

7. Memos recently sent to department heads alerting them of:

   National antimicrobial shortages and alternatives to use
   New antimicrobial procedures or restrictions
   Changes to existing antimicrobial protocols or order sets

8. Antimicrobial Sub-Committee meeting minutes

For more info about this example contact Olga DeTorres, PharmD at Olga.DeTorres@palomarhealth.org

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Example 4.2 Kaiser Northern CA ASP Activities Reported to QI Committees (1 of 3)

KAISER PERMANENTE®

Kaiser Permanente Northern California
Antimicrobial Stewardship Program Assessment Tool

FACILITY																					
1. Number of pharmacists participating in ASP	Red	Red	Yellow	Green	Green	Yellow	Green	Green	Green	Green	Green	Green	Green	Red	Red	Green					
2. Physician Engagement	Yellow	Yellow	Green	Yellow	Yellow	Yellow	Green	Green	Green	Green	Yellow	Green	Green	Green	Green	Green					
3. Chart review by ASP pharmacist	Yellow	Yellow	Yellow	Green	Yellow	Yellow	Green	Yellow	Green	Yellow	Yellow	Yellow	Yellow	Red	Red	Green					
4. Time commitment	Yellow	Yellow	Green	Green	Yellow	Green	Green	Green	Green	Green	Yellow	Green	Green	Red	Red	Yellow					
5. ASP RPh Patient Presentation	Yellow	Yellow	Yellow	Green	Yellow	Yellow	Green	Green	Green	Yellow	Yellow	Yellow	Green	Red	Red	Green					
6. Documentation of ASP Pharmacist Interventions	Red	Red	Red	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Red	Red	Yellow					
7. Method of ASP Interventions to Attending	Yellow	Yellow	Green	Green	Yellow	Yellow	Yellow	Yellow	Green	Green	Yellow	Green	Green	Red	Red	Green					
8. Generation of intervention reports/Reporting of ASP	Red	Yellow	Yellow	Yellow	Yellow	Green	Yellow	Green	Yellow	Green	Yellow	Red	Green	Red	Red	Yellow					
9. ASP Priorities	Green	Green	Yellow	Yellow	Yellow	Green	Green	Green	Green	Green	Yellow	Yellow	Yellow	Yellow	Yellow	Green					
10. Policy and Procedure	Red	Red	Red	Red	Yellow	Red	Yellow	Red	Red	Red	Red	Red	Red	Red	Red	Red					

Green - Fully Functional; recommendations may be included to optimize program
Yellow - Satisfactory; progress has been made but may require change of practice or optimization. See recommendations
Red - Unsatisfactory; component needs immediate attention. See recommendations

Page 1 of 3

For more info about this example contact Stephen Parodi at Stephen.M.Parodi@kp.org

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Example 4.2 Kaiser Northern CA ASP Activities Reported to QI Committees (continued 2 of 3)

KAISER PERMANENTE®

Kaiser Permanente Northern California
Antimicrobial Stewardship Program Assessment Tool

Issue # Status	Description	Findings and Assessment	Recommendations
1	Number of pharmacists participating in ASP	▪	▪
2	Physician Engagement	▪	▪
3	Chart review by ASP pharmacist	▪	▪
4	Time commitment	▪	▪
5	ASP RPh Patient Presentation	▪	▪
6	Documentation of ASP Pharmacist Interventions	▪	▪
7	Method of ASP Interventions to Attending	▪	▪
8	Generation of intervention reports/Reporting of ASP	▪	▪
9	ASP Priorities	▪	▪
10	Policy and Procedure	▪	▪

Scoring:
Green - Fully Functional; recommendations may be included to optimize program
Yellow - Satisfactory; progress has been made but may require change of practice or optimization. See recommendations
Red - Unsatisfactory; component needs immediate attention. See recommendations

Page 2 of 3

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Example 4.2 Kaiser Northern CA ASP Activities Reported to QI Committees (continued 3 of 3)

KAISER PERMANENTE®

Kaiser Permanente Northern California
Antimicrobial Stewardship Program Assessment Tool

Issue	Description	Evaluation Points
1	Number of pharmacists participating in ASP	Ideally limited to 1 to 3 pharmacists to ensure continuity and maintain pharmacist knowledge base.
2	Physician Engagement	All ID physicians should proactively participate and support process. Clear level of engagement by the ID Chief.
3	Chart review by ASP pharmacist	Patient chart reviews by ASP pharmacist are effective for evaluating antimicrobial needs.
4	Time commitment	Administration supports physician and pharmacist time to complete ASP according the population needs of the hospital.
5	ASP RPh Patient Presentation	Pharmacists present completely and effectively to ID physicians with clear recommendations for interventions.
6	Documentation of ASP Pharmacist Interventions	All interventions are documented in Medici and identify physician acceptance or rejection.
7	Method of ASP Interventions to Attending	Ideally recommendations of interventions are communicated with attending physicians directly (face to face, telephone) in lieu of written notes. Escalation occurs when there is a critical need for intervention.
8	Generation of intervention reports/Reporting of ASP	Comprehensive reports on antimicrobial utilization and interventions are provided at least quarterly to P&T Committees and Infection Control Committees. The committees take/recommend action based on results if needed.
9	ASP Priorities	ID physicians, pharmacy leaders, and ASP pharmacists agree on priorities according to local needs (i.e. antipseudomonals, broad spectrum antibiotics). The facility has a process to escalate HA-CDI cases for detailed interdisciplinary review.
10	Policy and Procedure	A medical executive committee approved hospital ASP policy and procedure is in place.

Page 3 of 3

For more info about this example contact Stephen Parodi at Stephen.M.Parodi@kp.org

CDPH does not endorse the specific content or recommendations included in these examples. They are for illustrative purposes only.

Antimicrobial Stewardship Program Element 5:

An annual antibiogram is developed using Clinical laboratory Standards Institute guidelines and distributed to medical staff, with follow-up education provided.

An antibiogram is a summary report of antimicrobial susceptibilities of selected pathogens using Clinical Laboratory Standards Institute (CLSI) criteria. The antibiogram of a facility or location within that facility reflects the percentage of a given organism that is susceptible to each of the antimicrobial agents routinely tested. Local antibiograms with pathogen-specific susceptibility data should be updated annually to provide guidance to clinicians on choosing appropriate empiric therapy. Examining trends in the susceptibility patterns of important antimicrobial-resistant bacterial pathogens, such as methicillin-resistant *Staphylococcus aureus* (MRSA), vancomycin-resistant *Enterococci* (VRE), extended-spectrum beta-lactamase (ESBL) producers, and carbapenem-resistant Enterobacteriaceae (CRE), can be useful in informing changes to empiric treatment guidelines as well as changes to the antimicrobial formulary.

The following examples demonstrate facility antibiograms from a variety of practice settings and facility sizes.

Links to other examples of antibiograms

http://idmp.ucsf.edu/news/updated-ucsf-adult-and-pediatric-antimicrobial-susceptibility- reports-2013

https://lane.stanford.edu/biomed-resources/antibiograms-shc.html

http://clinlabs.duke.edu/DukeMicrobiology/Antibiogram.aspx

http://hsl.uw.edu/toolkits/care-provider-toolkit-resources/more-antibiograms

References

Hebert C, Ridgway J, Vekhter B, Brown EC, Weber SG, Robicsek A. Demonstration of the weighted-incidence syndromic combination antibiogram: an empiric prescribing decision aid. *Infect Control Hosp Epidemiol.* 2012 Apr;33(4):381–8. http://www.ncbi.nlm.nih.gov/pubmed/?term=22418634

Hindler JF, Stelling J. Analysis and presentation of cumulative antibiograms: a new consensus guideline from the Clinical and Laboratory Standards Institute. *Clin Infect Dis*. 2007 Mar 15;44(6):867-73.http://www.ncbi.nlm.nih.gov/pubmed/?term=17304462

Example 5.1 University of California San Francisco Benioff Children's Hospital Oakland Antibiogram 2013 (1 of 3)

UCSF Benioff Children's Hospital Oakland
Antibiogram 2013

# of isolates		473	246	93	5	109	15	48	47	12	32	9	43	701	54	26	82	22	126	30	35	3
Antibiotic	Cost (Pediatric/Adult)	Meth-SUSCEPTIBLE Staph aureus (MSSA)	Meth-RESISTANT Staph aureus (MRSA)	Coagulase-negative Staphylococcus	Group B Streptococcus	Enterococcus sp	Viridans Streptococcus	Strep pneumoniae (CSF)	Strep pneumoniae (non-CSF)	Citrobacter freundii	Enterobacter cloacae	Enterobacter aerogenes	Serratia marcesans	Escherichia coli	Klebsiella pneumoniae	Klebsiella oxytoca	Proteus mirabilis	Acinetobacter sp	Pseudomonas aeruginosa	Stenotrophomonas maltophilia	Salmonella sp	Shigella sp
penicillin (PO)	$	1%	0%	1%	100%		71%		74%													
penicillin (IV)	$ / $$	1%	0%	1%	100%		71%	73%	96%													
amoxicillin	$					95%																
ampicillin	$$					95%	67%			R	R	R	R	49%	R	R	88%				66%	33%
oxacillin	$$ / $$$$	100%	0%	41%																		
amp-sulbactam	$$					95%				R	R	R	R	51%	81%	54%	94%	91%				
piperacillin-tazo	$$ / $$$					95%				100%	84%	89%	74%	97%	93%	88%	100%		*98%*			
ticarcillin-clav	$$ / $$$																		*29%*	40%		
aztreonam	$$$ / $$$$$									78%	84%	75%	78%	95%	88%	76%	97%		87%			
cefazolin	$ / $$									R	R	R	R	*86%**	*79%**	*42%**	*100%**					
cefuroxime	$ / $$									R	R	R	R	95%	93%	89%	100%					
cefotaxime	$ / $$				100%		76%	92%	96%	67%	80%	62%	75%	95%	88%	82%	100%					
ceftriaxone	$ / $$				100%		80%	89%	98%	67%	80%	62%	75%	95%	88%	82%	100%				91%	
ceftazidime	$$									83%	81%	67%	72%	96%	94%	96%	100%	91%	90%	37%		
cefepime	$$									92%	100%	89%	93%	96%	96%	88%	100%	95%	87%			
meropenem	$$$ / $$$$$							85%	85%	100%	100%	100%	98%	99%	100%	100%	100%	95%	*97%*			
gentamicin	$	99%§	98%§	76%§		83%§				83%	100%	100%	91%	92%	93%	92%	96%	95%	82%			
tobramycin	$									83%	100%	89%	91%	93%	93%	92%	99%	95%	94%			
amikacin	$									100%	100%	100%	95%	100%	98%	100%	99%	95%	87%			
nitrofurantoin	$$	100%*		100%*		97%*				100%*	36%*	0%*	R	99%*	63%*	92%*	R					
trimeth-sulfa	IV: $/$$; PO: $	99%	99%	76%						83%	91%	100%	95%	71%	87%	88%	88%	91%		100%	100%	0%
ciprofloxacin	IV:$/$$; PO:$$/$	91%	60%	83%						100%	100%	100%	93%	93%	98%	96%	96%	95%	94%		100%	100%
tetracycline or doxycycline	IV: $$; PO: $	97%	98%																			
clindamycin	IV:$/$$$;PO:$$/$	82%	89%		75%		93%															
vancomycin	$ / $$	100%	100%	100%	100%	98%	100%	100%	100%													
linezolid	$$$$/$$$$$	100%	99%	100%		99%	100%															

"§" denotes utility as synergistic agent only "R" denotes intrinsic resistance "*" indicates data applicable to uncomplicated urinary tract infections only

Antibiotic color code:
- Green = preferred/first-line agents when appropriate for pathogen/type of infection
- Yellow = broader-spectrum agents: streamline to Green agents when appropriate for pathogen/type of infection
- Red = broadest-spectrum/last-line agents: streamline to Yellow or Green agents when appropriate for pathogen/type of infection

Additional information:
- Values (%) indicate the % of tested isolates that were SUSCEPTIBLE to the antibiotic by in vitro testing.
- *Italicized* % values are based on old susceptibility breakpoints which have changed. The new breakpoints are not reflected in this document.
- Dollar signs indicate approximate cost of one day of therapy: $=0-5 dollars, $$=5-25 dollars, $$$=25-50 dollars, $$$$=50-100 dollars, $$$$$=over 100 dollars.
- Dollar signs separated by "/" indicate cost difference between pediatric dose versus adult dose.

Version Date: 4/24/2014

For more info about this example contact Brian Lee, MD at blee@mail.cho.org

CDPH does not endorse the specific content or recommendations included in these examples.
They are for illustrative purposes only.

Example 5.1 University of California San Francisco Benioff Children's Hospital Oakland Antibiogram 2013 (continued 2 of 3)

UCSF Benioff Children's Hospital Oakland

UCSF Benioff Children's Hospital Oakland Antibiogram App Instructions

1. Search for and download "Antibiograms" app onto your smart device from Apple or Google Play App Store.
2. Send the attached "CHO 2013 Antibiogram" database to an email address that you can access from your smart device.
3. Click on the "CHO 2013 Antibiogram" attachment (while accessing the email on your smart device).
4. Select option "Open in Antibiograms". This will load the "CHO 2013 Antibiogram" database into your Antibiograms app.
5. Open the Antibiograms app and click on "Person" icon in the bottom right and select "All patients".
6. You may now explore the antibiogram by clicking on the "Bug" icon in the bottom middle to select an organism of interest.

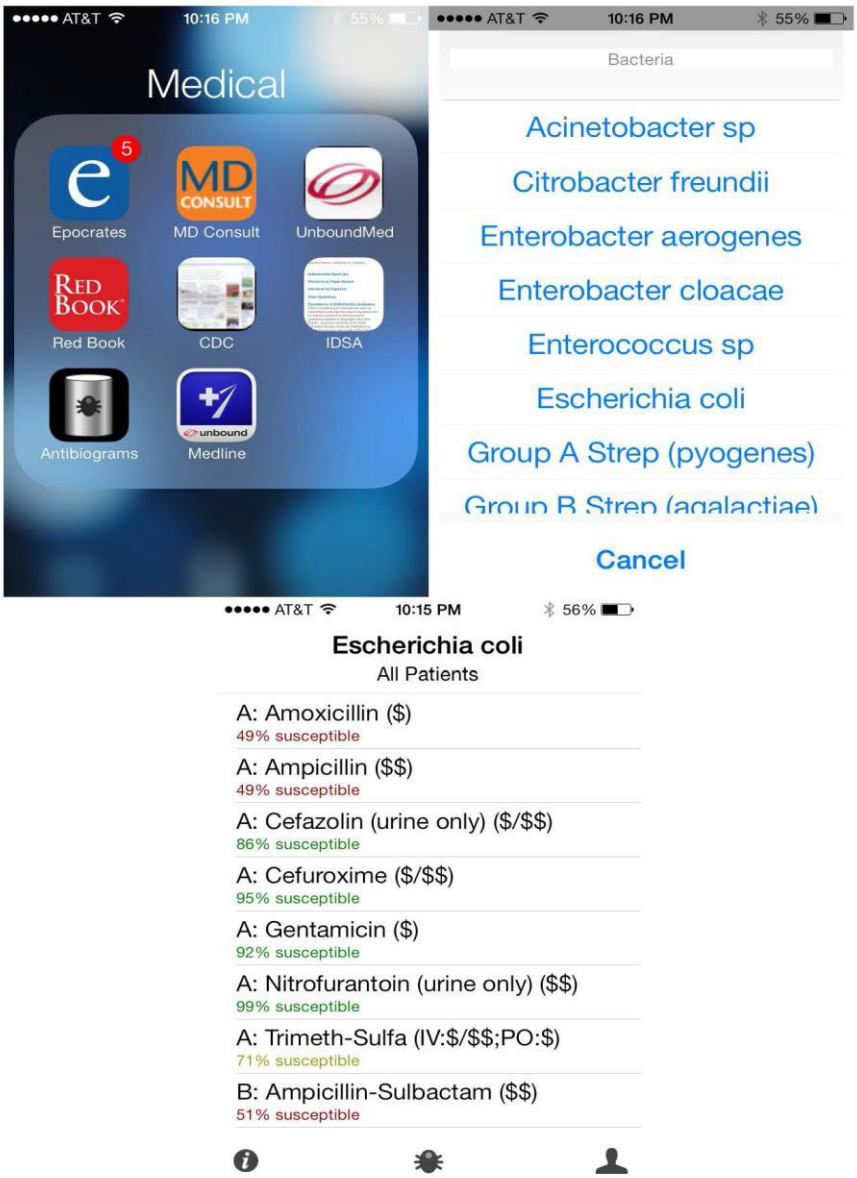
Additional notes:

- Organism or drug names with an asterix can be clicked to open a pop up window with additional information
- "R" indicates "intrinsically resistance"
- "S" indicates "predictably susceptible"
- Antibiotics are listed as "A", "B", or "C" agents:
  A = preferred/first-line agents when appropriate for the pathogen/type of infection
  B = broader-spectrum agents: streamline to "A" agents when appropriate for the pathogen/type of infection
  C = broadest-spectrum/last-line agents: streamline to "A" or "B" agents when appropriate for pathogen/type of infection
- Dollar signs indicate approximate cost of one day of therapy: $=0-5 dollars, $$=5-25 dollars, $$$=25-50 dollars, $$$$=50-100 dollars, $$$$$=over 100 dollars.
- Dollar signs separated by "/" indicate cost difference between pediatric dose versus adult dose.

For more info about this example contact Brian Lee, MD at blee@mail.cho.org

Example 5.1 University of California San Francisco Benioff Children's Hospital Oakland Antibiogram 2013 (continued 3 of 3)

UCSF Benioff Children's Hospital Oakland Antibiogram App



For more info about this example contact Brian Lee, MD at blee@mail.cho.org

Example 5.2 University of California San Francisco Medical Center Adult and Pediatric Antibiograms 2013 (1 of 8)

UCSF ADULT INPATIENT SUSCEPTIBILITY DATA 2013

N/A-testing NOT APPLICABLE to organism. **CZOL**-cefazolin, **CTRX**-ceftriaxone, **CTAZ**-ceftazidime, **CFPM**-cefepime, **GEN**-gentamicin, **TOB**-tobramycin, **T/S**-trimethoprim/sulfamethoxazole, **CIP**-ciprofloxacin, **MER**-meropenem, **P/T**-piperacillin-tazobactam, **PCN**-penicillin, **NAF**-nafcillin, **ERY**-erythromycin, **CLIN**-clindamycin, **DOX**-doxycycline, **VANC**-vancomycin, **AMP**-ampicillin

Total isolates include Floor Isolates and ICU Isolates from UCSF and Mt. Zion Hospitals (Does not include Outpatient)

Gram-negative Isolates (% Strains Susceptible, tested from all sites) 2013 data represents top row

Organism		Total Isolates	CZOL	CTRX	CTAZ	CFPM	GEN	TOB	T/S	CIP	P/T	MER
Acinetobacter baumannii	2013	15	N/A	47	□**80**	□**87**	**80**	**87**	**73**	**73**	**67**	**87**
	2012	16	N/A	38	**63**	**75**	**63**	**69**	**63**	**63**	**63**	**81**
	2011	12	N/A	42	50	50	50	83	50	50	42	58
Citrobacter freundii	2013	37	N/A	□**57**	□65	97	97	**86**	**70**	**86**	**76**	100
	2012	24	5	**75**	79	96	88	**79**	**75**	**75**	**83**	100
	2011	37	6	81	81	100	89	86	65	81	89	100
Enterobacter aerogenes	2013	43	N/A	**63**	**63**	100	100	100	**95**	95	**63**	98
	2012	40	N/A	70	73	98	95	98	90	95	**73**	100
	2011	27	N/A	74	74	100	96	96	89	96	81	100
Enterobacter cloacae	2013	71	N/A	**66**	**69**	99	**97**	92	75	86	**77**	100
	2012	65	N/A	71	74	100	89	91	77	89	**86**	100
	2011	70	N/A	66	70	96	93	93	79	87	79	100
Escherichia coli*	**2013**	**969**	**60**	85	91	95	86	86	65	69	97	100
	2012	**810**	□**60**	85	90	95	84	83	65	67	96	100
	2011	592	73	88	92	96	87	85	65	68	96	100
Klebsiella oxytoca	2013	44	**25**	93	100	100	98	100	**93**	98	91	100
	2012	44	**36**	91	95	100	98	95	86	98	95	100
	2011	31	48	94	97	100	97	97	90	100	90	100
Klebsiella pneumoniae	2013	**263**	**84**	89	92	96	92	91	**84**	87	95	100
	2012	**227**	□**78**	89	91	96	95	92	77	90	93	100
	2011	169	86	94	95	99	95	93	78	90	92	100
Proteus mirabilis	2013	**122**	**17**	99	100	100	91	93	**81**	□**68**	100	100
	2012	**106**	□**19**	97	97	100	90	92	**70**	80	100	99
	2011	60	45	95	98	100	90	94	76	77	100	100
Pseudomonas aeruginosa**		275	N/A	N/A	83	87	**N/A**	93	N/A	**72**	80	**80**
	2013 ICU	88	N/A	N/A	**79**	**83**	**N/A**	96	N/A	**81**	75	**71**
	2012 ICU	49	N/A	N/A	**76**	**73**	**N/A**	94	N/A	67	**71**	**84**
	2011 ICU	60	N/A	N/A	87	85	**N/A**	90	N/A	68	93	78
	2013 Non-ICU	187	N/A	N/A	85	89	**N/A**	91	N/A	68	**82**	85
	2012 Non-ICU	137	N/A	N/A	86	88	**N/A**	96	N/A	77	85	90
	2011 Non-ICU	128	N/A	N/A	90	90	**N/A**	95	N/A	75	91	90
Serratia marcescens	2013	44	N/A	95	100	100	98	**100**	98	95	100	100
	2012	24	N/A	96	100	100	96	92	100	96	100	100
	2011	37	N/A	97	100	100	100	95	97	97	100	100

*** Pseudomonas aeruginosa isolates do not include isolates from cystic fibrosis patients; [a]Zosyn S ≤64; [b]Zosyn S ≤16; [c]Meropenem S ≤4; [d]Meropenem S ≤2*

♦ ***Escherichia coli**	Outpatient TMP/SMX susceptibility is 72% **(66,** 69, **68%**). Outpatient ciprofloxacin susceptibility is 81% (74, 79, 78%). Nitrofurantoin susceptibility is 98**% (100.** 97, 97%) and should only be used for uncomplicated UTIs in patients with CrCl >60 ml/min. Outpatient cefazolin susceptibility is **73% (70, 80, 92%**).
♦ **Haemophilus influenzae**	National incidence of β-lactamase production is 37% (2010)
♦ **Stenotrophomonas maltophilia**	Routine antimicrobial susceptibility testing is performed on sterile sites. TMP/SMX is the most active agent versus this organism. Contact ID or ID pharmacy for alternatives.

For more info about this example contact Catherine Liu at catherine.liu@ucsf.edu and/or Conan MacDougall at macdougall@pharmacy.ucsf.edu

Example 5.2 University of California San Francisco Medical Center Adult and Pediatric Antibiograms 2013 (continued 2 of 8)

All Gram-negatives Antibiogram Adults

	CTX	ERTA	CTAZ	CPIM	CIP	PIPTAZ	MER
All Patients	60% (83%)*	70% (97%)*	85%	93%	80%	88%	94%
ICU	52% (80%)*	63% (97%)*	82%	92%	86%	84%	89%
Floor	63% (84%)*	73% (98%)*	85%	94%	79%	90%	96%
	CTX + CIP	MER+ TOB	PIPTAZ+ TOB	CPIM+ TOB	MER+ CIP	PIPTAZ+ CIP	CPIM+CI P
All Patients	60→87%	94→99%	88→97%	93→97%	94→97%	88→94%	93→95%
ICU	21→89%	89→99%	84→95%	92→97%	89→95%	84→93%	92→95%
Floor	32→85%	63→99%	90→98%	94→98%	96→97%	90→95%	96→98%

*excluding *Pseudomonas & Acinetobacter*

***Pseudomonas* Combination Antibiogram Adults**

	MER+TOB	PIP+TOB	CPIM+TOB	MER+CIP	PIP+CIP	CPIM+CIP
All Patients	80→97%	80→96%	87 → 95%	80→90%	80 →89%	87 → 93%
ICU	71→98%	75→97%	83 → 97%	71→89%	75 →88%	83 → 93%
Floor	85→95%	82→94%	89→94%	85→92%	82→88%	89 → 92%

For more info about this example contact Catherine Liu at catherine.liu@ucsf.edu and/or Conan MacDougall at macdougall@pharmacy.ucsf.edu

Example 5.2 University of California San Francisco Medical Center Adult and Pediatric Antibiograms 2013 (continued 3 of 8)

UCSF ADULT INPATIENT SUSCEPTIBILITY DATA 2013

N/A-testing NOT APPLICABLE to organism. **PIP**-piperacillin, **CZOL**-cefazolin, **CTRX**-ceftriaxone, **CTAZ**-ceftazidime, **CFPM**-cefepime, **GEN**-gentamicin, **TOB**-tobramycin, **T/S**-trimethoprim/sulfamethoxazole, **CIP**-ciprofloxacin, **MER**-meropenem, **P/T**-piperacillin-tazobactam, **PCN**-penicillin, **NAF**-nafcillin, **ERY**-erythromycin, **CLIN**-clindamycin, **DOX**-doxycycline, **VANC**-vancomycin, **AMP**-ampicillin

Total isolates include Floor Isolates and ICU Isolates from UCSF and Mt. Zion Hospitals (Does not include Outpatient)

Gram-positive Isolates (% Strains Susceptible, tested from all sites) 2013 data represents top row

Organism		Total Isolates	PCN	NAF	ERY	CLIN	CIP	DOX	T/S	VANC
Staphylococcus aureus*	2013	596	0	58	33	**65**	55	92	93	99
	2012	651	0	57	42	**□63**	53	93	95	99
	2011	483	5	61	44	70	60	95	94	100
MRSA	2013	249	N/A	N/A	7	**50**	**21**	**93**	93	99
MRSA	2012	280	N/A	N/A	10	**45**	**17**	**88**	94	98
MRSA	2011	191	N/A	N/A	10	53	48	95	94	100
MSSA	2013	347	0	100	51	76	**80**	91	93	100
MSSA	2012	371	0	100	66	77	**80**	96	95	100
MSSA	2011	293		100	66	80	48	95	95	100
Staphylococcus epidermidis	2013	155	0	**43**	**□13**	71	46	88	**57**	100
	2012	212	0	**35**	**33**	69	47	82	**48**	100
	2011	251	6	43	41	69	48	84	56	100
Streptococcus pneumoniae†	2013	**72**	See below	N/A	**64**	**68**	N/A	59	**55**	100
	2012	**56**	See below	N/A	**55**	**74**	N/A	73	**□38**	100
Parnassus	2011	23	See below	N/A	61	83	N/A	74	70	100
Mount Zion	2011	3	See below	N/A	33	33	N/A	33	67	100

† Rates prior to 2012 do not include Mt. Zion strains

◆ ***Staphylococcus aureus** Outpatient Nafcillin susceptibility is 76% (Previously 76, 72, 70, 69%). Nafcillin resistance predicts cephalosporin resistance.

Adult Inpatient Vancomycin MIC Distribution for *S. aureus*

Vancomycin MIC (All *S. aureus*)	2012	2013
0.5	1.86% (12/645)	2.7% (16/588)
1	92% (594/645)	91.2% (536/588)
2	5.74% (37/645)	5.6% (33/588)
4	0.31% (2/645)	0.34% (2/588)
Vancomycin MIC (MRSA only)		
0.5	0.72% (2/276)	1.2% (3/248)
1	92% (255/276)	88.7% (220/248)
2	6.2% (17/276)	9.3% (23/248)
4	0.72% (2/276)	0.8% (2/249)

Adult Outpatient Susceptibilities for *S. aureus*

Outpatient 2013	Total Isolates	ERY	CLIN	CIP	DOX	T/S	VANC
Staphylococcus aureus	669	52	72	71	92	96	99
MRSA	(24%) 163	7	51	23	89	94	98.1
MSSA	506	61	79	86	92	96	99.6
Outpatient 2012	Total Isolates	ERY	CLIN	CIP	DOX	T/S	
Staphylococcus aureus	630	47	68	64	91	94	
MRSA	178	10	57	19	90	93	
MSSA	452	62	73	82	91	95	

◆ **Enterococcus species** *Enterococcus faecalis* species are 100% AMP susceptible. *Enterococcus faecium* can be multi-drug resistant. Check vancomycin susceptibilities for all isolates from sterile sites. The addition of gentamicin (1 mg/kg Q8h) is required for bactericidal activity in serious systemic enterococcal infections. Of 100 (99, 88, 89, 88) enterococcal bacteremias in 2013 (2012, 2011, 2010), 57 (62, 66, 51) were due to

For more info about this example contact Catherine Liu at catherine.liu@ucsf.edu and/or Conan MacDougall at macdougall@pharmacy.ucsf.edu

Example 5.2 University of California San Francisco Medical Center Adult and Pediatric Antibiograms 2013 (continued 4 of 8)

Enterococcus faecium. **81% (82, 90, 89, 85%) of the *Enterococcus faecium* were vancomycin resistant**. Of the 48 (44, 57, 59, 43) VRE blood isolates in 2013, 5 were linezolid resistant.

◆ †**Streptococcus pneumoniae** Across all isolates, 65% (47/72 isolates) were PCN susceptible, 71/72 (99%) levofloxacin susceptible, and 46/72 (64%) erythromycin susceptible. Among PCN-nonsusceptible isolates, 13/17 (76%) were ceftriaxone susceptible. Among blood and CSF isolates, 71% were susceptible to PCN, 93% ceftriaxone susceptible, and 100% vancomycin susceptible.

NOTE: For the treatment of meningitis, pending susceptibilities, VANC empirically should be added to the regimen since failures (due to highly resistant isolates) have been reported with ALL third generation cephalosporins.

Inpatient Adult Enterococcal Blood Isolates

		Total Isolates	Amp	Dapto*	Linez	Q/D	Tetr	Vanc
Enterococcus faecalis	2013	38	100%	100%	100%	0%	10%	100%
	2012	42	100%	100%	100	4%	20%	100%
	2011	26	100%	100%	100	8%	23%	96%
Enterococcus faecium	2013	57	13%	90%*	**91%**	100%	**30%**	**19%**
	2012	51	2%	94%	**92**	94%	**31%**	**18**
	2011	62	0%	89%	100	94%	11%	10
Other Enterococcal species	2013	5	80%	100%	100%		40%	60%

- ***Dapto MIC distribution: All isolates: <=0.5: 14% 1: 25% 2: 37% 4: 19% >4: 6% VRE: <=0.5: 4% 1: 14% 2: 48% 4: 24% >4: 10%***

For more info about this example contact Catherine Liu at catherine.liu@ucsf.edu and/or Conan MacDougall at macdougall@pharmacy.ucsf.edu

Example 5.2 University of California San Francisco Medical Center Adult and Pediatric Antibiograms 2013 (continued 5 of 8)

UCSF PEDIATRIC SUSCEPTIBILITY DATA 2013

N/A-testing NOT APPLICABLE to organism. **PIP**-piperacillin, **CZOL**-cefazolin, **CTRX**-ceftriaxone, **CTAZ**-ceftazidime, **CFPM**-cefepime, **GEN**-gentamicin, **TOB**-tobramycin, **T/S**-trimethoprim/sulfamethoxazole, **CIP**-ciprofloxacin, **MER**-meropenem, **P/T**-piperacillin-tazobactam, **PCN**-penicillin, **NAF**-nafcillin, **ERY**-erythromycin, **CLIN**-clindamycin, **DOX**-doxycycline, **VANC**-vancomycin, **AMP**-ampicillin

Total isolates include Floor Isolates and ICU Isolates from UCSF and Mt. Zion Hospitals (Does not include Outpatient)

Gram-negative isolates (% strains susceptible, tested from all sites) 2013 data represents top row

Organism		Total isolates	CZOL	CTRX	CTAZ	CFPM	GEN	TOB	T/S	CIP	P/T	MER
Acinetobacter baumannii	2013	0	0	**0**	0	**0**	0	0	0	0	**0**	0
	2012	3	N/A	**0**	100	**100**	100	100	100	100	**100**	100
	2011	4	N/A	50	100	75	100	100	100	100	75	100
Citrobacter freundii	2013	3	0	**↓33**	**↓33**	100	**100**	**□100**	**□100**	**100**	**↓33**	100
	2012	5	N/A	**80**	**80**	100	80	**60**	**60**	**100**	**100**	100
	2011	5	0	40	40	100	80	80	80	80	60	100
Enterobacter aerogenes	2013	8	0	**63**	**63**	**100**	100	100	**88**	**100**	**63**	100
	2012	4	N/A	**50**	**50**	**100**	100	100	**100**	**100**	**50**	100
	2011	5	0	60	40	80	100	100	80	80	60	100
Enterobacter cloacae	2013	17	0	**53**	**53**	100	94	**94**	88	100	**□82**	100
	2012	22	N/A	**32**	**41**	100	86	**82**	73	95	**64**	95
	2011	31	0	56	55	100	91	91	78	91	72	100
Escherichia coli*	2013	103	70	93	96	97	94	94	**65**	**90**	97	100
	2012	83	70	95	98	98	94	93	71	**93**	95	100
	2011	68	69	90	96	97	93	91	71	85	99	100
Klebsiella oxytoca	2013	10	**30**	**100**	100	100	100	100	**100**	**100**	**80**	100
	2012	17	**□24**	**88**	100	100	100	100	**82**	**94**	**88**	100
	2011	15	67	100	100	100	100	93	100	100	100	100
Klebsiella pneumoniae	2013	35	**60**	91	**91**	97	**97**	**91**	**□91**	**94**	**94**	100
	2012	30	**73**	90	**90**	100	87	**83**	**□67**	90	100	100
	2011	19	84	95	100	100	89	95	97	95	95	100
Proteus mirabilis	2013	9	**44**	100	100	100	100	100	**↓89**	100	100	100
	2012	4	**↓0**	100	100	100	100	100	**□100**	100	100	100
	2011	6	50	100	100	100	100	100	50	100	100	100
Pseudomonas aeruginosa**		40	N/A	N/A	**88**	**96**	100	100	N/A	92	88	88
	2012	20	N/A	N/A	**95**	**95**	100	100	N/A	100	100	95
	Peds ICU 2013	19	N/A	N/A	79	92	100	100	N/A	92	82	84
	Peds ICU 2012	9	N/A	N/A	100	100	100	100	N/A	100	89	100
	Non-ICU 2013	24	N/A	N/A	96	100	0	100	N/A	93	93	93
	Non-ICU 2012	14	N/A	N/A	93	93	100	100	N/A	93	100	93
Serratia marcescens	2013	11	N/A	**↓73**	100	100	100	100	**100**	100	**91**	100
	2012	13	N/A	**100**	100	100	100	100	**92**	100	**100**	100
	2011	8	N/A	88	100	100	100	100	100	100	88	100

*** Pseudomonas aeruginosa isolates do not include isolates from cystic fibrosis patients; [a]Zosyn S ≤64; [b]Zosyn S ≤16; [c]Meropenem S ≤4; [d]Meropenem S ≤2*

For more info about this example contact Catherine Liu at catherine.liu@ucsf.edu and/or Conan MacDougall at macdougall@pharmacy.ucsf.edu

Example 5.2 University of California San Francisco Medical Center Adult and Pediatric Antibiograms 2013 (continued 6 of 8)

***Pseudomonas* Combination Antibiogram Peds**

	Mero+ Tobra	Piptazo+Tobra	Cefepime+Tobra	Mero+Cipro	Piptazo+Cipro	Cefepime+Cipro
All Patients	88→100%	88→100%	96 → 100%	88→94%	88 →94%	96 → 98%

All Gram-negatives Antibiogram PEDS

	CTX	ERTA	CTAZ	CPIM	CIP	PIPTAZ	MER
All Patients	51% (75%)*	67% (98%)*	81%	97%	93%	85%	96%
	CTX + CIP	**Mero+ Tobra**	**Piptazo+ Tobra**	**Cefepime+ Tobra**	**Mero+ Cipro**	**Piptazo+ Cipro**	**Cefepime+ Cipro**
All Patients	51→95%	96→100%	85→99%	97→99%	94→98%	85→98%	96→98%

◆ Escherichia coli*	Outpatient cefazolin/cephalexin susceptibility is 79% in 2013 (78, 85, 92%). Outpatient TMP/SMX susceptibility is 74% (69, 69, 70%). Outpatient ciprofloxacin susceptibility is 97% (93, 95, 91%). Nitrofurantoin susceptibility is 100% (100, 98, 99%) and should only be used for uncomplicated UTIs in patients with CrCl >60 mL/min.
◆ Haemophilus influenzae	National incidence of β-lactamase production is 37% (2010)
◆ Stenotrophomonas maltophilia	Routine antimicrobial susceptibility testing is performed on sterile sites and cystic fibrosis isolates. TMP/SMX is the most active agent versus this organism.

For more info about this example contact Catherine Liu at catherine.liu@ucsf.edu and/or Conan MacDougall at macdougall@pharmacy.ucsf.edu

Example 5.2 University of California San Francisco Medical Center Adult and Pediatric Antibiograms 2013 (continued 7 of 8)

UCSF PEDIATRIC SUSCEPTIBILITY DATA 2013

N/A-testing NOT APPLICABLE to organism. **PIP**-piperacillin, **CZOL**-cefazolin, **CTRX**-ceftriaxone, **CTAZ**-ceftazidime, **CFPM**-cefepime, **GEN**-gentamicin, **TOB**-tobramycin, **T/S**-trimethoprim/sulfamethoxazole, **CIP**-ciprofloxacin, **MER**-meropenem, **P/T**-piperacillin-tazobactam, **PCN**-penicillin, **NAF**-nafcillin, **ERY**-erythromycin, **CLIN**-clindamycin, **DOX**-doxycycline, **VANC**-vancomycin, **AMP**-ampicillin

Total isolates include Floor isolates and ICU isolates from UCSF and Mt. Zion Hospitals (Does not include Outpatient)

Gram-positive isolates (% strains susceptible, tested from all sites) 2013 data represents top row

Organism		Total Isolates	PCN	NAF	ERY	CLIN	CIP	DOX	T/S	VANC
Staphylococcus aureus	2013	93	0	**63**	**50**	**85**	**74**	94	99	100
	2012	127	0	**69**	**54**	**71**	**75**	91	92	99
	2011	121	5	79	59	78	83	94	95	100
	MRSA 2013	34	N/A	N/A	**23**	**82**	**41**	100	**97**	100
	MRSA 2012	39	N/A	N/A	**5**	**38**	**□38**	97	87	100
	MRSA 2011	26	N/A	N/A	15	64	73	100	92	100
	MSSA 2013	59	N/A	100	**65**	87	**95**	91	100	100
	MSSA 2012	88	0	100	75	85	**□91**	88	94	99
	MSSA 2011	95			71	82	73	93	96	100
Staphylococcus epidermidis	2013	25	0	20	**↓4**	**60**	**56**	88	**48**	100
	2012	44	0	30	25	**70**	**65**	86	**45**	100
	2011	46	2	26	30	57	74	85	65	100
Streptococcus pneumoniae†	2013	**25**	See below	N/A	**68**	**70**	N/A	**64**	**50**	100
	2012	**32**	See below	N/A	**75**	**60**	N/A	**76**	**29**	100
	2011	6	See below	N/A	50	83	N/A	67	83	100

† Rates prior to 2012 do not include Mt. Zion strains

- *Staphylococcus aureus — Outpatient Nafcillin susceptibility 79% (79, 74, 77, 76%) (Nafcillin resistance predicts cephalosporin resistance).

Pediatric Inpatient Vancomycin MIC Distribution for *S. aureus*

Vancomycin MIC (All *S. aureus*)	2012	2013
0.5	0% (0/126)	1.1% (1/91)
1	93% (117/126)	94.5% (86/91)
2	7% (9/126)	4.4% (4/91)
Vancomycin MIC (MRSA only)		
0.5	0% (0/39)	2.9% (1/34)
1	85% (33/39)	91.2% (31/34)
2	15% (6/39)	5.8% (2/34)

Pediatric Outpatient Susceptibilities for *S. aureus*

Outpatient 2013	Total Isolates	ERY	CLIN	CIP	DOX	T/S	VANC
Staphylococcus aureus	226	55	86	83	92	95	100
MRSA	(21%) 47	18	74	50	91	87	100
MSSA	179	65	89	91	92	97	100
Outpatient 2012	Total Isolates	ERY	CLIN	CIP	DOX	T/S	
Staphylococcus aureus	148	57	86	82	96	99	
MRSA	38	11	87	53	90	100	
MSSA	110	73	86	92	98	99	

For more info about this example contact Catherine Liu at catherine.liu@ucsf.edu and/or Conan MacDougall at macdougall@pharmacy.ucsf.edu

Example 5.2 University of California San Francisco Medical Center Adult and Pediatric Antibiograms 2013 (continued 8 of 8)

◆ Enterococcus spp.	*Enterococcus faecalis* species are 100% AMP susceptible. *Enterococcus faecium* can be multi-drug resistant. Check vancomycin susceptibilities for all isolates from sterile sites. The addition of gentamicin (1 mg/kg Q8h) is required for bactericidal activity in serious systemic enterococcal infections. Of 13 (18, 23, 23, 31) enterococcal bacteremias in 2013, 1 was vancomycin-resistant.
◆ †Streptococcus pneumoniae	Across all isolates, 64% (16/25 isolates) were PCN susceptible, 100% levofloxacin susceptible, and 68% erythromycin susceptible. Among PCN-nonsusceptible isolates, 1/6 (16%) were ceftriaxone susceptible, and 100% were vancomycin susceptible. There were no isolates from blood or CSF. ***NOTE: For the treatment of meningitis, pending susceptibilities VANC empirically should be added to the regimen since failures (due to highly resistant isolates) have been reported with ALL third generation cephalosporins.***

Inpatient Pediatric Enterococcal Blood Isolates

		Total Isolates	Amp	Dapto	Linez	Q/D	Tetr	Vanc
Enterococcus faecalis	2013	10	100	100	100	0	**27**	100
	2012	15	100	100	100	0	**0**	100
	2011	15	100	100	100	0	13	100
Enterococcus faecium	2013	**1**	0	**100**	100	N/T	**0**	**100**
	2012	**3**	0	**100**	100	100	**0**	**100**
	2011	8	0	75	100	100	38	38
Other Enterococcal species	2013	2	100	100	100	100	100	50

For more info about this example contact Catherine Liu at catherine.liu@ucsf.edu and/or Conan MacDougall at macdougall@pharmacy.ucsf.edu

Example 5.3 Sutter Eden Medical Center Antibiogram 2014 (1 of 1)

Sutter Health
We Plus You

Sutter Health Shared Laboratory
2950 Collier Canyon Rd.
Livermore CA 94551

Eden Medical Center
1January-31December 2014 Cumulative Antimicrobial Susceptibility Report*
Percent Susceptible

Gram Negative Organisms	No. Strains	ESBL	Ampicillin	Ampicillin/Sulbactam	Cefazolin	Cefoxitin	Ceftazidime	Ceftriaxone	Cefepime	Ciprofloxacin	Ertapenem	Gentamicin	Imipenem	Levofloxacin	Nitrofurantoin**	Piperacillin/Tazobactam	Trimethoprim/Sulfa
Citrobacter freundii	31	-	-	-	-	-	81%	81%	100%	94%	100%	94%	97%	97%	93%	-	81%
Enterobacter cloacae	54	-	-	-	-	-	72%	71%	98%	96%	91%	96%	96%	96%	35%	81%	88%
Escherichia coli	1495	10%	49%	59%	43%	86%	94%	90%	97%	72%	99%	90%	100%	72%	94%	95%	73%
Klebsiella oxytoca	35	3%	-	62%	8%	97%	97%	97%	100%	97%	100%	97%	100%	97%	87%	97%	88%
Klebsiella pneumoniae	258	12%	-	78%	46%	93%	90%	89%	97%	88%	97%	95%	98%	88%	33%	89%	86%
Morganella species	42	-	-	2%	-	43%	79%	74%	95%	48%	100%	76%	-	51%	-	95%	48%
Proteus mirabilis	230	-	65%	78%	15%	86%	94%	83%	94%	53%	100%	77%	-	57%	-	100%	59%
Providencia species	36	-	-	-	-	94%	88%	85%	97%	24%	93%	-	-	24%	-	94%	61%
Pseudomonas aeruginosa	204	-	-	-	-	-	87%	-	92%	62%	-	88%	85%	58%	-	87%	-

Note: CLSI recommends that to obtain a reasonable statistical estimate of cumulative %S rates, it is desirable to include only species with testing data for >= 30 isolates.

* %S for each organism/antimicrobial combination was generated by including the first isolate of that organism encountered on a given patient.

**Nitrofurantoin, data from testing urine isolates only

(-) drug not tested or drug not indicated

Acinetobacter baumanii complex†	18	-	-	-	82%	-	-	37%	-	53%	42%	-	58%	84%	42%	-	-	53%
Stenotrophomonas maltophilia†	17	-	-	-	-	-	-	-	-	-	-	-	-	-	81%	-	-	100%

† Fewer than 30 isolates indicates less statistical validity of the estimates of % S. Interpret with caution.

Gram Positive Organisms	No. Strains	Ampicillin	Cefazolin	Erythromycin	Linezolid	Levofloxacin	Nitrofurantoin	Clindamycin	Oxacillin	Pencillin	Tetracycline	Trimethoprim/Sulfa	Vancomycin
Enterococcus faecalis	37	97%	-	-	100%	57%	100%	-	-	97%	24%	-	81%
Enterococcus faecium	35	8%	-	-	100%	3%	10%	-	-	8%	17%	-	11%
Enterococcus NOS	173	95%	-	-	100%	74%	98%	-	-	96%	21%	-	99%
Methicillin resistant Staphylococcus aureus (MRSA)	158	-	-	12%	-	21%	95%	58%	-	-	92%	99%	100%
Staphylococcus aureus (MSSA)	237	-	100%	68%	-	79%	100%	83%	99%	-	94%	99%	100%

+For Staphylococus aureus, 42% of all isolates reported an MIC of <=0.5 and 57% reported an MIC of 1.

Streptococcus pneumoniae†	8	-	-	75%	-	100%	-	100%	-	88%	-	-	100%

MIC's performed only on sterile site isolates and those that are penicillin screen resisitant.

† Fewer than 30 isolates indicates less statistical validity of the estimates of % S. Interpret with caution.

For more info about this example contact Jeffrey Silvers, MD at Silverj@sutterhealth.org

Antimicrobial Stewardship Program Element 6:

Institutional guidelines have been developed for the management of common infection syndromes (e.g. order sets, clinical pathways, empiric antimicrobial therapy guides).

Development of evidence-based clinical management guidelines that incorporate local microbiology and resistance patterns can improve antimicrobial utilization. Guideline adherence can be facilitated through provider education, use of electronic order sets, guideline distribution on websites or mobile applications, and provider feedback on antimicrobial use and patient outcomes.

Example 6.1 provides an example of facility-specific clinical management guidelines, tailored to a pediatric facility.

Links to other examples of institutional guidelines

http://idmp.ucsf.edu/guidelines-empiric-antimicrobial-therapy

https://my.agilemd.com/club/ucsfidmp#hello (mobile application)

http://www.uphs.upenn.edu/bugdrug/antibiotic_manual/table%20of%20contents.htm

http://www.hopkinsmedicine.org/amp/guidelines/index.html

http://www.nebraskamed.com/document/31406/antimicrobial-guidebook

References

Brown EM. Guidelines for antibiotic usage in hospitals. *J Antimicrob Chemother*. 2002 Apr;49(4):587-92. http://www.ncbi.nlm.nih.gov/pubmed/?term=11909830

Gross PA, Pujat D. Implementing practice guidelines for appropriate antimicrobial usage: a systematic review. *Med Care*. 2001 Aug;39(8 Suppl 2):II55-69. http://www.ncbi.nlm.nih.gov/pubmed/?term=11583122

Talpaert MJ, et al. Impact of guidelines and enhanced antibiotic stewardship on reducing broad-spectrum antibiotic usage and its effect on incidence of *Clostridium difficile* infection. *J Antimicrob Chemother*. 2011 Sep;66(9):2168-74. http://www.ncbi.nlm.nih.gov/pubmed/?term=21676904

Example 6.1 Children's Hospital & Research Center Oakland Empiric Therapy Guide 2014 (1 of 5)

Children's Hospital & Research Center Oakland
2014 Empiric Antimicrobial Therapy Guide (EATG)

(The following are guidelines only and should not replace clinical judgment. Immunocompromised patients may require special considerations not addressed here.)

Condition/Syndrome	Major Pathogen(s)	Empiric Outpatient Therapy	Empiric Inpatient Therapy	Duration/Notes
Abdominal – complicated[1]				Consult ID if severe illness
A. Community-associated (CA) (ruptured appy, abdominal abscess)	enteric GNR, anaerobes	N/A	ceftriaxone 50-75 mg/kg/day IV q24 AND metronidazole 30-40 mg/kg/day IV q 8	
B. Healthcare-associated (HA)	GNR, anaerobes	N/A	piperacillin/tazobactam 200-300 mg/kg/day IV q6	
C. Necrotizing enterocolitis[1,2]	GNR, anaerobes	N/A	Bell Stage I-II: ampicillin AND gentamicin AND metronidazole Bell Stage III: cefepime AND metronidazole	Refer to dosing guidelines for premature infants and neonates
Arthritis – septic/bacterial	S. aureus, GAS	N/A	clindamycin 40 mg/kg/day IV q8 OR vancomycin 60 mg/kg/day IV q6	Consult ID
C. difficile colitis/diarrhea (antibiotic-associated)[3,4]	C. difficile	Discontinue inciting antibiotic ASAP; metronidazole 30 mg/kg/day PO qid	Discontinue inciting antibiotic ASAP; Mild-mod: metronidazole 30 mg/kg/day PO/IV q6 Severe: vancomycin 40 mg/kg/day PO q6	Defer therapy if diarrhea resolves after inciting antibiotic is stopped Duration (if tx needed): 10 days
Gastroenteritis (bacterial)[3,5]	E. coli 0157, Salmonella, Shigella, Camplyobacter, Yersenia	Supportive care (hydration/nutrition); High-risk patient (age <3mos, chronic GI disease, immunocompromised): consider ceftriaxone 50 mg/kg IV/IM q24 OR azithromycin 12 mg/kg PO on day 1, then 6 mg/kg/day PO on days 2-5	Supportive care (hydration/nutrition); High-risk patient (age <3mos, chronic GI disease, immunocompromised): ceftriaxone 50 mg/kg IV/IM q24	Consider azithromycin if stool+ for Shigella or Campylobacter
Herpes simplex virus (neonatal)	HSV	N/A	acyclovir 60 mg/kg/day IV q 8 hours	Consult ID
Influenza[6]	Influenza virus	oseltamivir if suspected/proven influenza AND high-risk patient (e.g. age <2y; chronic pulm, CV, renal, hepatic, heme, metabolic, or neuro/develop condition; morbid obesity; immunosuppression; etc) 0 to <8 mos: 3 mg/kg/dose PO bid 9 to 11 mos: 3.5 mg/kg/dose PO bid ≥12 mos: ≤15 kg: 30 mg PO bid >15 to 23 kg: 45 mg PO bid >23 to 40 kg: 60 mg PO bid >40 kg: 75 mg PO bid	oseltamivir if suspected/proven influenza requiring hospitalization	Treatment duration: 5 days For chemoprophylaxis: Age <3 mos: not recommended unless situation judged critical Age ≥3 mos: use treatment dose given once daily for 10 days
Lymphadenitis[7]	GAS, S. aureus	cephalexin 50 mg/kg/day PO tid OR clindamycin 30 mg/kg/day PO tid	oxacillin 150-200 mg/kg/day IV q6 OR clindamycin 40 mg/kg/day IV q 8	Duration: 10 days (OR 5-7 days after abscess drainage)
Mastoiditis[7]				Consult ID
A. Acute (sxs of <1 mo duration)	S. pneumoniae, GAS, S. aureus	N/A	ampicillin/sulbactam 200 mg/kg/day IV q8 Suspect MRSA: add vancomycin 60 mg/kg/dayIVq6	
B. Chronic (sxs of ≥1 mo duration)	P. aeruginosa, S. aureus, anaerobes	N/A	piperacillin/tazobactam 300 mg/kg/day IV q6 Suspect MRSA: add vancomycin 60 mg/kg/dayIVq6	
Meningitis (bacterial)[3,8]				Consult ID
A. Age 0 - 28d	GBS, GNR, Listeria	N/A	Age 0-7d: ampicillin 150 mg/kg/day IV q8 AND cefotaxime 150 mg/kg/day IV q8 +/- gentamicin 5 mg/kg/day IV q12 Age 8-28d: ampicillin 200 mg/kg/day IV q6 AND cefotaxime 200 mg/kg/day IV q6 +/- gentamicin 7.5 mg/kg/day IV q8	Refer to meningitis dosing guidelines for premature infants and neonates Consider neonatal HSV (in age ≤6 wks)
B. Age 29 - 90d	S. pneumoniae, N. meningitidis, GBS, GNR	N/A	vancomycin 60 mg/kg/day IV q 6 AND ceftriaxone 100 mg/kg/day IV q 12	
C. Age >90d	S. pneumoniae, N. meningitidis	N/A	vancomycin 60 mg/kg/day IV q 6 AND ceftriaxone 100 mg/kg/day IV q 12	
Orbital cellulitis[9]	S. aureus, Streptococci, H. influenzae, anaerobes	N/A	ampicillin/sulbactam 200 mg/kg/day IV q6 Suspect MRSA: add vancomycin 60mg/kg/day IVq6	Consult ID
Osteomyelitis	S. aureus, GAS	N/A	clindamycin 40 mg/kg/day IV q8 OR vancomycin 60 mg/kg/day IV q6	Consult ID

Approval Dates: 10/2011 (Antimicrobial Stewardship & Infection Control), 3/2012 (MEC)

Revision Date: 1/2014

For more info about this example contact Brian Lee, MD at blee@mail.cho.org

CDPH does not endorse the specific content or recommendations included in these examples.
They are for illustrative purposes only.

Example 6.1 Children's Hospital & Research Center Oakland Empiric Therapy Guide 2014 (continued 2 of 5)

Children's Hospital & Research Center Oakland
2014 Empiric Antimicrobial Therapy Guide (EATG)

(The following are guidelines only and should not replace clinical judgment. Immunocompromised patients may require special considerations not addressed here.)

Condition/Syndrome	Major Pathogen(s)	Empiric Outpatient Therapy	Empiric Inpatient Therapy	Duration/Notes
Otitis media[10]	S. pneumoniae H. influenzae M. catarrhalis	Consider observation if: 6mo-2y: unilateral, no otorrhea, and nonsevere ≥2y: no otorrhea and nonsevere Mild/mod: amoxicillin 80-90 mg/kg/day PO bid Severe (all ages): amoxicillin/clavulanate 80-90 mg/kg/day PO bid	Same as outpatient	Pain control for all children Duration: <2y or severe AOM: 10 days 2-5y: 7 days ≥6y: 5-7 days
Pertussis[11]	B. pertussis, B. parapertussis	Age 0-5mo: azithromycin 10 mg/kg PO qDay x5day Age ≥6mo: azithromycin 10 mg/kg (max: 500 mg) PO on day 1, then 5 mg/kg (max: 250 mg) qDay on days 2-5	Same as outpatient	Provide prophylaxis to close contacts using treatment regimens
Pharyngitis				
A. Strep throat[3,12]	GAS	amoxicillin 50 mg/kg PO qDay (max: 1 gram) OR <27kg: benzathine penicillin 600,000 Unit IM x1 ≥27kg: benzathine penicillin 1.2 million Unit IM x1	Same as outpatient	Duration: 10 days (PO therapy)
B. Peritonsillar or retropharyngeal abscess	GAS, S. aureus, anaerobes	amoxicillin/clavulanate 50 mg/kg/day PO bid OR clindamycin 30 mg/kg/day PO tid	ampicillin/sulbactam 150-200 mg/kg/day IV q6 OR clindamycin 40 mg/kg/day IV q8	Duration: 10 days (or 5-7 days after abscess drainage)
Pneumonia (bacterial)[7,13]				
A. Community-associated (CA)	S. pneumoniae, M. pneumoniae (esp. age≥5y)	amoxicillin 90 mg/kg/day PO bid or tid Suspect atypical: azithromycin 10 mg/kg PO on day 1, then 5 mg/kg qDay on days 2-5	ampicillin 150-200 mg/kg/day IV q6 Suspect atypical: azithromycin x 5 days	Duration for ß-lactam therapy: Mild: 5-7 days Mod: 10 days
B. CA – complicated (effusion/empyema/necrosis)	S. pneumoniae, S. aureus, GAS	N/A	Mild-mod effusion/stable patient: ampicillin (as dosed above) Mod-large effusion, or necrotizing: ceftriaxone 50-100 mg/kg/day IV q12-24 AND clindamycin 40 mg/kg/day IVq8 Critical illness: vancomycin 60 mg/kg/day IV q6 AND ceftriaxone 100 mg/kg/day IV q12	Consult ID
B. Healthcare-associated (HA)	S. aureus, GNR	N/A	Target therapy based on respiratory culture OR Use empiric therapy for HA NICU/PICU infections in "Sepsis rule out" section	Consult ID
Sepsis rule out (See "Meningitis" if CSF abnormal)				Consult ID if severe illness or positive culture
A. CA neonatal early/late onset (Age 0-28d)	GBS, GNR, Listeria	N/A	ampicillin AND gentamicin Suspect MRSA: vancomycin AND gentamicin Severe sepsis: vancomycin AND cefotaxime	Refer to dosing guidelines for premature infants and neonates Consider neonatal HSV (in age ≤6 wks)
B. CA neonatal late onset (Age 29-90d)	S. pneumoniae, GBS, GNR, Listeria	Consider ceftriaxone 50 mg/kg/day IV/IM q24	ampicillin AND cefotaxime Severe sepsis or suspect MRSA: vancomycin AND cefotaxime	Refer to dosing guidelines for premature infants and neonates Consider neonatal HSV (in age ≤6 wks)
C. CA infant/child/teen (Age >90d)	S. pneumoniae, N. meningitides, S. aureus	Consider ceftriaxone 50 mg/kg/day IV/IM q24	ceftriaxone 50 mg/kg/day IV q24 Severe sepsis or suspect MRSA: vancomycin 60-80 mg/kg/day IV q6 AND ceftriaxone 100 mg/kg/day IV q12 Suspect toxic shock syndrome: add clindamycin 40 mg/kg/day IV q8	
D. HA NICU late onset (Age≥3d)	Coag-neg Staph, S. aureus, GNR, Candida	N/A	vancomycin AND gentamicin Severe sepsis: vancomycin AND cefepime	Refer to dosing guidelines for premature infants and neonates

Approval Dates: 10/2011 (Antimicrobial Stewardship & Infection Control), 3/2012 (MEC)

Revision Date: 1/2014

For more info about this example contact Brian Lee, MD at blee@mail.cho.org

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Example 6.1 Children's Hospital & Research Center Oakland Empiric Therapy Guide 2014 (continued 3 of 5)

Children's Hospital & Research Center Oakland
2014 Empiric Antimicrobial Therapy Guide (EATG)

(The following are guidelines only and should not replace clinical judgment. Immunocompromised patients may require special considerations not addressed here.)

Condition/Syndrome	Major Pathogen(s)	Empiric Outpatient Therapy	Empiric Inpatient Therapy	Duration/Notes
E. HA PICU infant/child/teen	Coag-neg Staph, S. aureus, GNR	N/A	cefepime 150 mg/kg/day IV q8 Central line or suspect MRSA: vancomycin 60 mg/kg/day IV q6 AND cefepime Severe sepsis: vancomycin 60-80 mg/kg/day IV q6 AND meropenem 120 mg/kg/day IV q8	
Sexually transmitted diseases[14]				
A. Chlamydia	C. trachomatis	azithromycin 1 gram PO x1 OR doxycycline 100 mg PO bid (age >7y) x 7d	Same as outpatient	
B. Gonorrhea[15]	N. gonorrhoeae	ceftriaxone 250 mg IM x1 AND either: azithromycin 1 gram PO x1 OR doxycycline 100 mg PO bid (age >7y) x 7d	Same as outpatient	Obtain culture with treatment failure or with use of alternative regimens
C. Pelvic inflammatory disease	N. gonorrhoeae, C. trachomatis, other vaginal flora	ceftriaxone 250 mg IM x1 AND doxycycline 100 mg PO bid x14d +/- metronidazole 500 mg PO bid x14d	cefoxitin 2 grams IV q6 AND doxycycline 100 mg PO/IV q12 x 14d (PO preferred if tolerated)	
D. Herpes (genital)	Herpes simplex virus	First episode: acyclovir 400 mg PO tid x 7-10 days OR valacyclovir 1 gram PO bid x 7-10 days Recurrent episode: acyclovir 400 mg PO tid x 5days OR valacyclovir 500 mg PO bid x 3 days OR valacyclovir 1 gram PO qDay x 5 days	Same as outpatient	
E. Syphilis	T. pallidum	Primary/secondary: benzathine 2.4 million Unit IM x1 Early latent/late latent/unknown: benzathine penicillin 2.4 million Unit IM weekly x3	Same as outpatient	
Sinusitis (bacterial)[3,18]	S. pneumoniae, H. influenzae, M. catarrhalis	Consider observation if persistent symptoms only Nonsevere: amoxicillin 80-90 mg/kg/day PO bid Severe: amox/clavulanate 80-90 mg/kg/day PO bid	Same as outpatient OR ampicillin/sulbactam 150-200 mg/kg/day IV q6	Duration: 10-14 days
Skin/soft tissue infection[3,16,17]				
A. Uncomplicated cellulitis	GAS	cephalexin 50 mg/kg/day PO tid (max:500 mg/dose) OR dicloxacillin 500 mg PO qid if >40 kg	oxacillin 150-200 mg/kg/day IV q6	Duration: 5-10 days
B. Purulent cellulitis	S. aureus	TMP/SMX 8-12 mg/kg/day of TMP PO bid OR doxycycline 2 mg/kg/dose (max: 100 mg) PO bid if age >7y	clindamycin 40 mg/kg/day IV q8	Duration: 5-10 days
C. Abscess (uncomplicated)	S. aureus	I&D alone often sufficient OR consider short course of TMP/SMX	I&D AND clindamycin 40 mg/kg/day IV q8	Duration: 5-10 days
D. Abscess (complicated)	S. aureus	N/A	I&D AND clindamycin 40 mg/kg/day IV q8 OR vancomycin 60 mg/kg/day IV q6	Duration: 7-14 days
E. Animal/human bite	P. multocida (cat/dog), Staph/Strep, anaerobes, Eikenella (human)	Consider rabies prophylaxis AND Update tetanus immunization status AND amoxicillin/clavulanate 50 mg/kg/day PO bid	Consider rabies prophylaxis AND Update tetanus immunization status AND ampicillin/sulbactam 150-200 mg/kg/day IV q6	Duration: Prophylaxis: 3-5 days Treatment: 7-10 days
Urinary tract infection (See "Sepsis rule out" if age <2mo)				
A. Age 2mo-2y[19]	E. coli, other enteric GNR	cephalexin 50-100 mg/kg/day tid OR ceftriaxone 50-75 mg/kg/day IV/IM q 24	ceftriaxone 50-75 mg/kg/day IV q24	Duration: 7-10 days (14 days if severe)
B. Cystitis - uncomplicated[20]	E. coli, other enteric GNR	Age <12y: cephalexin 50-100 mg/kg/day PO tid Age >12y: nitrofurantoin (Macrobid) 100mg PO bid	Age <12y: cephalexin 50-100 mg/kg/day PO tid Age >12y: nitrofurantoin (Macrobid) 100mg PO bid	Duration: 5 days
C. Pyelonephritis[20, 21, 22]	E. coli, other enteric GNR	Same as inpatient if need initial parenteral therapy OR cefixime 8 mg/kg load (max: 400 mg), then 8 mg/kg/day PO bid (max: 200 mg PO bid) OR ciprofloxacin 20-30 mg/kg/day PO bid if age >12y (max: 500 mg PO bid)	ceftriaxone 50-75 mg/kg/day IV/IM q24 (max: 1 gram) OR gentamicin 5-7 mg/kg/day IV/IM q24	Duration: ß-lactams: 10-14 days ciprofloxacin: 7 days

Approval Dates: 10/2011 (Antimicrobial Stewardship & Infection Control), 3/2012 (MEC) Revision Date: 1/2014

For more info about this example contact Brian Lee, MD at blee@mail.cho.org

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Example 6.1 Children's Hospital & Research Center Oakland Empiric Therapy Guide 2014 (continued 4 of 5)

Children's Hospital & Research Center Oakland
2014 Empiric Antimicrobial Therapy Guide (EATG)
(The following are guidelines only and should not replace clinical judgment. Immunocompromised patients may require special considerations not addressed here.)

Strategies to Reduce Inappropriate Antimicrobial Use and Its Negative Consequences

1. Avoid using antibiotics when bacterial infection is unlikely. Do not treat colonization or contamination.
2. Obtain appropriate cultures and other diagnostic testing.
3. Select empiric antimicrobial therapy based on likely pathogens, using CHRCO EATG and CHRCO antbiogram for guidance.
4. Determine appropriate dose based on site and severity of infection, using CHRCO EATG and drug formulary for guidance.
5. Within 48-72 hours, de-escalate therapy based on the likely diagnosis, and when available, based on culture and susceptibility data.
   a. Use narrowest effective regimen
   b. Discontinue unnecessary antimicrobials, including redundant coverage
6. Switch from IV to PO therapy as soon as it is clinically appropriate.
7. Treat with the shortest duration of therapy that is effective for the presumed or proven infection.

Approval Dates: 10/2011 (Antimicrobial Stewardship & Infection Control), 3/2012 (MEC)

Revision Date: 1/2014

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Example 6.1 Children's Hospital & Research Center Oakland Empiric Therapy Guide 2014 (continued 5 of 5)

Children's Hospital & Research Center Oakland
2014 Empiric Antimicrobial Therapy Guide (EATG)

(The following are guidelines only and should not replace clinical judgment. Immunocompromised patients may require special considerations not addressed here.)

References

1. Solomkin JS et al. Diagnosis and Management of Complicated Intra-abdominal Infection in Adults and Children: Guidelines by the Surgical Infection Society and the Infectious Diseases Society of America. *CID* 2010;50:133-64.
2. Remington JS, Klein JO, Wilson CB, Nizet V, Maldonado YA, editors. *Infectious diseases of the fetus and newborn infant.* 7th ed. Philadelphia: Elsevier Saunders; 2006.
3. American Academy of Pediatrics. In: Pickering LK, Baker CJ, Kimberlin DW, Long SS, eds. *Red Book: 2012 Report of the Committee on Infectious Diseases*. 28th ed. Elk Grove Village, IL: American Academy of Pediatrics; 2012.
4. Committee on Infectious Diseases. Policy Statement: *Clostridium difficile* Infection in Infants and Children. *Pediatrics* 2013;131:196-200.
5. Guerrant RL et al. Practice Guidelines for the Management of Infectious Diarrhea. *CID* 2001;32:331-51.
6. Committee on Infectious Diseases. Recommendations for Prevention and Control of Influenza in Children, 2013-2014. *Pediatrics* 2013;132:1-16.
7. Feigen RD, Cherry JD, Demmler GJ, Kaplan SL, eds. *Textbook of Pediatric Infectious Diseases.* Sixth Edition. Philadelphia: Saunders Elsevier; 2009.
8. Tunkel AR et al. Practice Guidelines for the Management of Bacterial Meningitis. *CID* 2004;39:1267-84.
9. Wald ER. Periorbital and Orbital Infections. *Infectious Disease Clinics of North America* 2007;21:393-408.
10. Lieberthal AS et al. Clinical Practice Guideline: The Diagnosis and Management of Acute Otitis Media. *Pediatrics* 2013;131:e964-e999.
11. Tiwari T et al. Recommended Antimicrobial Agents for the Treatment and Postexposure Prophylaxis of Pertussis. *MMWR* Dec 9, 2005;54:1-16.
12. Shulman ST et al. Clinical Practice Guideline for the Diagnosis and Management of Group A Streptococcal Pharyngitis: 2012 Update by the Infectious Diseases Society of America. *CID* 2012; Published online on September 9, 2012.
13. Bradley JS et al. The Management of Community-Acquired Pneumonia in Infants and Children Older Than 3 Months of Age: Clinical Practice Guidelines by the Pediatric Infectious Diseases Society and the Infectious Diseases Society of America. *CID* 2011; Published online on August 30, 2011.
14. Workowski KA, Berman S. Sexually Transmitted Diseases Treatment Guidelines, 2010. *MWWR* Dec 17, 2010;59:RR-12.
15. del Rio, C et al. Update to CDC's *Sexually Transmitted Diseases Treatment Guidelines, 2010*: Oral Cephalosporins No Longer a Recommended Treatment for Gonococcal Infections. *MMWR* August 10, 2012 / 61(31);590-594.
16. Stevens DL et al. Practice Guidelines for the Diagnosis and Management of Skin and Soft-Tissue Infections. *CID* 2005;41:1373-1406.
17. Liu C et al. Clinical Practice Guidelines by the Infectious Diseases Society of America for the Treatment of Methicillin-Resistant Staphylococcus Aureus infections in Adults and Children. *CID* 2011;52:1-38.
18. Wald ER et al. Clinical Practice Guideline for the Diagnosis and Management of Acute Bacterial Sinusitis in Children Aged 1 to 18 Years. *Pediatrics* 2013;132:e262-e280.
19. American Academy of Pediatrics. Urinary Tract Infection: Clinical Practice Guideline for the Diagnosis and Management of the Initial UTI in Febrile Infants and Children 2 to 24 months. *Pediatrics* 2011;128:595-610.
20. Gupta K et al. International Clinical Practice Guidelines for the Treatment of Acute Uncomplicated Cystitis and Pyelonephritis in Women: A 2010 Update by the Infectious Disease Society of America and the European Society for Microbiology and Infectious Diseases. *CID* 2011;53:e103-e120.
21. Bocquet N et al. Randomized Trial of Oral Versus Sequential IV/Oral Antibiotic for Acute Pyelonephritis in Children. *Pediatrics* 2012;129:e269-e275.
22. Hodson EM et al. Antibiotics for acute pyelonephritis in children. *Cochrane Database of Systematic Reviews* 2007, Issue 4. Art. No.:CD003772. DOI: 10.1002/14651858.CD003772.pub3.

Approval Dates: 10/2011 (Antimicrobial Stewardship & Infection Control), 3/2012 (MEC)

Revision Date: 1/2014

For more info about this example contact Brian Lee, MD at blee@mail.cho.org

Antimicrobial Stewardship Program Element 7:

Usage patterns of antibiotics determined to be of importance to the resistance ecology of the facility are monitored using defined daily dosing (DDD) or days of therapy (DOT).

Measurement of aggregate usage of antimicrobials in a healthcare facility can help to optimize antimicrobial utilization and patient outcomes through:

- Identifying patterns of antimicrobial usage over time and measuring the effect of interventions that affect antimicrobial utilization;
- Benchmarking antimicrobial usage relative to similar institutions to identify outlying patterns that may be candidates for intervention;
- Providing clinicians with data on their prescribing habits in context of and comparisons with their peers.

Techniques for aggregate measurement of antimicrobial use will vary based on the available data and resources at each institution. DDD or DOT are the preferred units of measurement.

The following example provides a step-by step guide to measuring and analyzing antimicrobial use including DDD and DOT.

References

Centers for Disease Control and Prevention: Surveillance for Antimicrobial Use and Antimicrobial Resistance. http://www.cdc.gov/nhsn/acute-care-hospital/aur/

Kubin CJ, et al. Lack of Significant Variability among Different Methods for Calculating Antimicrobial Days of Therapy. *Infect Control Hosp Epidemiol* ;33:421-423. http://www.ncbi.nlm.nih.gov/pubmed/?term=22418642

Polk RE, et al. Measurement of adult antibacterial drug use in 130 US hospitals: comparison of defined daily dose and days of therapy. *Clin Infect Dis* 2007;44:664– 670. http://www.ncbi.nlm.nih.gov/pubmed/?term=17278056

Polk RE, et al. Benchmarking Risk-Adjusted Adult Antibacterial Drug Use in 70 US Academic Medical Center Hospitals. *Clin Infect Dis* 2011;53:1100–10. http://www.ncbi.nlm.nih.gov/pubmed/?term=21998281

Example 7.1 University of California San Francisco Medical Center Measuring Antimicrobial Use (1 of 8)

Measuring Antimicrobial Use: A Step-by-Step Guide

What is antimicrobial "use"?

The first step in measuring antimicrobial use is determining what you will actually be measuring. Figure 1 displays all of the different steps in the medication use process where one could consider measuring antimicrobial use. Most clinicians would consider "use" of antimicrobials to be administration of a drug to a patient. But it turns out that most studies that report antimicrobial use are actually measuring a different step in the antimicrobial use process, from as far removed as the drug being purchased by the pharmacy, through various steps of ordering and delivering the drug, to steps that occur after the use has actually occurred, such as billing data. It's important to know what step in the process you are measuring, since the data may exist in different places depending on the step, and because comparisons are most valid when performed at the same step.

Table 1: Steps at which antimicrobial use could be measured

Measurement Level	Data Source	Advantage	Disadvantage
Drug purchased by pharmacy	-Pharmacy purchasing data -Wholesaler data	-Easiest to obtain aggregate data	-"Farthest" from actual use -Time trends irregular
Drug prescribed by physician	-Chart orders	-Measures intent	-Impracticable if no computerized prescriber order entry
Drug order entered by pharmacy	-Pharmacy system	-Measures intent	-Can be difficult to query
Drug dispensed by pharmacy	-Pharmacy system	-Approximates administration	-Can be difficult to query
Drug delivered to floor/bedside	-Medication administration record	-Most accurate	-Impracticable if no barcode medication administration scanning
Drug administered to patient	-Hospital billing records -Group data	-Sometimes easier to obtain -Benchmarking	-Over- or under-estimate -Delay
Drug billed to patient	-Pharmacy purchasing -Wholesaler data	-Easiest to obtain aggregate data	-"Farthest" from actual use -Time trends irregular

The level of measurement you choose will likely be determined in part by the healthcare technology used in your institution, particularly whether computerized prescriber order entry and/or barcode medication administration scanning are available.

For more info about this example contact Conan MacDougall, PharmD at macdougallc@pharmacy.ucsf.edu

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Example 7.1 University of California San Francisco Medical Center Measuring Antimicrobial Use (continued 2 of 8)

OK, I know where I'm getting my data from and what step of the process I'll be measuring. What do I actually want to measure?

This depends, not surprisingly, on what you want to know. If you want to know how often patients are getting any, or particular, antibiotics, you'll be interested in a point (at a particular time, such as at ICU admission) or period (for example, over the course of an admission) prevalence. If you're less interested in the start of antibiotics and more in their finish, you can examine the mean or median duration of antibiotics, for all causes or for a particular infection. Obviously both of these contribute to the total amount of antibiotic use, and so a commonly used metric is the incidence density rate of Defined Daily Doses (DDD) or Days of Therapy (DOT) per 1000 patient-days. Adjusting for patient-days allows comparisons between time periods and across institutions and services with different numbers of patients and different lengths of stay.

Table 2: Measurement metrics

I want to know...	Measurement	Examples
...how often patients are getting antibiotics	Point (period) prevalence	% of CAP patients receiving atypical coverage
...how long people are getting antibiotics for	Mean or median duration	Duration of antibiotic therapy for VAP
...the overall amount of antibiotics received adjusted for patient time at risk	Incidence density rate	Defined daily doses or days of therapy/1000 patient-days

What's a DDD or DOT and how do I measure it?

We mentioned two potential measurements for aggregate antibiotic use – defined daily doses or days of therapy. There are various technical pluses and minuses of the two measures, but both can provide useful information. Defined daily doses (DDD) can be measured on a variety of data sources, and involves summing the total grams of drug used during the period of interest, and dividing by a number set by the World Health Organization as representing an "average", or defined, daily dose. The WHO defined doses for antimicrobials are available here: http://www.whocc.no/atc_ddd_index/

Days of therapy (DOT) involves summing the total number of days that a patient received any number of doses of a drug. Both should be adjusted for some measure of time at risk, such as patient-days, bed-days, admissions, etc. These numbers are typically multiplied by 1000 simply to avoid small fractions. Depending on the drug, the dose given, and the WHO's definition of a daily dose, sometimes the DDDs and DOTs give the same answer. Sometimes they don't. So while either can be a valid measure, they really shouldn't be compared to each other.

For more info about this example contact Conan MacDougall, PharmD at macdougallc@pharmacy.ucsf.edu

Example 7.1 University of California San Francisco Medical Center Measuring Antimicrobial Use (continued 3 of 8)

Let's go through some examples. Although we don't typically measure DDD or DOT on individual patients, such an exercise can be useful to show the similarities and differences:

A patient is admitted for a surgical removal of an inflamed appendix. The patient receives cefazolin 1g IV x1 as surgical prophylaxis. After a single post-operative fever spike (white count remains normal), the patient is initiated on vancomycin (1g IV q12h) and ampicillin/sulbactam (3g IV q6h) for 3 days. Three days later the patient is discharged on moxifloxacin 400mg po daily to complete 7 days of antibiotic therapy.

Table 3: Patient-level measurement of DDD and DOT

Drug	Regimen	Total grams	WHO defined daily dose	Defined Daily Doses (DDD)	Days of Therapy (DOT)
cefazolin	1g IV x1	1g	3g	1/3 = 0.33	1
vancomycin	1g IV q12h x3 days	6g	2g	6/2 = 3	3
ampicillin/ sulbactam	3g (2/1g) IV q6h x3 days	24g	2g (of ampicillin)	24/2 = 12	3
moxifloxacin	400mg po qd x4 days	1.6g	0.4g	1.6/0.4 = 4	4
Total				19.33	11

Thus you can see that the number of DDDs and DOTs for a patient can vary depending on factors like the number of doses administered, and the correlation between the actual prescribed dose and the WHO defined daily dose.

More commonly, you would be analyzing large sets of data provided by your IT or pharmacy department of aggregated antimicrobial use. Table 4 on the next page shows an example of the values you might see over several months of antibiotic use in a large healthcare facility, and how DDDs and DOTs might compare.

For more info about this example contact Conan MacDougall, PharmD at macdougallc@pharmacy.ucsf.edu

Example 7.1 University of California San Francisco Medical Center Measuring Antimicrobial Use (continued 4 of 8)

Table 4: Aggregate Measurement of DDD and DOT

Drug	Patient Admits	Patient Mean Length of Stay (All Patients)	Patient Days (All Patients)	Number of Patients receiving drug	% Patients receiving drug	Mean duration of therapy for patients receiving drug	Total grams of drug for patients receiving drug	WHO defined daily dose	Defined Daily Doses (DDD)	DDD/1000 patient-days	Days of Therapy (DOT)	DOT/1000 patient-days
Cefazolin	24007	6.04	24007* 6.04= 145002	6481	6481/ 24007= 26.9%	1.8	26489	3g	26489/3 = 8829	(8829/ 145002) * 1000= **60.8**	6481*1.8 = 11665	(11665/ 145002) * 1000= **80.4**
vancomycin	24007	6.04	24007* 6.04= 145002	5715	5715/ 24007= 21.6%	4.8	47992	2g	47992/2 = 23996	(23996/ 145002) * 1000 = **165.2**	5715 * 4.8 = 27432	(27432/ 145002) * 1000 = **168.5**
ampicillin/ sulbactam	24007	6.04	24007* 6.04= 145002	111	111/ 24007= 0.46%	3.3	2974	2g (ampicillin)	2974/2= 1487	(1487/ 145002)*1000 = **10.2**	111 * 3.3 = 366	(366/ 145002) * 1000= **2.5**
moxifloxacin	24007	6.04	24007* 6.04= 145002	723	723/ 24007= 3.0%	6.3	1804	0.4g	1804/0.4= 4510	(4510/ 145002) * 1000 = **31.0**	723 * 6.3 = 4554	(4554/ 145002) * 1000 = **31.4**
Total										**267.2**		**303**

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Example 7.1 University of California San Francisco Medical Center Measuring Antimicrobial Use (continued 5 of 8)

OK, now what do I do with these numbers?

Once you obtain your data, whatever it is, it's important to put it in context. After all, knowing you use X number of days of therapy of an antibiotic isn't intrinsically meaningful. One level of comparison is to some absolute standard – what should that number be? In a number of quality improvement contexts, we can set an absolute standard goal: no central-line-associated infections, or 100% hand hygiene compliance. Those standards may be high, but they represent a clear goal. However, for some measurements there is not a reasonable absolute standard – we certainly don't want our antibiotic use to be zero, and currently there is no "magic number" that represents the "correct" amount of total antibiotic use! Thus, we are forced to use other standards. One is through comparison to other groups – these might be other hospitals, or other teams or services within an institution. For this comparison challenges can include obtaining data from comparators – some folks don't want to air their possibly dirty laundry – and ensuring that a comparator really represents a good benchmark for your institution. One way to remove the variability with comparators is to use your own institution as a reference standard. When doing so, you'll want to make sure there's adequate data to ensure that you are seeing a real effect, rather than just random variation.

Table 5: Approaches to interpreting DDD/DOT data

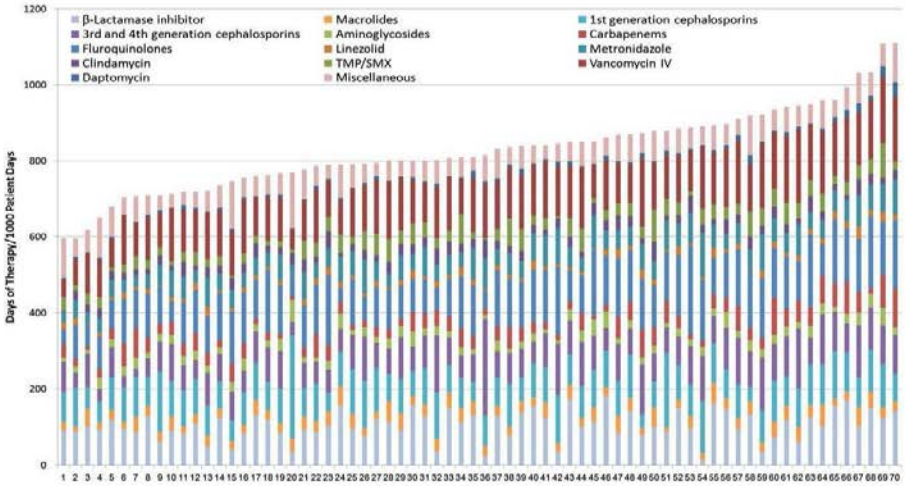
Approach	Pro	Con
Trend institutional data over time	-Allows to see patterns in utilization -Can be statistically tested for significance of trends -Can measure impact of interventions starting at a particular point in time	-Need lots (>1 year) of data points at frequent (month, quarter) intervals -Time-consuming -Doesn't measure appropriateness
Benchmark to external institutions	-Gives comparison to peer institutions -Allows to identify potential areas of excessive use -Understandable to C-suite folks	-Very difficult to obtain data from outside institutions -Risk-adjustment for apples-to-apples comparison

Figure 1 below reports the aggregate antibacterial use in days of therapy per 1000 patient days across 70 university hospitals. Even though these are all academic medical centers, there is nearly a twofold variation in usage from the lowest to highest users. We'd like to be able to isolate what component of the variability comes from potentially improvable practice patterns, and what is a result of different mixes of patients across these institutions.

Figure 1: Aggregate antimicrobial use across university hospitals

For more info about this example contact Conan MacDougall, PharmD at macdougallc@pharmacy.ucsf.edu

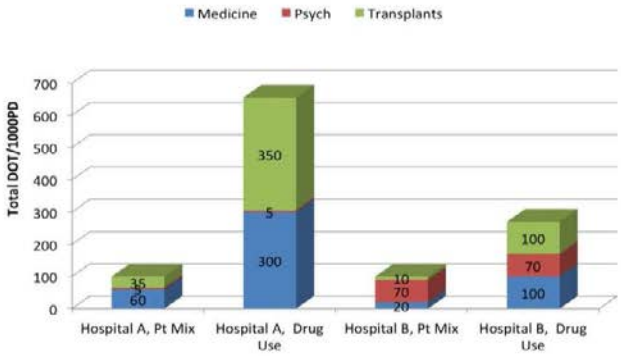
Example 7.1 University of California San Francisco Medical Center Measuring Antimicrobial Use (continued 6 of 8)



Polk RE, et al. Clinical Infectious Diseases 2011;53(11):1100–10

Figure 2 illustrates the impact that patient mix can have on utilization. In this hypothetical (and somewhat extreme for illustration purposes) example two hospitals A and B have different percentages of patients on medicine, psychiatry, and transplant services. Although each service has the same utilization rate per patient for each service – 5 days of therapy per 1000 patient days for medicine patients, 1 for psych patients, and 10 for transplant patients – the total utilization at institution A is much higher because of their mix that includes higher-use patients. Thus, these two hospitals have similar "modifiable" antibiotic use rates, but much different overall usage rates.

Figure 2: Effect of patient mix on utilization measures



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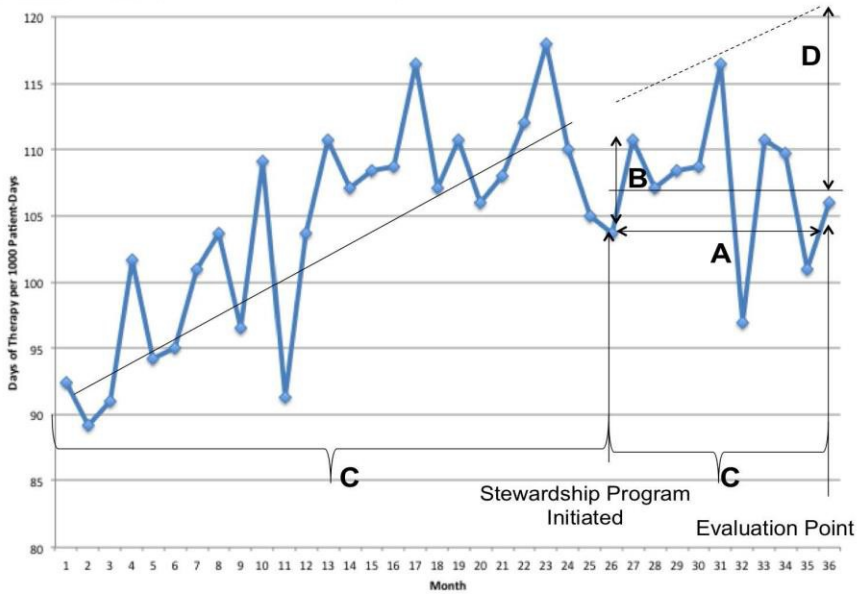
Example 7.1 University of California San Francisco Medical Center Measuring Antimicrobial Use (continued 7 of 8)

To avoid the issues with patient mix, and because data from comparator institutions can be difficult to obtain, institutions often use their own data over a period of time to put their findings in context. Figure 3 is an example of antimicrobial use data over a three-year period at an institution, although the concepts apply to any data that can be measured at repeated intervals over time. First note the general trends imposed onto the large amount of month-to-month variability. Next let's consider this data is being collected to evaluate the impact of an antimicrobial stewardship program, which is given one year to show its effect on utilization. We can ask what the best comparisons to perform on this dataset might be. One might compare the use just before the program was implemented to the utilization at the end of the study period. But in this case it would give a misleading story that there was little effect of the program. Even worse would be comparison of the utilization immediately before to immediately after the initiation of the stewardship program. It's unlikely there would be enough time to see a true effect, and instead the random variation might lead to the conclusion that the program increased utilization. Many studies would report the mean use in the period before the intervention and mean use during the intervention period. But this doesn't account for the trend in utilization, which was clearly increasing before the intervention, and which flattened out afterwards. A more accurate comparison would be to compare the observed trend in antimicrobial use after the intervention to the projected trend in utilization if the intervention had not occurred. Although slightly more complicated statistically, this interrupted time-series approach is recognized as the most valid way to analyze and present such data. Table 6 summarizes analyses at various time points.

Figure 6: Aggregate antimicrobial use plotted over time



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Example 7.1 University of California San Francisco Medical Center Measuring Antimicrobial Use (continued 8 of 8)

Table 6: Analysis points for Figure 3

Comparison	Rationale For?	Rationale Against?
A, the difference between use the first month of the program and the month of evaluation		-Only captures utilization during the program and not prior to program initiation; effect of program not captured
B, the difference between use the month prior to the program and the month after the program started		-Inadequate time to capture effect of intervention
C, the difference between the projected and actual antibiotic use at the month of evaluation	-Captures trend in utilization (usually upwards) prior to intervention -Allows demonstration of cost/utilization avoidance	-Lots of data points required -Statistically analysis somewhat more complex
D, the mean monthly antibiotic use before and after program implementation	-Easily interpretable -Easily to statistically evaluate	-Does not account for pre-existing trends -Can under- or over-estimate impact of program

For more info about this example contact Conan MacDougall, PharmD at macdougallc@pharmacy.ucsf.edu

Antimicrobial Stewardship Program Element 8:

Regular antimicrobial stewardship education is provided to medical staff and committees.

One of the most important aspects of an effective ASP is the dissemination of stewardship education and metrics data to medical staff. Practitioners are much more likely to change their prescribing habits when local data are presented that demonstrate opportunities for improvement.

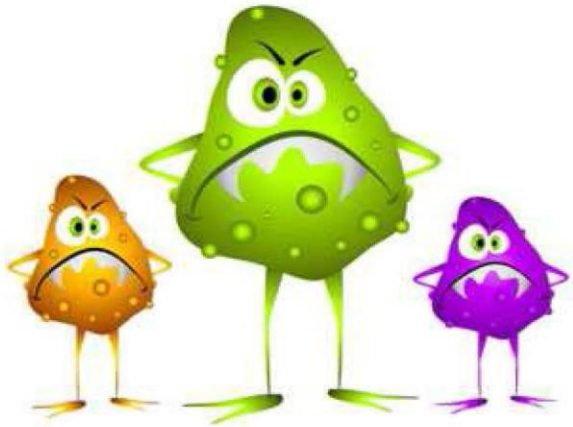
Positive feedback to practitioners on their participation in the ASP, such as acceptance of ASP recommendations for changing therapy, can help maintain their participation. Reviewing de-identified cases with providers where changes in antimicrobial therapy could have been made is another approach. Education can be provided in any number of ways, including regular reports at medical staff or departmental meetings, monthly newsletters, and regular conferences or grand rounds. A variety of web-based educational resources are available that can help hospitals develop education content.

The following examples illustrate various means of providing antimicrobial stewardship education to medical providers in the form of periodic newsletters and reports.

Reference

Gauthier TP, Lantz E, Heyliger A, et al. Internet-Based Institutional Antimicrobial Stewardship Program Resources in Leading US Academic Medical Centers. *Clin Infect Dis* 2014;58(3):445–446.

Example 8.1 Children's Hospital & Research Center Oakland Newsletter (1 of 1)



BUGS AND DRUGS

Antimicrobial Stewardship Program Newsletter

Page **77-BUGS** for antibiotic pre-approval, ASP consult or therapeutic drug monitoring

MAY 2014

Tip of the month:

Cephalexin alone is sufficient for nonpurulent cellulitis

- Skin infections with purulent drainage/abscess are usually caused by *Staph aureus* (often MRSA), but the microbiology of nonpurulent cellulitis has been less clear, leading some to treat with 2 antibiotics.
- Now a double-blind, randomized-controlled trial involving children and adults has demonstrated that **cephalexin combined with trimethoprim-sulfamethoxazole is no better than cephalexin alone in patients with nonpurulent, uncomplicated cellulitis without abscess.**

Cephalexin Plus TMP/SMX vs. Cephalexin Alone for treatment of nonpurulent cellulitis	
Clinical cure rate	No significant difference (P=0.66)
Progression to abscess	No significant difference (P=1)

- These results support the Infectious Disease Society of America recommendation that cephalexin alone is reasonable for most cases of uncomplicated cellulitis (MRSA coverage is usually not necessary). In contrast, for purulent cellulitis/abscess, single drug therapy targeting *Staph aureus* (including MRSA) is appropriate.

Pallin DJ et al. *CID* 2013:56(12): 1754-62.
Chambers H. *CID* 2013;56:1763-4.

CDC Antibiotic Resistance Threats

Urgent Threats:
Clostridium difficile

Carbapenem-resistant Enterobacteriaceae
Drug-resistant *Neisseria gonorrhoeae*

Serious Threats:
Multidrug-resistant *Acinetobacter*
Drug-resistant *Campylobacter*
Drug resistant *Salmonella/Shigella*
ESBL, VRE, MRSA
Drug resistant *S. pneumoniae*
Multidrug-resistant *Pseudomonas*

Concerning Threats:
Vancomycin-resistant *Staphylococcus aureus*
Clindamycin-resistant Group B *Streptococcus*

For more info about this example contact Brian Lee, MD at blee@mail.cho.org

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Example 8.2 Sutter Eden Medical Center Director's Report (1 of 1)

Eden Medical Center
A Sutter Health Affiliate
With You. For Life.

Medical Director's Report

February 2014

INFECTION PREVENTION

Influenza Update

The week ending February 8th shows widespread activity in California although it is probably decreasing now. H1N1 has been active throughout the country.

Through January 18, 2014, local health jurisdictions in California had reported 95 deaths and 311 intensive care unit admissions with a positive influenza test result, more reports for that time period than in any season since the 2009 H1N1 pandemic. I anticipate that we will be offering the quadrivalent vaccine next season rather than the trivalent vaccine.

Influenza and pneumococcal vaccinations for patients.

Please order the vaccinations and remind the nursing staff to give the injections. We need physicians to verify with the nurse that it was actually accomplished. Administration is still not reliably happening for all candidates.

PHARMACY ASP: GREAT JOB

EDD - Day # 3 of Antibiotics remember **EDD**

- Evaluate
- Define
- Deescalate.

Antibiotic stewardship is progressing nicely. Vancomycin has been added to Zosyn monitoring. Zosyn usage down >50% in January from baseline year.

We are seeing more physicians document and de-escalate on day #3 before we even make contact. We are collecting data on that and will present in the future.

Decreasing usage of PPI. Will be collecting data and presenting update probably in March.

WOUND CARE

Regular evaluation of wounds by the physician is important part of inpatient management. "Dressing intact" as a daily message is inadequate. If you are the attending physician or the physician responsible for the wound care, it is reasonable and acceptable to take down the dressing to evaluate the wound. Have saline moistened fluffs applied to the wound to keep it moist and then have the nurse or WOCN redress the wound. If the wound is covered by a NPWD (VAC), take the liberty to remove the dressing on the day that the dressing is due to be changed and evaluate/document the wound. If the patient is septic and the wound is a possible source, remove the dressing, including NPWD.

DIABETES

Lab is to call all blood sugars < 70 as critical values. Previously <50. Cases being missed by MD on rounds. Only ~2 cases per day. Overall blood sugar control in facility is excellent.

SEPSIS

new order sets in ED. Diagnosis directed antibiotic suggestions. Working on order sets for patients who develop sepsis after admission.

SPLENECTOMY

Flow chart enclosed.

1 of 1

For more info about this example contact Jeffrey Silvers, MD at Silverj@sutterhealth.org

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Example 8.3 Palomar Health Newsletter (1 of 4)

encapsulated news
OCT.2013
PHARMACY INFORMATION FOR PHYSICIANS, NURSES AND PHARMACISTS

VTE Prophylaxis: Enoxaparin (Lovenox) Is Out; BID SubQ Heparin Is In

Jeremy Lee, Pharm.D., BCPS

New therapeutic substitution: enoxaparin to subQ heparin in selective populations

Venous Thromboembolism (VTE) prophylaxis with subcutaneous (subQ) unfractionated heparin is a cost effective option for Palomar Health patients.

Palomar Health utilizes both enoxaparin (Lovenox) and subQ heparin for VTE prophylaxis in medical patients. The American College of Chest Physicians (ACCP) guidelines state that both heparinoids are equally effective for VTE prophylaxis in most patient populations, except for the following populations: orthopedic surgery, stroke, trauma and bariatric surgery (in which enoxaparin is recommended). The guidelines also state that twice daily administration of subQ heparin is just as effective as three times daily administration.

Unfractionated Heparin (UFH) is a cost effective option for VTE prophylaxis. The cost of enoxaparin 40mg daily is $5.70 and heparin 5,000 units twice a day is $2.34. Current utilization patterns indicate physicians utilize either heparinoid for VTE prophylaxis. Order sets currently list both medications as an option for VTE prophylaxis and physicians prescribe both medications as well. There is opportunity to utilize subQ heparin in an estimated 60% of patients receiving enoxaparin for VTE prophylaxis. Significant cost savings can be realized with a uniform conversion from enoxaparin to heparin use in VTE prophylaxis. The transition can result in an estimated $20,000 - $40,000 in cost savings, should maintain similar efficacy and complies with the ACCP recommendations for VTE prophylaxis.

Plan

1. **Providers:**
   a. **Utilize subQ heparin 5,000 units twice daily in appropriate patients for VTE prophylaxis.** Physicians may still choose to order 7,500 unit doses or the TID frequency at their discretion. This may be especially appropriate for morbidly obese patients, along with the use of pulsatile ankle stockings (PAS).
   b. **Maintain enoxaparin prophylactic therapy in orthopedic surgery, stroke, trauma and bariatric surgery** patients where there is compelling evidence of either increased efficacy or safety with enoxaparin.
2. **Information Systems: Revise necessary powerplans** to reflect use of subQ heparin as preferred medication option and the BID dosing of subQ heparin. This is underway, but will take time.
3. **Pharmacy: Pharmacy has implemented an automatic therapeutic substitution enabling pharmacists to change orders for prophylactic doses of enoxaparin to heparin subQ 5,000 units BID except in the orthopedic surgery, stroke, trauma and bariatric surgery patient populations.**

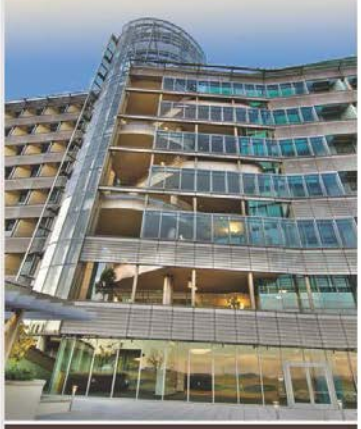
NOTE: These changes do NOT apply to the use of "therapeutic" doses of enoxaparin used to TREAT thromboembolic diseases like DVT, PE or MI. Nor does it apply when enoxaparin is used as prophylaxis against stroke (e.g. A-fib, electrophysiology procedures). SubQ heparin is NOT indicated for these conditions.

Page 1
VTE Prophylaxis: Enoxaparin (Lovenox) Is Out; BID SubQ Heparin Is In

Page 2
4-factor Prothrombin Complex Concentrate (Kcentra) for Reversal of Warfarin
IV to Oral Azithromycin

Page 3
Antimicrobial Prophylaxis for Pacemaker & Defibrillator Insertion – A Success Story!
Fluzone High-Dose Influenza Virus Vaccine
Safety of Ganciclovir & Valganciclovir

Page 4
Summary of Drugs



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For more info about this example contact Olga DeTorres, PharmD at Olga.DeTorres@palomarhealth.org

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Example 8.3 Palomar Health Newsletter (continued 2 of 4)

encapsulated news

4-factor Prothrombin Complex Concentrate (Kcentra) for Reversal of Warfarin

By Michael Kruse, Pharm.D., MBA, BCPS

SUMMARY:
Kcentra is the first 4-factor prothrombin complex concentrate approved in the United States. The product includes more factor VII, protein C, and protein S than the 3-factor products. Overall, studies have found it to be equal in safety and efficacy for reversal or warfarin. There are trends toward increased embolic events but decrease fluid overload. Because of the trends for increased embolic events, there is a Black Box Warning. This warning and the drug cost necessitate reserving the drug for its FDA indication – reversal of warfarin in patients with acute major bleeding. Canadian guidelines also allow for use in patients on warfarin who need urgent surgery (< 6 hours). The product has been added to the formulary with restriction to these two indications. Pharmacists will screen patients to assure appropriate use. This product will replace most FFP for this indication and all factor VIIa (with possible exception for Jehovah's Witness patients). Although made from human blood, the risk of infectious agents is low due to multiple neutralization/sterilization techniques.

PHARMACOKINETICS:
International Normalized Ratio (INR)

In the plasma-controlled RCT in acute major bleeding, the median INR was above 3.0 prior to the infusion and dropped to a median value of 1.20 by the 30 minute time point after start of Kcentra infusion. By contrast, the median value for plasma was 2.4 at 30 minutes after the start of infusion.

EFFICACY:
Overall efficacy in major bleeding was non-inferior hemostasis compared to plasma at 24 hours. However, 62.2% of patients had an INR less than 1.3 at 30 minutes compared to 9.6% in the plasma arm.

SAFETY:
The incidence of thromboembolic (TE) adverse reactions assessed as at least possibly related to study treatment by the investigator or, in the case of serious thromboembolic events, the blinded safety adjudication board (SAB) was 5 (4.9%) in the Kcentra group and 3 (2.8%) in the plasma group.

There were 6 subjects (5.8%, all non-related by investigator assessment) in the Kcentra group who experienced fluid overload in the plasma-controlled RCT in acute major bleeding and 14 (12.8%, 7 events related by investigator assessment) who had fluid overload in the plasma group.

PURCHASE PRICE:
4-factor PCC (Kcentra) costs $1.27 per unit. The price per dose is based on the pre-treatment INR.

Pre-treatment INR	2 – < 4	4 – 6	> 6
Dose of Kcentra (units of Factor IX) / kg body weight	25	35	50
Maximum dose (units of Factor IX)	Not to exceed 2500	Not to exceed 3500	Not to exceed 5000
80 kg patient cost	2000 units = $2540	2800 units = $3556	4000 units = $5080
Maximum dose cost	2500 units = $3175	3500 units = $4445	5000 units = $6350

NEW PROCESSES OR MECHANISMS FOR ORDERING, ADMINISTRATION AND MONITORING:

1. PowerPlan to be released on September 10th that will guide warfarin reversal. Kcentra will only be available within this PowerPlan. New order sentences will be created for vitamin K to balance the need to reverse warfarin but prevent warfarin resistance.
2. Because of the Black Box Warning and cost of the medication, pharmacists will need to screen patients to assure it is only used in acute major bleeding in patients on warfarin OR in patients on warfarin needing urgent (< 6 hours) surgery.
3. Administration: 4-10 vials must be reconstituted with 20 mL of sterile water for each vial. This cumbersome mixing requires mixing in pharmacy and delivered STAT. This will be injected into a 500 mL bag.
4. Alaris: The product should be administered at a rate of 0.12 mL/kg/min (~3 units/kg/min) to a maximum rate of 8.4 mL/min. This calculates to a rate of 400-504 mL/HR. Alaris has been programmed with Guardrails at 400 and 505 mL/HR.
5. Dedicated line: this product requires a dedicated line.
6. Monitoring: any patient administered a reversal agent should be monitored for embolic events.

IV to Oral Azithromycin

By Olga DeTorres, Pharm.D., FASHP, BCPS-ID

Azithromycin is a commonly prescribed antibiotic for the treatment of community-acquired pneumonia, bronchitis and COPD/asthma exacerbation because to its broad bacterial spectrum and anti-inflammatory effects. Patients admitted with community-acquired pneumonia, bronchitis and COPD/asthma exacerbation are kept on IV antibiotics longer than necessary. Early conversion from IV to the PO route has been reported to increase patient safety and comfort, reduce cost and facilitate earlier discharge without compromising medical care. The dosing regimen for oral Azithromycin is the same as IV: 500 mg every 24 hr. Serum and tissue levels after oral administration are similar to those achieved with parenteral azithromycin administration. The cost of an azithromycin 500 mg vial is almost twice that of the oral 500 mg tablets. By implementing an IV-to-PO switch for Azithromycin, Palomar Health could save up to $3,000 per year. Most university medical centers have an automatic IV-to-PO automatic substitution in place for azithromycin. The Antibiotic Sub-Committee recommended that Palomar Health implement a similar procedure. Pharmacy will be performing an automatic substitution for IV Azithromycin to PO whenever patients meet the criteria listed in the "IV to PO - Automatic Substitution by a Pharmacist" Procedure. With the addition of azithromycin to this procedure, we hope to increase patient satisfaction while shortening length of hospital stay.

For more info about this example contact Olga DeTorres, PharmD at Olga.DeTorres@palomarhealth.org

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Example 8.3 Palomar Health Newsletter (continued 3 of 4)

Antimicrobial Prophylaxis for Pacemaker & Defibrillator Insertion – A Success Story!

By Olga DeTorres, Pharm.D., FASHP, BCPS-ID

In 2006 an outbreak of Methicillin-Resistant *Staphylococcus aureus* (MRSA) pocket infections triggered the Cardiology Department to review the measures they used to prevent infection during pacemaker and intra-cardiac defibrillator placement. These infections when they occur can be quite costly. Treatment usually requires that the device be surgically removed and that the patient receive several weeks of parenteral antibiotic therapy. The review found that all patients received antimicrobial prophylaxis prior to pacemaker and intra-cardiac defibrillator placement. A systemic prophylactic antibiotic (cefazolin) was ordered in all cases. The results were reviewed by the Antibiotic Subcommittee of the Palomar Health Pharmacy and Therapeutics Committee. They made the following recommendations:

- To prevent MRSA pocket infections and/or endocarditis from occurring after the placement of pacemakers and intra-cardiac defibrillators, Vancomycin IV should be given in conjunction with cefazolin IV as antimicrobial prophylaxis prior to these procedures.
- Beta-lactam allergic patients should receive Vancomycin IV alone for antimicrobial prophylaxis.

A repeat Medication Use Evaluation (MUE) reviewed the charts of all patients who had undergone a pacemaker or defibrillator insertion during the month of July 2012. The MUE found that 100% of patients received antimicrobial prophylaxis prior to pacemaker or defibrillator insertion. Appropriate antibiotics were ordered in most patients (96.2%). The duration of prophylaxis (< 24 hours) was appropriate in 100% patients. Not one patient experienced a post- procedure infection. The old adage is still true today: "An ounce of prevention is better than a pound of cure." Congratulations to the cardiologists and the cath lab staff for a job well done!

Fluzone High-Dose Influenza Virus Vaccine

By Olga DeTorres, Pharm.D., FASHP, BCPS-ID

The standard adult dose influenza vaccine generates an immunological response in only 44% for patients < 65 years of age and 19% of patients who are 65 years or older. Current adult influenza vaccines provide inadequate coverage against influenza in the elderly resulting in serious morbidity and increased mortality. An influenza vaccine with greater immunogenicity compared with the currently available vaccines was needed. Fluzone High-Dose, an inactivated influenza vaccine was recently added to the Palomar Health formulary. Each 0.5 mL dose contains 60 mcg of hemagglutinin from each of the three influenza strains, subtypes A (H1N1 and H3N2) and type B which is four times greater than the standard vaccine. The vaccine works by inducing the production of neutralizing antibodies. Patients are considered to have seroconverted when they generate hemagglutination inhibition antibody titers that are 1:40.

Contraindications are the same as for other influenza vaccines, e.g. history of severe allergic reaction (e.g., anaphylaxis) to any component of the vaccine, including egg protein, or to a previous dose of any influenza vaccine or history of Guillain-Barre Syndrome. Common side effects include injection site reactions (e.g. tenderness, erythema, swelling, induration, ecchymosis), fever, vomiting, drowsiness, lost appetite and irritability. Patients should be monitored for fever after administration.

Fluzone High-Dose is a welcome addition to our vaccine formulary. Its use will be limited to patients ≥ 65 years of age.

Safety of Ganciclovir & Valganciclovir

By Olga DeTorres, Pharm.D., FASHP, BCPS-ID

Ganciclovir was the first antiviral agent approved for the treatment of cytomegalovirus (CMV) infection. It is widely used for the treatment of CMV infections in patients with poorly controlled and advanced HIV/AIDS, and recipients of solid organ and bone marrow transplantation, who are at high risk for invasive CMV disease. Valganciclovir, an oral prodrug that is rapidly converted to ganciclovir, also plays a major role in the treatment and prevention of CMV infections in immunocompromised hosts. Ganciclovir is commonly associated with a range of serious hematological adverse effects including granulocytopenia, neutropenia, anemia, thrombocytopenia, as well as seizures, pain and phlebitis at injection site (due to high pH), rash, itching, increased serum creatinine and BUN concentrations. It is also considered a potential human carcinogen, teratogen and mutagen. It can potentially cause inhibition of spermatogenesis. Ganciclovir is handled as a cytotoxic drug in the clinical setting. Because of safety concerns, the charts of all patients who received ganciclovir or valganciclovir during the past six months were reviewed.

Our use of ganciclovir and valganciclovir is very low. There were only five patients during the study period. Two patients received the drug for prophylaxis after organ transplantation, one patient received it as empiric therapy for CMV esophagitis, while two patients were treated for CMV retinitis or viremia. Two of the five patients experienced a hematological adverse event during their hospital stay, neutropenia and pancytopenia. The chart review found that renal function and CBC were not monitored in patients who had been receiving these agents as outpatients. Given the risk of bone marrow suppression, patients receiving ganciclovir or valganciclovir should have a complete blood count (CBC) with a differential at least twice a week during induction therapy, then weekly thereafter. In addition, renal function monitoring should be done at least weekly during induction therapy, since a decline in renal function may require adjusting the dose of ganciclovir. More frequent monitoring should be considered in patients at particularly high risk for nephrotoxicity, such as those receiving cyclosporine, tacrolimus, aminoglycosides or amphotericin B. The Antibiotic Sub-Committee recommended that ganciclovir and valganciclovir be added to the Pharmacy Clinical Monitoring Report, allowing pharmacists to order weekly serum creatinine and CBC whenever physicians fail to do so.

In the past, these agents were restricted to use by Infectious Disease specialists; the Antibiotic Sub-Committee recommended that the ganciclovir and valganciclovir restrictions be expanded to include hematologists/oncologists and gastroenterologists as their patients often present with serious CMV infections. The Pharmacy and Therapeutics Committee approved their recommendations.

encapsulated news

For more info about this example contact Olga DeTorres, PharmD at Olga.DeTorres@palomarhealth.org

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Example 8.3 Palomar Health Newsletter (continued 4 of 4)

PALOMAR HEALTH
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Pharmacy Department
2185 Citracado Parkway
Escondido, CA 92029

Presort Standard
U.S. Postage
PAID
Permit 2838
San Diego, CA

Summary of Drugs

SUMMARY OF DRUGS ADDED TO THE FORMULARY WITH RESTRICTIONS...

Generic	Brand	Indication	Class
Prothrombin complex concentrate 4-factor (PCC-4)	Kcentra	Reversal of warfarin in patients with acute major bleeding or the need for urgent surgery within 6 hours.	Hemostatic; Prothrombin Complex Concentrate (PCC)
Influenza virus vaccine	Fluzone High-Dose	Active immunization against influenza virus in adults 65 years and older	Vaccine, Inactivated (viral)

encapsulated news OCT.2013

For more info about this example contact Olga DeTorres, PharmD at Olga.DeTorres@palomarhealth.org

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Antimicrobial Stewardship Program Element 9:

The antimicrobial formulary is reviewed annually and changes made based on local antibiogram.

The local annual antibiogram provides essential information to guide empiric antimicrobial therapy pending final culture results. The microbiology laboratory should provide an antibiogram for analysis on an annual basis (at a minimum). Serial antibiogram evaluations permit the identification of trends in local antimicrobial resistance. The ASP committee should review, make changes to the formulary and order sets to ensure that the options are congruent with the antimicrobial susceptibility patterns seen on the most recent antibiogram. Antimicrobial-resistant organisms such as methicillin-resistant *Staphylococcus aureus* (MRSA), vancomycin-resistant *Enterococci* (VRE), extended-spectrum beta-lactamase (ESBL) producers, and carbapenem-resistant Enterobacteriaceae (CRE), should be identified and highlighted in the report. Periodic education of providers should be based on this analysis and any resulting changes to the formulary and order sets.

The following examples depict an interpretation of a local antibiogram that can inform the composition of the antimicrobial formulary and empiric antimicrobial therapy guidelines.

References

Hebert C, Ridgway J, Vekhter B, Brown EC, Weber SG, Robicsek A. Demonstration of the weighted-incidence syndromic combination antibiogram: an empiric prescribing decision aid. *Infect Control Hosp Epidemiol.* 2012 Apr;33(4):381-8. http://www.ncbi.nlm.nih.gov/pubmed/?term=22418634

Hindler JF, Stelling J. Analysis and presentation of cumulative antibiograms: a new consensus guideline from the Clinical and Laboratory Standards Institute. *Clin Infect Dis*. 2007 Mar 15;44(6):867-73.http://www.ncbi.nlm.nih.gov/pubmed/?term=17304462

Example 9.1 Sutter Eden Medical Center Antimicrobial Formulary Review (1 of 3)

Antimicrobial formulary that is reviewed annually with changes made based on local antibiogram

The annual antibiogram provides essential information that should be used to guide empiric antimicrobial therapy pending final culture results. Presenting the antibiogram without an analysis of the results will limit the usefulness and is unlikely to be referred to by very many practitioners. The main points in analysis should be for sensitivity profiles of organisms of importance e.g. MRSA, ESBL, CRE, and VRE.

A copy of one of our reports is provided as an example of the analysis with recommendations at the end.

1. Data was compared to the last 6 years
2. Staph aureus
    a. Incidence of MRSA as seen nationally is dropping, now down and stable for 2 years at 43%.
    b. Clindamycin sensitivity has remained stable the last 2 years at about 75%.
        i. MRSA is resistant to clindamycin 1/3 of the time
        ii. MSSA still retains ~90% sensitivity
    c. Levofloxacin sensitivity has increased again, now up to 62% from about 50% in 2011.
        i. Most of the resistance is attributable to MRSA (2/3 resistant)
        ii. MSSA sensitive is up to 87%
    d. Trimethoprim-sulfa sensitivity remains excellent at 98%.
    e. No Vanco MIC 2 or greater in 2013 probably related to using Vitek and not Microscan system.
    f. Tetracycline sensitivity remains steady about 94%.
3. Enterococcus
    a. Enterococcus faecalis
        i. Levofloxacin resistance is probably stable. Data is difficult to interpret.
        ii. Ampicillin sensitivity remains excellent at >95%.
            1. Different mechanism from VRE
        iii. Tetracycline only ~10% sensitivity.
        iv. Vancomycin >95% sensitive and stable.
    b. Enterococcus faecium
        i. VRE is the predominant isolate in this species.
        ii. Tetracycline sensitivity is ~ 20%
            1. May still be useful for urine if sensitive.
        iii. Ampicillin sensitivity remains low at ~10%
4. Streptococcus pneumonia

For more info about this example contact Jeffrey Silvers, MD at Silverj@sutterhealth.org

Example 9.1 Sutter Eden Medical Center Antimicrobial Formulary Review (continued 2 of 3)

a. Penicillin sensitivity has gradually been increasing from low of 66% 2007 to 100% 2011.
    i. Number of isolates has decreased because of increased usage of vaccination

5. Acinetobacter
    a. Huge issue with resistance
    b. Although still small numbers: 32 isolates 2013 compared to 15 isolates 2012.
        i. Ceftazidime sensitivity has progressively decreased from 1997 at 100% to 18% in 2013.
        ii. Ciprofloxacin sensitivity has continued to spiral down. Decreased from 100% in 1997 to 37% in 2011 and now down to 25% (3/4 resistant now)
        iii. Imipenem has decreased from sensitivity of 100% as recently as 2009 now stable last few years at 68% (1/3 resistant).
        iv. Piperacillin-tazobactam (Zosyn) has decreased from 100% just for piperacillin alone in 1997 to 25% 2011 to 15% (6/7 resistant) in 2013. Again small numbers to compare 2011 and 2013.
6. E coli
    a. ESBL stable about 8%
    b. Cefazolin sensitivity down to about 77%
    c. Levofloxacin stable about 75%
    d. Cefoxitin almost 90% sensitive.
    e. Zosyn and imipenem >95%
7. Klebsiella
    a. Cephalosporin sensitivity historically frequently lower
    b. ESBL more common in klebsiella
        i. About 15%
        ii. Ceftriaxone 100% down to 85% secondary to ESBL
8. Proteus mirabilis
    a. Frequently acts like ESBL but labs can't report as such
        i. ~10% resistant to cephalosporins
    b. Trimethoprim-sulfa sensitivity took large drop to ~60%. Lowest in 20 years, and still with significant # isolates (182). Has been gradually decreasing from 90% over time. Was 70% in 2010.
9. Pseudomonas
    a. Zosyn, ceftazidime, cefepime and Gentamycin sensitivity stable ~85%
    b. Ciprofloxacin and levofloxacin resistance about 1/3 of the time

For more info about this example contact Jeffrey Silvers, MD at Silverj@sutterhealth.org

Example 9.1 Sutter Eden Medical Center Antimicrobial Formulary Review (continued 3 of 3)

2013 ANTIBIOGRAM TAKE-HOME MESSAGES

1. MRSA, although still prevalent is continuing the decline in incidence, as seen nationally and for us over the last few years. Nothing to suggest VISA in our data.
2. Clindamycin should not be assumed to treat MRSA unless sensitivity returns.
3. E. faecalis, is still the most common enterococcus isolated but with the new system, speciation is not performed.
4. S. pneumonia isolates continue in small number- low numbers because of efficacy of vaccination
    a. continue to order appropriate immunizations
5. Acinetobacter is one of the scariest GNR organisms in 2013-2014. Our isolates have doubled and they tend to be very resistant. Recommend ID consult if treatment contemplated as inappropriate choices and doses can encourage resistance.
6. E. coli, Klebsiella, and Proteus still sensitive to cefoxitin. Should continue to work as surgical prophylaxis for GI surgery.
7. Pseudomonas, don't trust fluoroquinilones until sensitivity returns.

For more info about this example contact Jeffrey Silvers, MD at Silverj@sutterhealth.org

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Antimicrobial Stewardship Program Element 10:

Prospective audits of antimicrobial prescriptions are performed and interventions / feedback is provided to prescribers

Prospective audits with intervention and feedback to the prescriber have been demonstrated to improve appropriate antimicrobial use. This process allows the ASP to identify opportunities for optimization of antimicrobial therapy by addressing antimicrobial choice, dosing, route, and/or duration. The feedback process also serves as an opportunity for one-on-one education of prescribers. Once empiric antimicrobial guidelines are developed and approved by medical specialty groups throughout the hospital/health-system, antimicrobial orders/prescriptions should be audited for appropriateness.

The ASP team may intervene on orders/prescriptions that fail to meet criteria for use according to the empiric antimicrobial guidelines. Various methods of feedback may be effective, including written interventions in the chart or a phone call may be placed to the prescribing physician to recommend alternate agents to use. The ASP team can also join physicians during rounds and discuss antibiotic choices for their patients. Audit and feedback require the availability of an expert in antimicrobial use, and some smaller hospitals accomplish this by engaging external experts to advise on case reviews.

Physicians who repeatedly fail to follow hospital empiric therapy guidelines or de- escalate antimicrobial therapy may be counseled by the ASP team. If several physicians in a department fail to follow hospital antimicrobial guidelines, inappropriate orders/prescriptions for antimicrobials can be tallied and reported to the respective department chairs. The ASP team can attend department meeting to discuss alternative antimicrobial agents to use, criteria for using restricted agents, and potential problems with their overuse.

The following examples outline a process and criteria for performing prospective audits of antimicrobial prescriptions and mechanisms for communicating interventions/feedback and a monthly report of outcomes of ASP interventions, i.e. numbers of ASP interventions accepted.

References

Cosgrove SE, Patel A, Song X, et al. Impact of different methods of feedback to clinicians after postprescription antimicrobial review based on the Centers For Disease Control and Prevention's 12 Steps to Prevent Antimicrobial Resistance Among Hospitalized Adults. *Infect Control Hosp Epidemiol* 2007;28(6):641–6.

Davey P, Brown E, Charani E, et al. Interventions to improve antibiotic prescribing practices for hospital inpatients. *Cochrane Database Syst Rev* 2013;4:CD003543.

Example 10.1 Palomar Health Prospective Audits with Feedback/Intervention Program (1 of 2)

Prospective Audits of Antimicrobial Prescriptions Performed and Intervention/Feedback Provided

1. Daily list of patients on antimicrobials targeted by the ASP is printed in the Pharmacy.
2. Each order is reviewed for:
   a. Appropriate indication
   b. Can a narrower spectrum agent be used based on cultures or indication?
   c. Does the agent cover the pathogen isolated?
   d. Is the dose appropriate based on the patient's weight, renal function or indication?
   e. How long has the patient been on the agent? Can it be discontinued?
   f. Does this agent duplicate other agents that the patient is currently receiving?
   g. Can this agent be switched to an oral equivalent?
   h. Does the patient have any contraindications for using this agent, e.g. pregnancy, drug allergy, etc?
   i. Are there any potential drug interactions with this agent?
   j. Is the patient experiencing any adverse effects from this agent?
   k. Cost effectiveness – Can a less expensive agent be used instead?
3. Orders that meet criteria for appropriateness are discarded or filed for future reference.
4. Orders that fail to meet any of the above criteria require an intervention:
   a. Hospitals that use paper charts utilize designated forms that are not part of the permanent record. These forms are removed from the chart when the patient is discharged; the forms are sent back to the Pharmacy Department.
      i. A form is completed that states the problem with the current antimicrobial order. It includes a suggested alternative to use or dosage adjustment.
      ii. Physician can respond on the bottom of the intervention, explaining why current antimicrobial order cannot be changed.
      iii. The paper form is followed up with a phone call during the same day to the physician, where the patient's care can be discussed in further detail.
      iv. A copy of the intervention or report that includes the patients' name, medical record number, the date of the intervention, and physician that was contacted is kept in a folder. Orders that have not been changed by the following day generate a second phone call from the ASP pharmacist to the physician.
   b. Hospitals that are fully computerized and paperless often utilize a Message Board that alerts physicians to messages about their patients when they log on.
      i. An electronic form is completed that states the problem with the current antimicrobial order. It includes a suggested alternative to use or dosage adjustment.
      ii. Physician can respond on the bottom of the message, explaining why current antimicrobial order cannot be changed.
      iii. The electronic message is followed up with a phone call during the same day to the physician, where the patient's care can be discussed in further detail.
      iv. A copy of the intervention or report that includes the patients' name, medical record number, date of the intervention, and physician that was contacted is kept in a folder or electronic file. Messages that have not been opened or responded to by

For more info about this example contact Olga DeTorres, PharmD at Olga.DeTorres@palomarhealth.org

Example 10.1 Palomar Health Prospective Audits with Feedback/Intervention Program (continued 2 of 2)

the following day generate a second phone call from the ASP pharmacist to the physician.

5. Rejected interventions are tracked by medical specialty. Departments that fail to follow ASP guidelines will have:
    a. In-service education performed at department meetings or Medical Grand Rounds.
    b. Articles published in physician & pharmacy newsletters.
    c. Educational posters displayed where physicians are most likely to see them.
    d. Pre-printed order sets developed with input from the respective medical specialties.
    e. The ASP ID physician privately counsel physicians who are repeat offenders.
6. Medical departments that change their prescribing habits with improved outcomes are publically commended at department meetings, Quality Management Committee meetings, and newsletter articles. Positive reinforcement encourages continued compliance.

For more info about this example contact Olga DeTorres, PharmD at Olga.DeTorres@palomarhealth.org

Example 10.2 Palomar Health Antibiotic Interventions March 2013-April 2014 (1 of 1)

Antibiotic Interventions:

Intervention Type	Oct 2013	Nov 2013	Dec 2013	Jan 2014	Feb 2014	Mar 2014	April 2014
Drug Allergy	1	3	1	1	2	0	2
Accepted	1	2	1	0	2	0	2
Organism was resistant to current antibiotic	4	3	4	4	3	5	6
Accepted	3	2	2	4	3	4	5
Broad Spectrum to narrow spectrum	27	14	24	16	54	19	13
Accepted	20	8	14	13	33	14	7
Add an antibiotic	1	3	0	1	3	5	1
Accepted	1	3	0	1	2	5	0
Discontinue antibiotic	10	5	4	9	15	16	6
Accepted	10	4	4	6	12	8	4
Duplication in coverage	5	7	3	6	8	8	2
Accepted	1	5	2	6	3	6	2
IV to PO	4	5	6	1	1	3	1
Accepted	4	5	6	1	1	3	1
Renal dosing of antibiotics	2	2	4	1	1	7	2
Accepted	2	0	4	1	1	6	2
Cost Effective Regimen	13	11	12	4	8	12	7
Accepted	7	6	5	2	3	8	3
Dose adjustment based on indication	5	3	5	5	12	4	2
Accepted	5	3	4	5	11	4	2
Toxicity due to antibiotic regimen	1	0	0	0	1	1	0
Accepted	1	0	0	0	1	1	0
Drug Interaction with antimicrobial	5	5	3	9	12	6	3
Accepted	5	4	3	6	10	4	3
Agent contraindicated	0	0	0	2	0	1	1
Accepted	0	0	0	2	0	1	1
Alternate regimen recommendation, e.g continuous infusion, hospital protocol, etc	1	0	2	3	6	1	3
Accepted	0	0	1	1	2	1	1
Total	79	61	68	62	126	88	49
Interventions Accepted	60	42	46	48	84	65	33
Percent Acceptance	76%	69%	68%	77%	67%	74%	67%

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Antimicrobial Stewardship Program Element 11:

Formulary restriction with preauthorization has been implemented.

The rationale for placing restrictions on specific antimicrobials is to limit the inappropriate use of certain broad-spectrum antimicrobial agents, last-line agents, or agents with concerning toxicities. To minimize the development of antimicrobial resistance and serious adverse effects, restricted antimicrobials should be reserved for the treatment of infections caused by multi-drug resistant organisms and for patients with multiple drug allergies or contraindications to first-line agents. The ASP Committee should review and recommend which antimicrobials will be restricted based on the hospital's antimicrobial formulary, bacterial resistance patterns, and risks of drug toxicity.

The ASP must develop criteria for use and a process for reviewing all requests for restricted antimicrobials in a timely manner. If an antimicrobial order or prescription fails to meet use criteria, the antimicrobial stewardship team should contact the prescribing physician to discuss alternative agents. If the physician insists on using the restricted antimicrobial, the ASP team may recommend that the prescriber obtain an Infectious Disease consult.

The following examples illustrate a list of restricted antimicrobials with accepted criteria for use, and a report monitoring appropriateness of restricted antimicrobials.

Reference

Davey P, Brown E, Charani E, et al. Interventions to improve antibiotic prescribing practices for hospital inpatients. *Cochrane Database Syst Rev* 2013;4:CD003543.

Example 11.1 Palomar Health Restricted Antibiotic List (1 of 2)

Restricted Antimicrobial List*

Drug	Criteria For Use
Cephalosporins	
Ceftaroline	1. Treatment of complicated skin and soft tissue infections in patients who are intolerant to vancomycin IV. 2. Infectious Disease Service
Cefepime	1. Febrile neutropenia 2. Organism is resistant to other beta-lactams, fluoroquinolones, & trimethoprim-sulfamethoxazole 3. Infectious Disease Service
Carbapenems	
Meropenem	1. Organism is resistant to other beta-lactams, fluoroquinolones, trimethoprim-sulfamethoxazole & aminoglycosides. 2. Infectious Disease Service
Imipenem/Cilastatin	1. Organism is resistant to Meropenem, other beta-lactams, fluoroquinolones, trimethoprim-sulfamethoxazole & aminoglycosides. 2. Infectious Disease Service
Ertapenem	1. Discharge dose for Kaiser patients with documented ESBL-producing Gram negative infections who will be receiving Ertapenem as outpatient therapy. 2. Infectious Disease Service
Aminoglycosides	
Amikacin	1. Organism is resistant to other aminoglycosides 2. Intra-ocular injection 3. Infectious Disease Service
Streptomycin	Infectious Disease Service
Inhaled Tobramycin	Pulmonary & Infectious Disease Services
Gram Positive Agents	
Linezolid	1. MRSA infection in a Vancomycin-allergic patient. 2. VRE infection outside of the urinary tract. 3. Infectious Disease Service 4. Orthopedic Surgery Service
Quinupristin/Dalfopristin	1. MRSA infection in a Vancomycin-allergic patient. 2. VRE infection outside of the urinary tract. 3. Infectious Disease Service
Daptomycin	1. MRSA infection (excluding pneumonia) in a Vancomycin-allergic patient. 2. VRE infection outside of the urinary tract. 3. Infectious Disease Service

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Example 11.1 Palomar Health Restricted Antibiotic List (continued 2 of 2)

Miscellaneous Agents	
Ciprofloxacin injection	1. Gram negative infection resistant to Levofloxacin
Minocycline injection	1. Interventional Radiology 2. Infectious Disease Service
Tigecycline	1. Organism is resistant to Meropenem, other beta-lactams, fluoroquinolones, trimethoprim-sulfamethoxazole & aminoglycosides. 2. Infectious Disease Service
Pentamidine	Infectious Disease Service
Quinine Injection	Infectious Disease Service
Quinine	1. Treatment of malaria 2. Continuation of home medication for leg cramps
Antifungals	
Amphotericin B	Infectious Disease Service
Liposomal Amphotericin B	Infectious Disease Service
Flucytosine	Infectious Disease Service
Caspofungin	1. Candidal infection (excluding UTI's) resistant to fluconazole 2. Candidal infection in fluconazole-intolerant patient 3. Infectious Disease Service
Itraconazole	1. Suspected or documented Aspergillus infection 2. Infectious Disease Service
Voriconazole	1. Documented Aspergillus infection 2. Fungal infection that has failed to respond to itraconazole 3. Infectious Disease Service
Posaconazole	1. Documented Zygomycetes infection 2. Fungal infection that has failed to respond to voriconazole 2. Infectious Disease Service
Antivirals	
Ganciclovir	1. Infectious Disease Service 2. Hematology/Oncology Service 3. Gastroenterologists
Valganciclovir	1. Documented CMV infection 2. Infectious Disease Service
Cidofovir	1. Infectious Disease Service 2. ENT Surgery- Intra-lesional Administration only

*** Patients transferred from another facility on a restricted antimicrobial will be continued on the agent or switched to a PPH formulary equivalent until culture & sensitivity results become available.**

For more info about this example contact Olga DeTorres, PharmD at Olga.DeTorres@palomarhealth.org

Example 11.2 Palomar Health Restricted Antibiotic Report (1 of 3)

Palomar Pomerado Health
Antibiotic Committee
May 2014

Report on Use of Restricted Antibiotics By Non-Infectious Disease Specialists at PMC and POM

(March through April 2014)

Antibiotics restricted to infectious disease specialist:

linezolid	voriconazole	foscarnet	cidofovir
quinupristin-dalfopristin	caspofungin	imipenem-	Amphotericin B
daptomycin	itraconazole	cilastatin	Meropenem

Antibiotics which are not restricted, but whose use are strongly discouraged:

Tobramycin IH

Restricted antibiotics ordered by non-ID-specialist:

Antibiotic	MD/ site	Specialty	Comments	Discontinued after RPh intervention
			INAPPROPRIATE	
Daptomycin	K3/PMC	CARD SURG	Empiric therapy of a Staphylococcal bacteremia.	ID physician switched patient to cefazolin.
Daptomycin	L3/PMC	INTERN MED	Empiric therapy for a UTI	ID physician switched patient to Meropenem & Fluconazole.
Ciprofloxa-cin IV	SSS1/ PMC	INTERN MED	Empiric therapy for a UTI	Clinical pharmacist intervened. Pt was switched to Ceftriaxone after one dose
Ciprofloxa-cin IV	MMMM/ POM	GI	Empiric therapy for ischemic colitis	ID pharmacist was out of town.
Linezolid	I/POM	PUL	Treatment of an Enterococcal UTI in a penicillin-allergic patient. Pathogen was sensitive to Vancomycin	Patient expired after two doses. Incident occurred over the weekend. ID pharmacist was never notified.
Ganciclovir	JJ1/PMC	INTERN MED	Physician order entry error. He meant to order Acyclovir IV to treat shingles	Clinical pharmacist intervened. Pt was switched to acyclovir.
Meropenem	M3/POM	PUL	Treatment of an Enterobacter UTI	Clinical pharmacist intervened. Pt was switched to Ceftriaxone

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Example 11.2 Palomar Health Restricted Antibiotic Report (continued 2 of 3)

Meropenem	N3/ PHDC	PED	Empiric therapy for a UTI.	Pt was transferred to Rady's Children's Hospital after 2 doses. ID pharmacist was never notified.
Meropenem	KK1/ POM	INTERN MED	Treatment of an ESBL-producing E.coli UTI sensitive to cefotetan.	Clinical pharmacist intervened. Pt was switched to Cefotetan after one day.
Linezolid	A2/PMC	INTERN MED	Treatment of an Enterococcal UTI in a penicillin-allergic patient	ID pharmacist was never notified.
Meropenem	KK1/ PMC	INTERN MED	Treatment of an ESBL-producing E.coli UTI sensitive to cefotetan.	Clinical pharmacist intervened. MD chose not to change order.
APPROPRIATE				
Amikacin	ZZZ/ PMC	INTERN MED	Treatment of MDRO Pseudomonas osteomyelitis	
Quinupristin/ Dalfopristin	TT/PMC	PUL	Treatment of VRE bacteremia	
Linezolid	TT/PMC	PUL	Treatment of VRE bacteremia	
Linezolid	H3/PMC	INTERN MED	VRE UTI sensitive only to linezolid.	
Meropenem	ZZZ/ PHDC	INTERN MED	ESBL-producing E.coli UTI in a cefotetan-allergic patient	
Meropenem	L3/PMC	INTERN MED	Treatment of MDRO Pseudomonas UTI	
Meropenem	KK1/ POM	INTERN MED	Treatment of MDRO Proteus UTI	
Tobramycin Inhalation	O3/ PMC	ORTHO SURG	Continuation of home medication. Patient has chronic lung disease.	
Tobramycin Inhalation	XXXX/ PMC	INTERN MED	Continuation of home medication. Patient has chronic lung disease	
Tobramycin Inhalation	M2/ PMC	INTERN MED	Continuation of home medication. Patient has Cystic Fibrosis	
Tobramycin Inhalation	UUU/ PMC	INTERN MED	Continuation of home medication. Patient has Cystic Fibrosis	
Voriconazole	WWW1/ PMC	INTERN MED	Continuation of home medication. Patient is a S/P BMT.	
Voriconazole	T/PMC	PUL	Continuation of home medication. Patient has pulmonary Aspergillosis	
Daptomycin	U/PMC	VASC SURG	Surgical prophylaxis for a vascular graft in a vancomycin-allergic patient	
Daptomycin	R1/PMC	NEURO SURG	Surgical prophylaxis in a vancomycin-allergic patient	
Daptomycin	A/PMC	NEPH	VRE UTI in a patient taking an SSRI	
Ciprofloxa-	MMM/	INTERN	Empiric therapy for meningitis in a patient	

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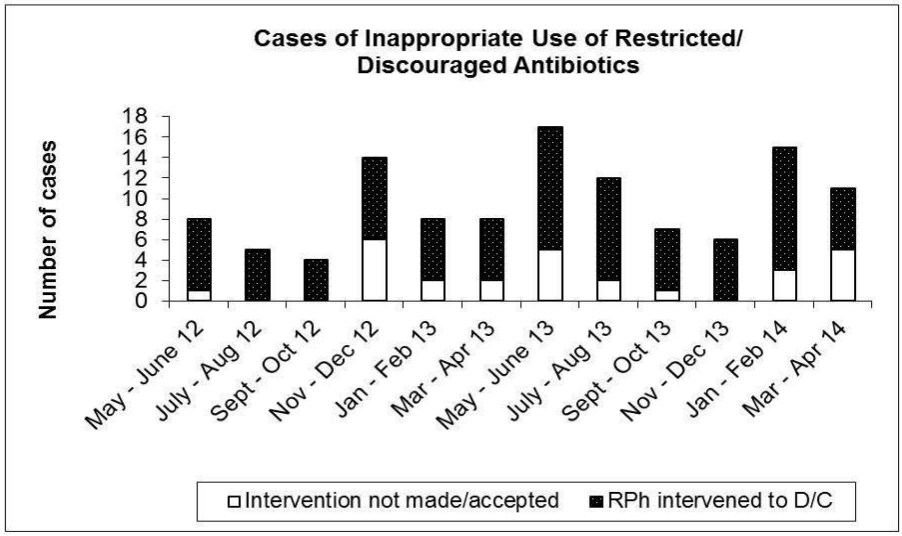
Example 11.2 Palomar Health Restricted Antibiotic Report (continued 3 of 3)

cin IV	PMC	MED	who experienced an allergic reaction to ceftriaxone.	
Ertapenem	G3/POM	INTERN MED	Discharge dose for a patient with an ESBL-producing E. coli UTI	
Tobramycin Inhalation	VVV/ PMC	INTERN MED	Continuation of home medication. Patient has chronic lung disease.	



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