

**2022 Updates in Therapeutics®: Pediatric Pharmacy  
Preparatory Review and Recertification Course**

Learning Objectives

**2022 Updates in Therapeutics®: Pediatric Pharmacy Preparatory Review and Recertification Course -  
Module 1: Foundation of Pediatric Pharmacy Practice: Principles, Communications, and Education,  
Biostatistics, Study Designs: Design and Application, Medication Safety**

Activity Number: 0217-0000-22-249-H04-P

4.25 contact hours

**Foundation of Pediatric Pharmacy Practice: Principles, Communications, and Education, Biostatistics**

1. Define pediatric patients and the corresponding normal limits of vital signs and laboratory values on the basis of age.
2. Compare fundamental differences between pediatric and adult patients in medication therapy management, including availability of treatment options, clinical evidence, and pediatric-friendly formulations.
3. Define off-label medication use and its implications in pediatric medication therapy.
4. Apply foundational pharmacotherapeutic concepts and pediatric-specific factors to provide care.
5. Develop rapport with patients by considering the different developmental stages of pediatric patients.
6. Integrate principles and tools to effectively communicate with patients and caregivers.
7. Identify factors influencing the need for pharmacists to be effective educators and preceptors.
8. Apply educational frameworks and evidence-based methods to design instructions for didactic and experiential learning.
9. Describe strategies to promote experiential learning such as instructing, modeling, coaching, and facilitating.
10. Apply best practices of assessment in evaluating achievement of learning outcomes.

**Biostatistics**

1. Describe, calculate, and interpret descriptive and inferential statistics.
2. Identify different types of data to determine an appropriate type of statistical test on the basis of the sample distribution, data type, and study design.
3. Describe, calculate, and interpret different types of measures of central tendency, data spread, and standard error of the mean.
4. Describe hypothesis testing, decision errors, p values, and confidence intervals.
5. Interpret the results of the most appropriate statistical test chosen on the basis of a given scenario.

**Study Designs: Design and Application**

1. Define, compare, and contrast the concepts of internal and external validity, bias, and confounding in clinical study design.

2. Compare and contrast the advantages and disadvantages of various study designs (e.g., prospective; retrospective; case-control; cohort; cross-sectional; randomized controlled clinical trials; systematic review; meta-analysis).
3. Delineate the difference between parallel and crossover study designs.
4. Define and evaluate odds, odds ratio, risk/incidence rate, risk ratio/relative risks (RRs), and other risk estimates.
5. Compute and evaluate number needed to treat and number needed to harm.
6. Define and calculate terms such as absolute risk difference and RR difference.
7. Define and calculate terms such as true positive, false positive, true negative, false negative, sensitivity, specificity, positive predictive value, negative predictive value, positive likelihood ratio, and negative likelihood ratio.
8. Define research, quality improvement, institutional review boards, and the peer review process.

### **Medication Safety**

1. Identify common medication safety events and risk factors in pediatric patients.
2. Analyze and address medication safety events in your organization.
3. Identify and evaluate error reduction strategies that could be used to address pediatric medication errors in your organization.

### **2022 Updates in Therapeutics®: Pediatric Pharmacy Preparatory Review and Recertification Course - Module 2: PICU I, PICU II, Neonatology**

Activity Number: 0217-0000-22-250-H01-P

4.0 contact hours

#### **PICU I**

1. Develop an appropriate treatment plan for patients with sepsis.
2. Recommend appropriate treatment strategies to manage sedation, delirium, and withdrawal prevention strategies in critical care patients.
3. Based on pharmacokinetic changes that occur during extracorporeal membrane oxygenation (ECMO), optimize patient's medication therapy while deployed on ECMO.
4. Differentiate between various therapeutic options for cardiac arrest and when to use each therapy and algorithm.
5. Compare and contrast various modalities for the optimization of mean arterial and intracranial pressure in traumatic brain injury (TBI).
6. Devise a fluid replacement and secondary response prevention plan for patients with severe burns.

#### **PICU II**

1. Classify primary and compensatory acid-base disorders when given pertinent patient details, including laboratory values.
2. Recognize clinical and biochemical differences between diabetic ketoacidosis (DKA) and hyperglycemic hyperosmolar state (HHS) and determine appropriate management for each disorder.

3. Define status epilepticus (SE) and describe appropriate strategies for escalation of SE treatment.
4. Outline the therapeutic options for and management of acute respiratory distress syndrome (ARDS) in children.
5. Develop appropriate strategies for prevention and empiric treatment of hospital-acquired pneumonia (HAP) or ventilator-associated pneumonia (VAP).
6. Describe appropriate interventions related to prevention and treatment of various gastrointestinal mucosa disorders.

### **Neonatology**

1. Compare the exogenous surfactant products available for the prevention and treatment of respiratory distress syndrome.
2. Describe the pharmacologic options for the prevention and treatment of bronchopulmonary dysplasia.
3. Describe the use of methylxanthines for the treatment of apnea of prematurity.
4. Describe the role of indomethacin for the prevention of intraventricular hemorrhage.
5. Compare the drugs available and the various therapeutic approaches (i.e., prophylaxis, early treatment, delayed treatment) for patent ductus arteriosus.
6. Discuss the supportive and targeted therapies for persistent pulmonary hypertension of the newborn.
7. Discuss therapeutic strategies to prevent and treat necrotizing enterocolitis.
8. Identify potential treatment options for common congenitally acquired infections, including herpes, syphilis, toxoplasmosis, cytomegalovirus, and hepatitis B.
9. Discuss the assessment and management of neonatal abstinence syndrome.
10. Explain important considerations, including the risk of fetal/neonatal harm and factors affecting drug transfer across the placenta or into breast milk, when choosing drugs for use during pregnancy or lactation.

### **2022 Updates in Therapeutics®: Pediatric Pharmacy Preparatory Review and Recertification Course - Module 3: Endocrine Disorders, Pharmacokinetics, Pharmacodynamics, Pharmacogenomics, and Drug Formulations, Practice Management, Toxicology**

Activity Number: 0217-0000-22-251-H01-P

4.5 contact hours

#### **Endocrine Disorders**

1. Given a specific patient, design or evaluate the effectiveness of a management regimen to optimize glycemic control in a child with diabetes mellitus.
2. Identify classifications and treatment strategies for obesity in children.
3. Develop a treatment strategy for thyroid disorders in children.
4. Differentiate between various treatments for disorders of water metabolism and other metabolic disorders in children.

## **Pharmacokinetics, Pharmacodynamics, Pharmacogenomics, and Drug Formulations**

1. Understand the effect of maturational development from a neonate to an adult on drug absorption after administration by different routes.
2. Compare the differences in distribution of hydrophilic and lipophilic drugs in the pediatric population as the newborn matures into an adolescent and an adult.
3. Explain the impact of maturational changes from a neonate to an adult on drug-metabolizing enzymes involved in phase I and phase II reactions.
4. Recognize the effect of physical and physiologic development on renal function, and make dosing recommendations for renally eliminated drugs using various noninvasive methods of estimating renal function.
5. Explore the differences between adults and children in how drugs can affect the body (pharmacodynamics).
6. List key pharmacogenomic variations that may affect efficacy, safety, and dosing of drugs in children.
7. Describe the need for, the methods of, and the challenges in compounding extemporaneous formulations in pediatric patients.

## **Practice Management**

1. Describe the responsibilities of a pediatric pharmacy representative to the pharmacy and therapeutics committee to ensure appropriate formulary management for the pediatric population.
2. Design a medication use evaluation to evaluate medication use or processes in a pediatric population.
3. Use the American Society of Health-System Pharmacists–Pediatric Pharmacy Association guideline to devise a plan for providing pharmacy services to pediatric patients in a health care system.
4. Develop strategies to manage drug shortages.
5. Devise a plan to optimally use medical and informational technology for pediatric patients.
6. Use appropriate quality improvement methods and metrics to improve the quality of care provided to pediatric patients.

## **Toxicology**

1. Describe the U.S. poison control system structure and the common pediatric poisonings reported.
2. Identify the common toxidrome classifications.
3. Review the modalities of gastric decontamination and their role in the present-day management of poison ingestion.
4. Describe the pathophysiology and management of select poisonings.
5. Understand potential management strategies for various substance use disorders.

**2022 Updates in Therapeutics®: Pediatric Pharmacy Preparatory Review and Recertification Course -  
Module 4: Gastroenterology, Infectious Diseases, Hematology and Oncology**

Activity Number: 0217-0000-22-252-H01-P

4.0 contact hours

**Gastroenterology**

1. Apply national guideline and consensus management strategies for the following pediatric gastrointestinal (GI) disorders, where applicable: gastroesophageal reflux disease (GERD), diarrhea, constipation, irritable bowel syndrome (IBS), Crohn disease (CD), ulcerative colitis (UC), short bowel syndrome (SBS), appendicitis, nausea and vomiting, and ulcers.
2. Design treatment and monitoring regimens for managing GERD in pediatric patients.
3. Identify causes of diarrhea in pediatric patients, and recommend appropriate treatment and supportive care management to prevent associated complications.
4. Generate appropriate prevention and treatment strategies for pediatric constipation.
5. Distinguish between and recognize the clinical criteria for the types of IBS in order to provide appropriate recommendations for each type.
6. Compare and contrast the different clinical signs and symptoms of UC and pediatric CD, and recommend corresponding treatment regimens.
7. Describe the influence of bowel length and residual function in the management of SBS, including pharmacotherapy and monitoring plans for diarrheal management in pediatric patients with SBS.

**Infectious Diseases**

1. Determine appropriate treatment for pediatric patients with respiratory tract infections, central nervous system (CNS) infections, soft tissue infections, bone and joint infections, urinary tract infections, (UTIs) intra-abdominal infections, and endocarditis.
2. Describe appropriate first-line treatment of fungal infections, tuberculosis, and parasitic infections in pediatric patients.
3. Identify appropriate surgical prophylactic strategies for pediatric patients.
4. Determine appropriate prophylactic agents for pediatric patients with respiratory tract infections and CNS infections.

**Hematology and Oncology**

1. Discuss the epidemiology, pathophysiology, risk factors, diagnosis, and general treatment approaches to common pediatric malignancies.
2. Explain the role of hematopoietic stem cell transplantation in children with hematologic or oncologic disorders.
3. Prevent and manage late treatment-related complications in survivors of childhood cancer.
4. Identify and mitigate treatment-related complications in children with cancer.
5. Propose a treatment approach for a child with blood disorders, such as hemophilia, sickle cell disease, or iron deficiency anemia.

**2022 Updates in Therapeutics®: Pediatric Pharmacy Preparatory Review and Recertification Course -  
Module 5: Solid Organ Transplantation, Cardiology, Pulmonary, Pediatric Public Health and Patient  
Advocacy**

Activity Number: 0217-0000-22-253-H01-P

4.25 contact hours

**Solid Organ Transplantation**

1. Examine how current strategies used to prevent and treat solid organ transplantation (SOT) rejection affect cellular and antibody-mediated immune responses.
2. Compare therapeutic effects, drug interactions, monitoring, and safety of current immunosuppressants used in SOT.
3. Determine the therapeutic goals for individual SOT recipients with respect to balancing preventing rejection and avoiding infections and other complications.
4. Differentiate how recommended immunizations for pre-SOT candidates and SOT recipients vary from U.S. recommendations for immunocompetent pediatric patients.
5. Describe preventive and treatment strategies for pediatric SOT complications, including infection, malignancy, linear growth impairment, posttransplant diabetes mellitus, and cardiovascular complications.

**Cardiology**

1. Develop strategies for the acute and long-term treatment of patients with a diagnosis of Kawasaki disease.
2. Discuss the pharmacologic agents used to manage the consequences associated with congenital heart diseases.
3. Determine appropriate first-line and alternative antihypertensive agents for the control of blood pressure in neonates, children, and adolescents.
4. Describe the pharmacologic management of the most commonly occurring arrhythmias in the pediatric population.
5. Determine appropriate pharmacologic agents for preventing and treating thrombosis in the pediatric population with cardiac disease.
6. Select the best therapeutic agent to manage acute and chronic pulmonary hypertension (PHN) in pediatric patients.

**Pulmonary**

1. Design an optimal treatment regimen for pediatric patients with asthma.
2. Discuss the role of pharmacologic therapies for status asthmaticus.
3. Assess and recommend treatment for a patient with cystic fibrosis (CF).
4. Review the management of CF-related comorbidities, including CF-related diabetes and pancreatic insufficiency.
5. Design a treatment regimen for community-acquired pneumonia in pediatric patients.

## **Pediatric Public Health and Patient Advocacy**

1. Describe the limitations regarding the regulation of medication use and availability in the pediatric population, and describe how the pediatric clinical pharmacy specialist can affect, inform, and address these limitations through advocacy and awareness.
2. Define organizations and resources available to support and advocate for specialized training and competency for the role of a pediatric clinical pharmacy specialist.
3. List health care initiatives aimed at promoting safe and effective medication use in the pediatric population.
4. Describe the role of pediatric clinical pharmacy specialist in advocating for the inherent challenges of caring for the pediatric population.

## **2022 Updates in Therapeutics®: Pediatric Pharmacy Preparatory Review and Recertification Course - Module 6: Immunology, Nephrology, Neurology/Psychiatry, Fluids, Electrolytes, and Nutrition**

Activity Number: 0217-0000-22-254-H01-P

4.25 contact hours

### **Immunology**

1. Develop a therapeutic regimen for patients with immunologic conditions.
2. Design a plan to monitor the safety and efficacy of a therapeutic regimen in patients with immunologic conditions.
3. Develop a therapeutic regimen to prevent acquisition of infection-related immunologic diseases.
4. Manage allergic hypersensitivity reactions effectively.
5. Develop an individualized immunization plan for a pediatric patient.

### **Nephrology**

1. Differentiate between treatment strategies for primary nephrotic syndrome.
2. Develop a plan for managing the long-term complications of nephrotic syndrome.
3. Identify the different grades of hydronephrosis and the grades for which treatment is indicated.
4. Determine which alkalizing agent may be appropriate for a given subset of renal tubular acidosis.
5. Identify acute kidney injury (AKI) in infants and children and know which AKI criteria are correctly applied to neonates versus children.
6. Explain to caregivers the management of common comorbidities in children with chronic kidney disease.
7. Propose empiric therapy and therapy modifications in accordance with culture results for a child with a peritoneal dialysis catheter infection.
8. Summarize the differences between atypical and typical hemolytic uremic syndrome and explain the different treatment approaches to each.

### **Neurology/Psychiatry**

1. Apply evidence-based medication therapy for acute and prophylactic treatment of migraines.

2. Distinguish between seizure medications by type of seizure, age, drug interactions, and adverse effects.
3. Differentiate between the medication therapies for cerebral palsy symptoms of spasticity, drooling, bone mineral density loss, sleep, and pain control.
4. Evaluate between the medications for autism spectrum disorders for target symptoms and adverse effects.
5. Select appropriate medication therapy and monitoring values for pediatric bipolar disorder according to symptoms, bipolar phase, and adverse events.
6. Develop treatment plans for attention-deficit/hyperactivity disorder, including medication recommendations, adverse events, and dosage formulations.
7. Identify treatment options and potential adverse effects of medications for pediatric depression.

### **Fluids, Electrolytes, and Nutrition**

1. Identify the changes in total body water, body compartments, and electrolytes during human development.
2. Interpret laboratory data and physical assessment in the evaluation of fluid status and dehydration.
3. Design intravenous fluid regimens to meet maintenance needs and to treat identified deficits based on calculated requirements.
4. Design parenteral and enteral nutrition regimens according to the changing nutrition needs and clinical status of infants and children at various stages in development.
5. Recommend appropriate therapies to manage parenteral nutrition-related complications.