



Entrustable Professional Activities

EPA 1 for Pediatric Infectious Diseases

EPA 1: Promoting Antimicrobial Stewardship Based on Microbiological Principles

Supervision Scale for This EPA

1. Trusted to participate only
2. Trusted to lead with direct supervision and coaching
3. Trusted to lead with supervisor occasionally present to provide advice
4. Trusted to lead without supervisor present but requires coaching to improve member and team performance
5. Trusted to lead without supervision to improve member and team performance

Description of the Activity

A key role for subspecialists is to utilize antimicrobial agents to target specific pathogens, effectively treating infectious diseases in children across the pediatric age ranges while minimizing adverse reactions, cost, and the emergence of antimicrobial resistance within individuals and populations.

The specific functions which define this EPA include:

1. Understanding the mechanisms of action, pharmacokinetic (PK), pharmacodynamic (PD), and pharmacogenomic properties, and potential adverse reactions of antimicrobial agents
2. Utilizing antimicrobial PK and PD properties to optimize dosing in healthy children and also in special populations (e.g., patients with cystic fibrosis, renal, or hepatic dysfunction)
3. Recognizing and managing common drug interactions between antimicrobials and between antimicrobials and other therapeutic agents
4. Utilizing therapeutic drug monitoring to optimize outcomes and minimize adverse reactions in the inpatient and outpatient settings
5. Determining the appropriate length of antimicrobial therapy and implementing IV to oral conversions
6. Utilizing institutional antibiograms to recommend optimal empiric antimicrobial therapy for common infectious disease syndromes
7. Describing different antimicrobial stewardship methods (e.g., pre-approval, prospective-audit-and-feedback)
8. Knowing the relative advantages, disadvantages, and costs of various antimicrobial stewardship interventions
9. Knowing the relationship between antimicrobial use and resistance, selection of antimicrobial resistant pathogens, and adverse patient outcomes
10. Applying data gathering and epidemiologic principles to plan and implement surveillance and outcomes assessment of antimicrobial stewardship programs
11. Participating in the development of antimicrobial stewardship activities or clinical guidelines

Judicious Mapping to Domains of Competence

- Patient Care
- Medical Knowledge
- Practice-Based Learning and Improvement
- Interpersonal and Communication Skills
- Professionalism
- Systems-Based Practice
- Personal and Professional Development



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Competencies Within Each Domain Critical to Entrustment Decisions

| | |
|---------|---|
| MK 2: | Practicing EBM |
| PBLI 4: | Analyzing practice |
| ICS 3: | Communicating with health professionals |
| ICS 4: | Working as a member of a health care team |
| ICS 5: | Consultative role |
| SBP 3: | Incorporating cost awareness into care |
| SBP 5: | Working interprofessional teams |
| PPD 6: | Providing leadership to improve care |

Context for the EPA

Rationale: Pediatric infectious disease (ID) specialists have a responsibility to promote judicious use of antimicrobials across a variety of health care settings with the optimal agent(s) for the right length of time. This is a critical EPA to ensure appropriate use of antimicrobials thereby helping to reduce unnecessary antibiotic exposure, resistance, and adverse drug events in patients receiving antimicrobial therapy.

Scope of Practice: This document is intended to address the scope of knowledge and essential skills that must be mastered by the pediatric ID physician in order to provide antimicrobial stewardship in both healthy and immunocompromised patients, in inpatient and outpatient health care settings, and in the population at large. These activities range from detailed knowledge regarding a wide range of antimicrobials to an understanding of and ability to utilize different stewardship methods in various health care settings. Communication, another core skill, occurs with a broad constituency: patients, families, other health care providers, public health authorities, policymakers, and the media.

Curricular Components That Support the Functions of the EPA

1. Understanding the mechanisms of action, pharmacokinetic (PK), pharmacodynamic (PD), and pharmacogenomic properties, and potential adverse reactions of antimicrobial agents
 - Describes the principles of pharmacokinetics and pharmacogenomics and applies them to antimicrobial drugs (e.g., abacavir and human leukocyte antigen [HLA] testing)
 - Applies population pharmacokinetics as a means to describe the variability of drug exposure among neonates, infants, and children in defined population groups
 - Knows the pharmacodynamic principles of bacterial growth restriction and/or killing by antibiotic class
 - Knows the difference between time-dependent and concentration-dependent antibiotics
 - Applies pharmacokinetic principles of terminal half-life to guide therapy (e.g., plateau effect with repetitive dosing)
 - Evaluates safety of antimicrobial drugs during pregnancy and breast feeding
 - Evaluates safety of antimicrobial drugs in a newborn infant, including ceftriaxone and trimethoprim-sulfamethoxazole
2. Utilizing antimicrobial PK and PD properties to optimize dosing in healthy children and also in special populations (e.g., patients with cystic fibrosis, renal, or hepatic dysfunction)



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- Applies the knowledge that antibiotic exposure (PK) at the level of infected tissue/fluid may be far greater or far less than serum antibiotic exposure to the care of individual patients
 - Knows the clinical situations when orally nonabsorbed or less-well absorbed antibiotics are appropriate (e.g., *Clostridium difficile*, shigellosis, bowel decontamination)
 - Optimizes dose and frequency of antimicrobials and determines when use of continuous antibiotic infusion may be indicated
 - Distinguishes clinical situations when bacteriostatic vs. bactericidal drugs are indicated (e.g., bacterial endocarditis) and relation of bactericidal vs. bacteriostatic drugs to inoculum and host defensive capability
3. Recognizing and managing common drug interactions between antimicrobials, and between antimicrobial and other therapeutic agents
- Recognizes metabolism dependent interactions between commonly used antimicrobials and other therapeutic agents (e.g., rifampin and mycophenolate, voriconazole and vincristine)
 - Recognizes metabolism dependent interactions between commonly used antimicrobials (e.g., rifampin and azole antifungals)
 - Recognizes nonmetabolic interactions between antimicrobial agents and other therapeutic agents (e.g., linezolid and selective serotonin reuptake inhibitors)
4. Utilizing therapeutic drug monitoring to optimize outcomes and minimize adverse reactions in the inpatient and outpatient settings
- Recognizes clinical circumstances when peak and/or trough concentrations of antimicrobial drugs are indicated, when they are not indicated, and how to interpret peak and/or trough concentrations
 - Plans dosage adjustment in a patient to achieve a targeted therapeutic level (e.g., vancomycin level in CNS infection, itraconazole for histoplasmosis)
 - Plans dosage adjustment in a patient to avoid or mitigate a supratherapeutic or toxic drug level (e.g., gentamicin dosing in a patient with renal dysfunction)
 - Recognizes toxicities related to specific antimicrobials (e.g., hearing loss with aminoglycosides, hepatotoxicity from tetracyclines)
5. Determining the appropriate length of antimicrobial therapy and implementing IV to oral conversions
- Recognizes appropriate and inappropriate routes of administration of antibiotics in reference to site and severity of infection and drug absorption (e.g., oral therapy for pneumococcal bacteremia)
 - Determines timing of intravenous to oral conversion of antimicrobial therapy based on clinical and laboratory improvement of the patient and specific PK/PD properties of the antimicrobial agent
 - Knows the risks and benefits associated with prolonged intravenous therapy vs. conversion to enteral therapy (e.g., thrombus with a peripherally inserted central venous catheter vs. adherence to multiple daily doses of enteral therapy)
 - Identifies antimicrobial agents for which bioavailability is high and which should be strongly considered for enteral therapy in most circumstances (e.g., fluconazole, clindamycin, ciprofloxacin)
 - Determines the appropriate length of antimicrobial therapy based on infecting organism, site of infection, and chronicity of infection



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6. Utilizing institutional antibiograms to recommend optimal empiric antimicrobial therapy for common infectious disease syndromes
 - Develops a working knowledge of one's institutional antibiogram to create recommendations to optimize empiric antimicrobial therapies for common infectious diseases (e.g., empiric use of clindamycin in setting of osteoarticular infection, Gram-negative infection in the neonatal intensive care unit [NICU])
 - Educates others on the use of the hospital antibiogram to guide empiric antibiotic therapy and where to locate this resource within the institution
7. Describing different antimicrobial stewardship methods (e.g., pre-approval, prospective-audit-and-feedback)
 - Describes pre-approval and prospective-audit-and-feedback antimicrobial stewardship methods and compares and contrasts their similarities and differences
8. Knowing the relative advantages, disadvantages, and costs of various antimicrobial stewardship interventions
 - Demonstrates knowledge of various stewardship interventions and determines which method is optimal for various health care settings
 - Recognizes that stewardship efforts are maximized by having a pharmacist lead the effort with the support of a pediatric ID physician
 - Compares and contrasts the benefits and associated costs of different stewardship efforts (e.g., prospective audit-and-feedback requires more infrastructure and may be more costly than less labor-intensive methods like pre-approval)
9. Knowing the relationship between antimicrobial use and resistance, selection of antimicrobial resistant pathogens, and adverse patient outcomes
 - Evaluates clinically appropriate uses for combination antibiotic therapy (e.g., prevention of emergence of resistance, polymicrobial infections, initial empirical therapy, decreased toxicity, synergy, immune compromised host) and inappropriate uses for combination antibiotic therapy (e.g., antagonism, cost, adverse effects)
 - Knows the mechanisms and examples of antibiotic resistance (e.g., mutations, plasmids, transposable elements, alterations of binding proteins, efflux pumps, ribosomal methylation, induction of resistance, altered porins, enzyme-based inactivation)
 - Explains how antibiotic exposure is thought to affect the microbiome and may lead to long-term adverse outcomes (e.g., asthma, obesity)
10. Apply data gathering and epidemiologic principles to plan and implement surveillance and outcomes assessment of antimicrobial stewardship programs
 - Recognizes that periodic monitoring of stewardship efforts should occur in order to improve recommendations, antibiotic use, and patient outcomes (e.g., utilizing QI methodology such as Plan-Do-Study-Act cycles to determine adherence to stewardship recommendations)
 - Evaluates patient level outcomes related to stewardship recommendations (e.g., hospital length of stay)
 - Evaluates hospital level outcomes with regard to antibiotic use overall and adherence to antimicrobial recommendations (e.g., monitor antibiotic use in the setting of bronchiolitis)



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- Investigates potential positive and negative effects of a stewardship program (e.g., decrease in *C. difficile* rates, or potential therapeutic failures with early therapy discontinuation, cost, overall antibiotic use)

11. Participating in the development of antimicrobial stewardship activities or clinical guidelines

- Outlines the limitations of the hospital-wide antibiogram (e.g., a pediatric specific antibiogram versus one that is primarily based on organism susceptibility patterns in adult patients, or susceptibility patterns from community vs. hospital-based isolates)
- Collaborates with the microbiology laboratory and Infection Prevention to develop and/or utilize unit specific pediatric antibiograms when data are available (e.g., NICU antibiogram)
- Understands that antimicrobial stewardship programs should be involved in the creation of local clinical practice guidelines for diagnosis and treatment of infection

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