
POSITION STATEMENT

Minimum Requirements for Core Competency in Pediatric Pharmacy Practice

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Colleges of pharmacy provide varying amounts of didactic and clinical hours in pediatrics resulting in variability in the knowledge, skills, and perceptions of new graduates toward pediatric pharmaceutical care. The Pediatric Pharmacy Advocacy Group (PPAG) endorses the application of a minimum set of core competencies for all pharmacists involved in the care of hospitalized children.

INDEX TERMS: competencies, pediatric pharmacy, position

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BACKGROUND

Children are not merely small adults when it comes to medication dosing and administration. Children undergo significant growth and physiologic change over time, resulting in variations in pharmacokinetic and pharmacodynamic parameters. Additionally, pediatrics is a heterogeneous population and can include children of varying weights and sizes, from the premature infant weighing 600 grams to the adolescent athlete weighing several hundred pounds. Although improving, there is a paucity of research and data regarding medications in children. Specific pediatric studies have not traditionally been performed to determine efficacy, optimal dosing, pharmacokinetics, or adverse effect profiles of many medications. Much of current practice in medication use for children is extrapolated from adult studies. Off-label prescribing is commonplace, although its frequency is influenced by many factors including practice setting and patient age.^{1–5}

Colleges of pharmacy provide varying amounts of didactic and clinical hours in pediatrics resulting in variability in the knowledge, skills, and perceptions of new graduates toward pediatric pharmaceutical care. In a survey by Prescott et al,⁶ the mean number of didactic hours in Doctor of Pharmacy programs related to pediatric topics

was 21.9 ± 22.9 with a range of 1 to 153 hours. A limited number of pharmacists pursue formal advanced training in pediatrics through completion of residencies or fellowships, which are optional following licensure. To date, there are about 46 first year postgraduate pharmacy residencies (PGY1) at children's hospitals and 47 American Society of Health System Pharmacy-Accredited second year postgraduate pharmacy residency (PGY2) programs.⁷ As a result of the limited number of pharmacists trained in pediatrics, extensive on-the-job training is often necessary to reach a minimum level of competency.

RATIONALE AND RECOMMENDATIONS

Any pharmacist caring for children in a hospital setting should demonstrate proficiency in core knowledge and skills before practicing independently. Pharmacists who have not completed residency training in a pediatric facility may have to gain this minimal level of competency through institution-based on-the-job training programs. Currently, there are no suggested minimal competencies for entry-level pharmacists caring for children in the health-system setting. Table 1 includes suggested topics for skill and knowledge development for entry-level pharmacists caring for hospitalized children. Though this is not

Table 1. Suggested Knowledge Topics and Skills for Pharmacists Caring for Hospitalized Children

Basic Topics for All Pharmacists	Additional Topics*
Weight-based dosing and calculations	Total parenteral nutrition
Problematic medication additives and preservatives	Intravenous drug administration devices and techniques
Appropriate pediatric references	Aminoglycoside and vancomycin pharmacokinetics
Appropriate dosage form selection	Communicating with children and caregivers
Appropriate medication routes of administration and volumes	Improving medication palatability, oral drug administration devices, and techniques
Maintenance fluid selection and calculations	Pediatric/neonatal advanced life support medication dosing and preparation
Developmental pharmacokinetics	Medications and human milk
Normal for age laboratory values and associated calculations (e.g., creatinine clearance, ideal body weight)	
Common pathogens and empiric antibiotic regimens for children	
Knowledge of clinical practice guidelines that include pediatric patients (e.g., community acquired pneumonia, anticoagulation)	

* On the basis of services provided

an exhaustive list, it may give employers some guidance on content to include in their programs. Employers should evaluate what services their institutions offer and try to match their minimal competencies to encompass those areas. For example, an institution whose sole pediatric population is in the neonatal intensive care unit should direct their training to the minimal competencies necessary to care for neonates.

A variety of training models would be appropriate to achieve the recommended goals. Possible options include self-directed learning modules, instructor-led learning, continuing education programming, experiential learning with a PGY2-trained pediatric pharmacist, and case-based and/or skill-based activities. Examples of some of these strategies have been published.⁸⁻¹⁰ Each of these approaches could involve the use of pre- and postassessment tools to gauge the learner's understanding and application of the material. One example of an existing program is the on-line continuing education program, "Pediatric Age-Based Competencies," available through PPAG. This program consists of a variety of different presentations on introductory pediatric topics. Table 2 includes a list of resources that employers can utilize to develop training modules or make available to entry-level phar-

macists for self-directed learning.

CONCLUSION

Most entry-level pharmacists receive limited formal training in pediatric pharmacotherapy within their Doctor of Pharmacy curricula. On the basis of the pediatric population within their institutions, employers should establish a minimal level of competency for entry-level pharmacists caring for hospitalized children. PPAG acknowledges that these minimal competency training programs are essential. However, at this time, PPAG cannot endorse one program over another. The selection of a training program must be based on the institution's patient demographics, services offered, resources available, and time allotted for training programs.

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Abbreviations PGY1, first year postgraduate pharmacy residencies; PGY2, second year postgraduate pharmacy residency; PPAG, Pediatric Pharmacy Advocacy Group

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Table 2. Suggested Resources for Development of Pediatric Pharmacy Competencies

Resource	Reference	Advantages	Disadvantages
Pediatric Pharmacotherapy	Nahata M, Benavides S, eds. <i>Pediatric Pharmacotherapy</i> . Lenexa, KS: American College of Clinical Pharmacy; 2013.	This is a general textbook that was designed for the student learner, and provides an overview of age-related pharmacokinetic changes, nutrition, and other miscellaneous disease states.	The textbook does cover advanced topics for seasoned practitioners. The reference does not provide in-depth drug information.
Advanced Pediatric Therapeutics	Eiland L, Todd T, eds. <i>Advanced Pediatric Therapeutics</i> . Memphis, TN: Pediatric Pharmacy Advocacy Group; 2015.	This book is intended for experienced practitioners and covers clinical controversies and cases for selected pharmacotherapeutic areas.	The textbook requires that pharmacists have a background knowledge of the disease state and therapeutic area.
Pediatric and Neonatal Drug Information Handbook	Takekomo CK, Hodding JH, Kraus DM, eds. <i>Lexi-Comp's Pediatric and Neonatal Dosage Handbook</i> . 20th ed. Hudson, OH: Lexi-Comp; 2015.	The most comprehensive dosage reference for pediatric patients including off-label dosing; includes recipes for published extemporaneous formulations.	Updated periodically; dosage recommendations vary (e.g., mg/kg/dose versus mg/kg/day in divided doses).
Drug Prescribing in Renal Failure: Dosing Guidelines for Adults and Children	Aronoff GA, Bennett WM, Berns JS, et al. <i>Drug Prescribing in Renal Failure: Dosing Guidelines for Adults and Children</i> . 5th ed. Philadelphia, PA: American College of Physicians; 2007.	Good reference for determining the appropriate dose adjustment required in pediatric and adult patients on the basis of glomerular filtration rate. Each dose recommendation includes the level of evidence to support it (e.g., case reports, randomized controlled trials).	Updated periodically; Recommendations based on "normal" dosing range but may not reflect dosing for specific indications.
The Harriet Lane Handbook	Engorn B, Flerlage J, ed. <i>The Harriet Lane Handbook</i> . 20th ed. Philadelphia, PA: Elsevier Mosby; 2015.	Good reference for pediatric diseases and vital sign ranges.	Drug dosing information is limited.
Neofax	Truven Health Analytics	Dosage reference specific to the neonatal population.	Available only online.
Nelson's Textbook of Pediatrics	Kliegman RM, Stanton B, St Geme J, Schor N eds. <i>Nelson's Textbook of Pediatrics</i> . 20th ed. Philadelphia, PA: Elsevier Saunders 2015.	Provides in-depth overview of pediatric diseases and stages of development.	Updated periodically; provides limited drug dosing information.
Red Book	apredbook.aapublications.org or Red Book: 2015 Report of the Committee on Infectious Diseases, 30th ed.	Publication of the American Academy of Pediatrics Committee on Infectious Diseases; provides disease and treatment option overviews for various pediatric infectious diseases.	Provides limited drug dosing recommendations.
The Teddy Bear Book: Pediatric Injectable Drugs	Phelps SJ, Hagemann TM, Lee KR, Thompson AJ, eds. <i>The Teddy Bear Book: Pediatric Injectable Drugs</i> . 10th ed. Bethesda, MD: American Society of Health System Pharmacists; 2013.	Excellent reference for IV medication preparation and administration (e.g., concentrations, dosing); application available for electronic devices (Peds Inject).	Updated periodically; no specific disease state information.
Medications and Mothers' Milk 2014: A Manual of Lactational Pharmacology	Hale TW, Rowe HE. <i>Medications and Mothers' Milk 2014: A Manual of Lactational Pharmacology</i> . 16th ed.	Evidenced-based information on medications in breastfeeding women.	Updated periodically.

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