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Improving pediatric pharmacy services in a primarily adult emergency department

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Purpose. The American Society of Health-System Pharmacists (ASHP) and Pediatric Pharmacy Advocacy Group (PPAG) guidelines for providing pediatric pharmacy services in hospitals and health systems can be used to improve medication safety wherever pediatric patients receive care, including in the emergency department (ED). The purpose of this initiative was to improve compliance with these guidelines in a primarily adult ED.

Methods. This quality improvement initiative was conducted in a level 1 trauma center ED between October 2019 and March 2020. The ASHP-PPAG guidelines were used to create practice elements applicable to the ED. An initial compliance assessment defined elements as noncompliant, partially compliant, fully compliant, or not applicable. Investigators identified interventions to improve compliance for noncompliant or partially compliant elements and then reassessed compliance following implementation. Data were expressed using descriptive statistics. This initiative was exempt from institutional review board approval.

Results. Ninety-three ED practice elements were identified within the 9 standards of the ASHP-PPAG guidelines. At the initial compliance assessment, the majority (59.8%) of practice elements were fully compliant; however, various service gaps were identified in 8 of the standards, and 16 interventions were implemented to improve compliance. At the final compliance assessment, there was a 19.5% increase in full compliance. Barriers to achieving full compliance included technology restrictions, time constraints, financial limitations, and influences external to pharmacy.

Conclusion. This quality improvement initiative demonstrated that the ASHP-PPAG guidelines can be used to improve ED pediatric pharmacy services in a primarily adult institution. The initiative may serve as an example for other hospitals to improve compliance with the guidelines.

Keywords: emergency, pediatrics, pharmacy services, quality improvement

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The pediatric population has unique healthcare needs and therefore can be particularly vulnerable to harm.[1,2] Pediatric patients experience a higher rate of medication errors than adults and may be subject to more adverse drug reactions as well.[1] The rate of medication errors in children may be as much as 3 times that in adults.[3] Factors contributing to this elevated risk include age-specific medication contraindications, need for personalized dosing strategies, nonpediatric providers, and a lack of pediatric safety alerts within information technology systems.[2,4-6] When adverse medication events occur in children, they are associated with a higher rate of morbidity and mortality than in adults, likely owing to a lower tolerance for errors.[2]

Children often receive initial disease management from adult acute care hospitals where pediatric resources may not be optimal.[2] These frontline health systems typically provide care for both adults and children, but tend to be more adult oriented, which can negatively influence outcomes for pediatric patients. While pediatric patients often represent a

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minority of encounters in these primarily adult facilities, they still commonly receive care in the emergency department (ED). The ED is a particularly high-risk environment owing to complex patients largely unknown to staff, verbal orders, hectic situations, and frequent transitions of care.[4] Of particular focus is the medication use process, which has amplified risks in the pediatric population. As exposure to and experience caring for pediatric patients decrease, the risk for errors in the medication use process is compounded.[2] It is essential for adult institutions providing pediatric pharmacy services to address the safety needs of this vulnerable population.

In an effort to meet the special needs of pediatric patients and supplement the minimum standards for hospital pharmacy practice, the American Society of Health-System Pharmacists (ASHP) and the Pediatric Pharmacy Advocacy Group (PPAG) published guidelines in 2018 addressing the provision of pediatric pharmacy services in health systems. Although the PPAG is now known as the Pediatric Pharmacy Association (PPA), it will be referred to as PPAG throughout this article to reflect the guidelines as previously published. The guidelines provide recommendations for the delivery of safe, effective, innovative, and economical care throughout the medication use process,[7] and they should be used to mitigate medication safety risks for pediatric patients wherever they receive care, including in the ED. The purpose of this initiative was to improve compliance with the ASHP-PPAG guidelines in a level 1 trauma center ED that primarily serves an adult patient population.

Methods

This was a quality improvement initiative conducted at a level 1 trauma center ED within a large academic medical center located in Detroit, MI. The hospital is 1 of 5 acute care facilities within a comprehensive, integrated, nonprofit healthcare organization in southeast and central Michigan. Each acute care hospital has an ED, and there are 4 additional ED satellite locations. The initiative site is an adult facility that provides care to pediatric patients only in the ED. In 2019, the institution had more than 100,000 ED encounters, 4.7% of which were pediatric patients who were15 years of age or younger. Of these pediatric visits, 72% represented medical diagnoses, 13% represented trauma, 8% represented psychiatric and social diagnoses, and the diagnosis code could not be determined for 7% of them. The age threshold of 15 years for characterizing patients as pediatric in this initiative was chosen on the basis of the definition for the health system, in which safety and monitoring parameters within the electronic medical record are set to those of a pediatric patient when patient age is less than or equal to 15 years.

ED clinical pharmacy services at the site are provided 24 hours a day, 7 days a week. These services include prospective and retrospective medication order review, medication optimization, participation in medical and trauma resuscitations and other emergent procedures, and consultations with providers and nurses. Operational services include medication compounding and dispensing. ED pharmacists are also involved with quality improvement projects, medication use policy development, and training for pharmacy residents and students. This initiative was conducted over a 6-month period and was exempt from institutional review board approval. All activities were done for the purposes of quality improvement, not research.

The goal of this initiative was to identify gaps in compliance with the ASHP-PPAG guidelines for providing pediatric pharmacy services in hospitals and health systems and implement interventions to improve guideline compliance and ED pharmacy services. This was done by creating and performing a gap analysis, improving pharmacy services identified as deficient by the gap analysis, and determining barriers where compliance could not be achieved. All steps of this initiative were conducted by the investigators with input from a pharmacist who is a pediatric content expert. The investigators included a full-time ED clinical pharmacist, the ED pharmacy team leader, and a postgraduate year 1 (PGY1) pharmacy resident. The ED pharmacy team leader is a pharmacy specialist responsible for clinical and operational services, regulatory compliance, and quality improvement. The role of the PGY1 pharmacy resident included initiative design, development of the protocol and gap analysis, communication with the institutional review board, data collection and analysis, identification and implementation of interventions, and manuscript development. The content expert, an author of the ASHP-PPAG guidelines who is not associated with the institution, was consulted to ensure statements from the guidelines were interpreted accurately, to provide

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oversight in the compliance review, and to evaluate interventions implemented by the investigators.

To objectively evaluate compliance with the guidelines, a set of standard statements were extrapolated from the text of the guidelines. Wording of the recommendations was taken directly from the guidelines and formatted to address ED pharmacy services. These "ED practice elements" are listed in the Appendix. Any recommendation made within the guidelines document was included as an ED practice element, with 2 exceptions. The sections related to outpatient pharmacy services and testing of dosage forms were not deemed pertinent for the purposes of this specific initiative because they did not reflect a pharmacy service specific to the ED practice setting, and these were therefore excluded. The content expert reviewed the ED practice elements to ensure accuracy and recommended updated wording as necessary for clarity. Creation of the ED practice elements necessitated the inclusion of a plan for consensus between the investigators and the pediatric content expert to ensure interpretation of the guideline recommendations was similar between the authors. Any disparities were discussed within the group until consensus was achieved.

The ED practice element statements were used to perform a gap analysis by evaluating compliance of pharmacy services compared to the ASHP-PPAG guidelines. Initial compliance was assessed in October 2019. Each ED practice element was identified as noncompliant, partially compliant, fully compliant, or not applicable. Noncompliant was defined as a pharmacy service not implemented. Partially compliant was defined as a pharmacy service that was not consistently provided or was in the process of being implemented at the time of the assessment. Fully compliant was defined as a pharmacy service that was always provided and represented the pharmacy department's desired level of practice for ED pediatric patients. ED practice elements were designated as not applicable if they were not pertinent to this institution's ED pharmacy services or model but could be pertinent at other EDs in the health system or nation. ED practice elements identified as "not applicable" differ from the guideline sections that were initially excluded as "not pertinent" in that they are still applicable to ED pharmacy services in general, just not at this institution.

For ED practice elements identified as deficient (noncompliant or partially compliant) during the initial assessment, the investigators developed interventions to improve compliance. The content expert assessed the interventions for their ability to improve compliance. If a proposed intervention would not improve compliance, the intervention was modified based on the content expert's recommendation. When interventions involved departments outside of pharmacy, the investigators collaborated with other departments to secure approval of the intervention and its implementation. Discussions with key stakeholders in the pharmacy department and other disciplines took place between November 2019 and February 2020. The authors provided the written ASHP-PPAG guidelines to key stakeholders, explained the compliance assessment process, discussed the deficiencies, and recommended improvements. Pharmacy and key stakeholders determined the steps to implement changes, such as inclusion of other disciplines, committee approvals, and, if necessary, funding. Following implementation of the interventions, final compliance was assessed in March 2020 utilizing the same method as the initial compliance assessment. Improvement in compliance was defined as a change in ED practice element designation from noncompliant to partially or fully compliant or from partially to fully compliant.

The investigators reviewed the ED practice elements remaining deficient at the time of the final compliance assessment and determined barriers to improving compliance. Barriers were determined among the investigators based on knowledge of the ED pharmacy services. Initial and final compliance assessment data were evaluated using Microsoft Excel (2013) (Microsoft Corporation, Redmond, WA). Results are presented using descriptive statistics as nominal data and percentage of compliance.

Results

A total of 93 ED practice elements were extrapolated from the ASHP-PPAG guideline recommendations, representing 9 unique practice standards (Appendix). The majority of ED practice elements were categorized under standard I for practice management. Upon initial compliance assessment, 6 ED practice elements were identified as not applicable to the institution's ED pharmacy services or practice model at the location of this initiative, so they were not included in the remainder of the gap analysis. These included recommendations for the absence of 24-hour pharmacy services (ED practice element 1.02, Appendix); pharmacy participation in immunization programs (1.09); use of pharmacy technician services (1.16, 1.17); point-of-care technology specific to smaller syringes and armbands (1.41); and extemporaneous compounding of noncommercially available medications (5.03). These elements were not applicable to this hospital ED because 24-hour pharmacy services are available, immunization programs and pharmacy technicians are not currently employed in the ED, appropriate syringe and armband sizes are utilized, point-of-care technology is not affected, and only commercially available products are dispensed. After excluding these 6 practice elements, there were a total of 87 practice elements for which to evaluate pharmacy services for the ED.

Pharmacy services were fully compliant with the majority (59.8%) of ED practice elements at the time of the initial compliance assessment (Table 1); however, this only represented full compliance with 1 of the 9 standards

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Table 1. Initial and Final Compliance Results

Practice Standard	Compliance Designation	Initial Compliance, No. (%)	Final Compliance, No. (%)
I: Practice management	Fully compliant	27 (31)	37 (42.5)
	Partially compliant	7 (8)	3 (3.4)
	Noncompliant	11 (12.6)	5 (5.7)
II: Medication use policy development	Fully compliant	5 (5.7)	5 (5.7)
	Partially compliant	0	0
	Noncompliant	2 (2.3)	2 (2.3)
III: Optimizing medication therapy	Fully compliant	4 (4.6)	4 (4.6)
	Partially compliant	1 (1.1)	1 (1.1)
	Noncompliant	2 (2.3)	2 (2.3)
IV: Managing inventory	Fully compliant	1 (1.1)	1 (1.1)
	Partially compliant	0	0
	Noncompliant	0	0
V: Preparing, packaging, and labeling medications	Fully compliant	5 (5.7)	6 (6.9)
	Partially compliant	1 (1.1)	0
	Noncompliant	0	0
VI: Medication delivery	Fully compliant	5 (5.7)	7 (8)
	Partially compliant	3 (3.4)	1 (1.1)
	Noncompliant	1 (1.1)	1 (1.1)
VII: Monitoring medication use	Fully compliant	2 (2.3)	3 (3.4)
	Partially compliant	0	0
	Noncompliant	1 (1.1)	0
VIII: Evaluating the effectiveness of the medication use system	Fully compliant	3 (3.4)	5 (5.7)
	Partially compliant	1 (1.1)	1 (1.1)
	Noncompliant	4 (4.6)	2 (2.3)
IX: Research	Fully compliant	0	1 (1.1)
	Partially compliant	0	0
	Noncompliant	1 (1.1)	0
Total	Fully compliant	52 (59.8)	69 (79.3)
	Partially compliant	13 (14.9)	6 (6.9)
	Noncompliant	22 (25.3)	12 (13.8)

(practice standard IV, managing inventory). About 15% of the elements were partially compliant and 25% were noncompliant, which represented possible opportunities to improve compliance. Gaps in full compliance were found in the following areas: participation in pediatric organizations (ED practice element 1.03, Appendix); pediatric-trained pharmacist involvement with emergency preparedness, information technology workflow, pediatric pump maintenance, hospital committees responsible for pediatric patients, and pediatric antimicrobial stewardship (1.07, 1.30, 1.44, 1.45, 1.48-1.50, 8.08); ED pharmacist position description reflecting pediatric care (1.10); standardized pediatric competency (1.14, 1.19); formalized workflow for staffing shortages (1.20); pediatric staff development topics (1.21, 3.02); automation, including profiled automatic dispensing cabinets

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Table 2. Interventions Identified to Improve Compliance

Practice Standard	Proposed and Implemented Interventions (Practice Element)
I: Practice management	ED pharmacist with pediatric training will join a national pediatric organization to keep up to date with current clinical trends and identify topics for continuing pharmacist development (1.03, 1.49)[a]
	Add ED pharmacist with pediatric training as a consultant to the hospital emergency preparedness team and all committees responsible for decisions regarding pediatric medication therapy in the ED (1.07, 1.50)[a]
	Update the ED pharmacist role and training document and ED pharmacist certification requirements to include pediatric role and training (1.10)[a]
	Create annual ED pharmacist pediatric competency (1.14, 1.19, 1.21)[a]
	Add an ED pharmacist staffing shortage plan to the departmental ill-call plan (1.20)
	Involve ED pharmacist with pediatric training with clinical decision support systems (1.30)[a]
	Purchase and implement ED pediatric syringe pumps (1.36, 1.46)
	Integrate drug-disease state checking for both ED and discharge medication orders (1.42)[a]
	ED pharmacist with pediatric training will maintain the pediatric parameters in the smart pump library (1.44)[a]
II: Medication use policy development	Implement medication use evaluation involving pediatric patients in the next year (2.05)
V: Preparing, packaging, and labeling medications	Improve barcode scanning labeling for ED pediatric medications (5.07)
VI: Medication delivery	Ensure pharmacist verification of all ED pediatric orders (6.03, 6.04)
VII: Monitoring medication use	Update oral liquid medication records for ambulatory prescriptions to include a note to pharmacy recommending education on appropriate use of a metric measuring device (7.02)[a]
VIII: Evaluating the effectiveness of the medication use system	Integrate ED pharmacist with pediatric training into antimicrobial stewardship workflow (8.08)[a]
	Implement a quarterly report for pediatric medication safety events and share at ED pharmacist team meeting (8.01)[a]
IX: Research	The initiative will serve as a research effort (9.01)

Abbreviation: ED, emergency department.
[a]Intervention impacted the health system, not just the site of the initiative.

(ADCs; 1.36, 6.05); barcode scanning (1.37, 5.07); drug-disease state checking software (1.42); lack of syringe pumps and patient-controlled analgesia (1.46); pediatric research, including quality improvement initiatives (2.05, 8.01, 8.04, 8.05, 9.01); documentation (2.06, 6.06); a pediatric pharmacy specialist (3.04); transitions of care (3.06); prospective and retrospective order verification (6.03, 6.04); education regarding measurement of liquid medications (7.02); and evaluation of overrides (1.47, 8.06).

A total of 16 interventions were identified to improve compliance for 22 ED practice elements initiallyidentified as noncompliant or partially compliant (Table 2). The number of fully compliant ED practice elements increased by 19.5% (52 vs 69) at the time of the final compliance assessment following these interventions (Table 1). Additionally, the number of partially compliant elements decreased by 8% (13 vs 6) and the number of noncompliant elements decreased by 11.5% (22 vs 12). A total of 18 practice elements remained either noncompliant or partially compliant. Barriers to achieving full compliance included technology restrictions, quality initiative time constraints, financial limitations, and influences external to pharmacy.

Interventions to increase compliance improved ED pharmacy services provided to the vulnerable pediatric population. In addition, increased compliance with the elements ultimately increased compliance with all 9 standards. Before this initiative, some ED pharmacy services were noncompliant or partially compliant with the guidelines. For example, commonly prescribed products were missing barcode labels and not all pediatric orders were prospectively reviewed by a pharmacist. Specific interventions included

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adding a barcode to commonly prescribed medications to help facilitate bedside barcode medication administration and updating the electronic medical record so that all ED pediatric orders required verification by a pharmacist. These interventions increased the number of pediatric medication orders prospectively reviewed by a pharmacist. Interventions to improve compliance with additional elements included creation of a pediatric competency for ED pharmacists to ensure adequate knowledge of common pediatric care, as well as including a standard note to outpatient pharmacies encouraging patient education on an appropriate metric measuring device for oral liquid medications prescribed at discharge. Interventions targeted at increased compliance with these elements ultimately improved compliance with the 9 standards overall. The full list of interventions can be found in Table 2.

Discussion

The ASHP-PPAG guidelines for providing pediatric pharmacy services in hospitals and health systems represent a desired level of pharmacy practice. The pharmacy department continuously evaluates pharmacy practice to ensure that it meets accreditation standards and follows best practices. Because the inpatient area of the hospital provides care to adult patients and ED pediatric patients are referred to pediatric hospitals, pharmacy services for the vulnerable pediatric population had not previously been a specific focus. However, as the ED provides care to pediatric patients, it was essential to evaluate pharmacy services for this population. Creating ED practice elements from the guidelines provided a more objective evaluation of pediatric pharmacy services on which to base the review. It also helped identify specific areas where ED pharmacy services could be improved. Over the course of this quality improvement initiative, full compliance with guideline recommendations was increased by almost 20% without changing the ED pharmacy practice model or requiring additional staff. In addition, one-third of the interventions from this initiative influenced pediatric medication safety in all acute care hospital EDs in the health system, not just at the primary site, and therefore resulted in improved pediatric safety throughout the health system (Table 2).

As described in the results, barriers to achieving full compliance for some ED practice elements included technology restrictions, quality initiative time constraints, financial limitations, and influences external to pharmacy. The institution utilizes nonprofiled ADCs for the majority of medications administered. If ED ADCs were profiled, the number of orders needing prospective order review would significantly increase and require the hiring of additional ED pharmacists. Therefore, changes would need to be made to the current staffing model to accommodate this increase in order volume. This would include hiring additional ED pharmacists to prospectively review all ED orders while sustaining the same ED pharmacist level of care or modifying the pharmacy department model so that non-ED pharmacists could verify ED medication orders from a different location. Financial limitations prevented the hiring of additional ED pharmacy staff. The institution plans to evaluate the hospital pharmacy practice model to identify ways in which it could increase prospective medication order review for all ED patients.

As it was not financially feasible to hire a board-certified pediatric pharmacist, financial limitations also impacted compliance with the ED practice elements related to the integration of a pediatric pharmacy expert into the ED workflow. Instead, an ED pharmacist with pediatric training in a postgraduate year 2 residency serves as the ED pharmacist with pediatric training. Time constraints also limited the ability to conduct a medication use evaluation during this initiative, but this was designed and started shortly after the ED initiative, thus improving overall compliance with the practice elements. Another outstanding intervention that could not be fully completed before the final compliance assessment was the implementation of syringe pumps at the institution. Because the purchase, training, and maintenance of these devices is a nursing responsibility at this institution, there were barriers external to pharmacy that prevented full compliance with this element during the initiative period. However, the nursing department purchased the devices and developed a nursing competency shortly after this initiative was completed, further improving compliance.

This initiative describes use of the ASHP-PPAG guidelines to evaluate ED pharmacy services. There is currently a paucity of literature discussing the delivery of pharmacy services to ED pediatric patients and ways to improve pediatric medication safety in EDs servicing primarily adult patients. Previous research supports the need for improving pediatric pharmacy services given that the rate of medication errors resulting in harm or death in children is higher than in adults (31% vs 13%, respectively).[8,9] Alvarez et al[10] conducted a gap analysis in 2016 to evaluate the presence of pediatric pharmacy services in medical centers servicing a majority-adult demographic. The authors found a reduction in the risk of medication errors following the implementation of various interventions focused on pediatric pharmacy practice. However, this work was conducted before the publication of the ASHP-PPAG guidelines, which address a significantly broader scope of pediatric pharmacy services. The ED pediatric pharmacy practice elements (Appendix), methods, and results from the current initiative could be used by other health systems to evaluate and improve their own ED pediatric pharmacy services.

The main limitation of this quality improvement initiative was the presence of observer bias. The gap analysis was completed by the investigators based on their interpretation of the ASHP-PPAG guidelines and therefore was only objective to the extent possible. To minimize subjectivity and

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bias, the investigators included an independent pediatric content expert. However, this individual, as a coauthor of the ASHP-PPAG guidelines, brings with them their own perspective, which could also be a form of observer bias. The use of multiple investigators and a plan for discussion until consensus was reached for any discrepancies made interpretation of the guidelines as impartial as possible, although this could still limit external application of the gap analysis at other institutions.

While the ASHP-PPAG guidelines generally provided specific and achievable recommendations, interpretation of the language differed among the investigators. For example, the terms "pediatric specialist" and "pediatric expert" were both used but were not defined. These 2 terms may have been intended to be interchangeable but were interpreted as 2 separate concepts by the investigators. In addition, there was minimal description of what constitutes adequate pediatric expertise and pediatric training for pharmacists. Clear verbiage on these topics would be beneficial for a nonpediatric institution where pharmacists are less likely to have postgraduate training in pediatrics or pediatric board certification. Discrepancies between intention and interpretation of guideline recommendations, such as those listed above, were only identified upon discussion of ED practice elements with the pediatric content expert. It is possible that errors may exist in the ED practice elements if any guideline statements were misinterpreted by the investigators; however, we attempted to mitigate this risk by including input from the pediatric content expert who had knowledge of the statement's intentions.

No patient data were collected as a part of this quality improvement initiative, so any influence of interventions on medication errors could not be evaluated. Future studies should evaluate whether the interventions discussed have an impact on the quality of care provided to pediatric ED patients.

Conclusion

The ASHP-PPAG guidelines provide a standard set of pharmacy practices to meet the needs of the pediatric population. This quality improvement initiative demonstrates that the guidelines can be used to improve ED pediatric pharmacy services in a primarily adult institution, with the goal of reducing errors in the medication use process. Similar to the way pharmacy practice models are routinely evaluated to ensure compliance with the ASHP minimum standard for pharmacies in hospitals, the ASHP-PPAG guidelines can be used to help ensure pharmacy departments provide the highest quality care for ED pediatric patients. Additional studies evaluating the influence of these improvements on pediatric medication error rates could be considered to provide further support for the present initiative.

Disclosures

The authors have declared no potential conflicts of interest.

Previous affiliations

At the time that experimental work was conducted, Dr. Hachem was employed at Henry Ford Hospital for her postgraduate year 1 residency.

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Appendix—Emergency Department Pediatric Pharmacy Practice Elements

Standard I: Practice management	
1.01	Pharmacy has 24-hour support for the emergency department (ED) pediatric population or a pharmacist with pediatric training is available on an on-call basis during off hours.
1.02	In the absence of 24-hour services, the Pharmacy and Therapeutics (P&T) committee, or equivalent multidisciplinary committee, has developed a list of accessible, urgent medications to be available to authorized providers at all times.
1.03	Pharmacy actively participates and collaborates with local and national organizations, especially those specific to pediatric patient care in the ED.
1.04	Policies and procedures address care of pediatric patients in the ED.
1.05	Emergency preparedness supplies at this site include the unique needs of the pediatric population.
1.06	The department's emergency preparedness plan (business continuity plan) includes procedures for providing safe and efficient pediatric pharmacy services to patients and their adult family members in case of emergencies or disaster situations.
1.07	The hospital's emergency preparedness team has pediatric pharmacy expertise.
1.08	The pharmacy is included on decisions about the contents of ED pediatric code carts, pediatric dosing references for emergency medication kits and trays, and the role of the ED pharmacist in a pediatric medical emergency.
1.09	The pharmacy participates in the development of relevant immunization programs for pediatric patients.
1.10	The ED pharmacist position description reflects service to the ED pediatric population.
1.11	A pharmacist with pediatric training is available in the ED, or available on an on-call basis.
1.12	ED pharmacists participate in ED pediatric resuscitations.
1.13	All pharmacists who work in the ED have active Pediatric Advanced Life Support, Basic Life Support, and Advanced Cardiac Life Support certification.
1.14	All pharmacists who work in the ED routinely complete a pediatric ED competency which includes mastery of pharmacokinetic and pharmacodynamic differences, weight-based dosing and calculations, fluid and nutrition requirements, common pediatric diseases and drugs, pharmacogenomics, drug information resources, and specialized drug preparation and administration techniques for pediatric patients.
1.15	All pharmacists who staff in the ED have completed an immunization certification program.
1.16	Pharmacy technicians who work in the ED have completed an American Society of Health-System Pharmacists–accredited pharmacy technician training program, are certified by the Pharmacy Technician Certification Board, and meet requirements of laws and regulations.
1.17	Pharmacy technicians who work in the ED completed a pediatric competency.
1.18	Pharmacists who work in the ED are encouraged to seek competency-related certifications or other pediatric pertinent certifications.
1.19	There is a structured procedure for ED pharmacy personnel to be oriented to acute care for the ED pediatric patient, including a competency assessment, before assuming responsibilities.
1.20	There is a written departmental staffing plan addressing how the ED pediatric patients' needs will be met during staff shortages, workload fluctuations, inclement weather, or patient acuity.
1.21	ED pharmacy staff development includes the needs of ED pediatric patients.
1.22	Adequate space, equipment, and supplies are available for professional and administrative functions related to ED pharmacy services.
1.23	ED pharmacy resources and services meet legal and regulatory requirements, are located in areas that facilitate the provision of services to patients and healthcare providers, and are integrated into the hospital's communication and delivery systems.

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1.24	The ED pharmacy facilities are suitable to enable and document receipt, storage, and preparation of medications under proper conditions of sanitation, temperature, light, moisture, ventilation, segregation, and security to ensure medication integrity and personnel safety.
1.25	The pharmacy facilities are suitable to enable the compounding, preparation, and labeling of sterile and nonsterile products, including hazardous drug products, in accordance with national and locally established quality assurance procedures for ED patients.
1.26	The ED pharmacy work environment promotes orderliness and efficiency and minimizes the potential for medication errors and contamination of products.
1.27	Computer resources are used to support the following in the ED: access to the patient medical record, documenting patient care activities, interfacing with other computerized systems, maintaining patient medication profile records, managing clerical functions, managing drug product inventories, managing electronic prescribing, performing necessary patient billing procedures, providing clinical decision support (CDS), and providing drug information.
1.28	A comprehensive pharmacy computer system is integrated with other hospital information systems and software for ED pediatric patients.
1.29	Computerized provider order entry (CPOE) order sets for ED pediatric patients are reviewed by the pharmacy department or by the pediatric pharmacy specialist.
1.30	A pharmacist with pediatric training is involved with the development and maintenance of order sets, templates, and dose ranges used in CPOE and CDS systems.
1.31	A pharmacist with pediatric training plays a leadership role in the selection of pediatric drug information resources used by ED pharmacists.
1.32	Information on pediatric dosages, extemporaneous formulations, drug compatibilities and stability, toxicology, drug effects, and safety during pregnancy and lactation are readily obtainable.
1.33	ED pharmacists have access to literature supporting the use of drugs for unlabeleduses in pediatric patients.
1.34	All ED healthcare personnel can access electronic drug information resources for pediatric patients.
1.35	Drug information resources have the capability to provide hard copies of drug information or counseling points for the pediatric population that the pharmacist can provide to the patient and caregiver.
1.36	Automation is used and able to accommodate pediatric dosage forms, dosage amounts, and delivery rates (neonatal intravenous syringes, oral liquid dose forms) in the ED.
1.37	Barcode administration rates are evaluated for ED pediatric patients.
1.38	The pharmacy information system indicates the medication dose and volume for ED pediatric patients.
1.39	The barcode or radio frequency identification technology provides electronic tracking and decision support around the 5 rights of medication administration to ED pediatric patients.
1.40	ED nursing documentation includes reasons for late doses as well as reasons for not administering to ED pediatric patients.
1.41	Point-of-care technology is evaluated for success rates in scanning labels on smaller syringe dosages and on armbands sized for infants and young children.
1.42	The electronic (E)-prescribing system includes age- and weight-specific drug dose checking and drug-allergy, drug-drug interaction, and drug-disease state checking for both ED and discharge medication orders.
1.43	The E-prescribing system is integrated into the electronic medical record (EMR).
1.44	The smart pump medication library in the ED includes pediatric parameters and is maintained by a pharmacist trained in pediatrics.
1.45	The smart pump medication library is reviewed at least annually, dose alerts installed as appropriate, and pump usage monitored closely.

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1.46	The smart infusion pumps used in the ED include large-volume bag pumps, small-volume syringe pumps, and patient-controlled analgesia pumps.
1.47	Pump usage in the ED is monitored to ensure providers of care use the library and are not overriding safeguards for pediatric patients.
1.48	There is a pediatric-specific workgroup with a pediatric-trained pharmacist to consider workflow and needs for ED pediatric patients, when CDS is used.
1.40	The ED pharmacists are actively involved with local, state, or national organizations associated with pediatric patient care.
1.50	A pharmacist with pediatric training is a member of, or is consulted by, all ED and hospital committees responsible for decisions regarding pediatric medication therapy in the ED.
Standard II: Medication use policy development	
2.01	ED policies, protocols, and guidelines which involve pediatric patients are developed or reviewed by a pharmacist with pediatric training.
2.02	A pharmacist with pediatric training is involved in the development, implementation, and assessment of pediatric care plans, standing orders, and order sets that involve medication therapy in the ED.
2.03	There is a process in place to ensure the ED has access to medications used for acute care needs of ED pediatric patients.
2.04	A well-controlled formulary of approved medications is maintained and regularly updated by the P&T committee, who also regularly review the formulary for pediatric efficacy and safety information.
2.05	Medication use evaluations include the ED pediatric population.
2.06	Pharmacy has a process for documenting and ensuring the quality of responses to drug information requests for ED pediatric patients.
2.07	Pharmacy has a plan to disseminate pertinent drug information to hospital staff and providers which could impact ED pediatric patients.
Standard III: Optimizing medication therapy	
3.01	ED clinical pharmacy services include but are not limited to drug therapy monitoring, drug information, medication profile review, adverse drug event surveillance, patient education and discharge counseling, and, when appropriate, medication reconciliation.
3.02	Additional services include routine nursing and prescriber education and other medication safety and quality initiatives.
3.03	ED pharmacy process to obtain a medication history includes pediatric patient medical histories.
3.04	There is a pediatric pharmacy specialist in the ED.
3.05	ED pharmacists have the ability to document pharmacy services in the EMR for pediatric patients.
3.06	ED pharmacists assume responsibility for continuity of care for pediatric patients.
3.07	ED pharmacy services include medication and immunization histories for pediatric patients, when appropriate.
Standard IV: Managing inventory	
4.01	Pharmacy leadership communicates operational and clinical changes impacting ED pediatric patients due to drug shortages.
Standard V: Preparing, packaging, and labeling medications	
5.01	Drug formulations, dosage forms, strengths, and packaging needed for ED pediatric care that are not available commercially for pediatric patients are prepared by appropriately trained personnel in accordance with applicable practice standards and regulations for ED pediatric patients.
5.02	Standardized concentrations of commercially available products are utilized to reduce medication errors.

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5.03	The pharmacy prepares and compounds medications that are not available commercially but are needed for pediatric patients in the ED.
5.04	The use of medications for ED pediatric patients that require nurses to withdraw doses from a container, reconstitute drug powder, label a container, or split a tablet is avoided to the extent possible.
5.05	The use of sterile medications compounded outside the ED pharmacy is avoided to the extent possible.
5.06	When sterile products are used in urgent or emergent circumstances in the ED, the pharmacy has procedures for aseptic preparation, quality assurance, expiration dating, and ongoing competency evaluations for compounding personnel.
5.07	All medication orders for ED pediatric patients are scanned prior to administration.
Standard VI: Medication delivery	
6.01	The metric system is used for ordering oral liquid medications for the ED pediatric population.
6.02	ED pediatric medication orders include the patient's allergies, weight in kilograms, height in centimeters, a weight-based dose designation, and a total dose, where applicable.
6.03	Medication orders for ED pediatric patients are prospectively reviewed by a pharmacist with adequate pediatric training and assessed in relation to pertinent patient and clinical information before the first dose is available, except in emergent situations where treatment would be compromised by a pharmacist's review.
6.04	There is a procedure for retrospective review of ED pediatric medication orders administered in emergent situations.
6.05	The automated dispensing cabinets use profile-based technology integrated with remote medication order-entry capabilities.
6.06	ED pharmacist consultations are documented in the medical record.
6.07	Administration technology consideration shall include standard concentrations, patient size, and administration rate.
6.08	ED personnel who administer medications to pediatric ED patients are appropriately trained and authorized.
6.09	ED pediatric patients with insulin pumps (or their caregivers) demonstrate competence in pump use to ensure appropriate administration.
Standard VII: Monitoring medication use	
7.01	ED pharmacists provide medication therapy monitoring for ED pediatric patients, including medications with a narrow therapeutic window, and document this in the EMR.
7.02	Pediatric ED patients, or their caregivers, are educated about the proper measurement for liquid formulations.
7.03	ED pharmacists provide medication education, including adherence, to pediatric ED patients or their caregivers, as appropriate.
Standard VIII: Evaluating the effectiveness of the medication use system	
8.01	There is an ongoing, systematic program for quality assessment and improvement of ED pharmacy services for pediatric patients.
8.02	Near-miss and adverse events for ED pediatric patients are reported in the institution's error reporting system.
8.03	The pharmacy has an ongoing process for consistent documentation of all pharmacy interventions, pediatric patient care services provided by ED pharmacists, and patient outcomes from therapy.
8.04	The pharmacy has metrics to monitor and document ED pharmacy workload for pediatric patients.
8.05	Pharmacy's ongoing evaluation of pediatric medication use identifies areas to improve ED pediatric medication prescribing.

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8.06	Pharmacy reviews and revises pediatric-specific requirements for medication management, including considerations for look-alike/sound-alike drugs, high-alert medications, ready-to-administer doses, turnaround times, overrides, and medication storage and labeling.
8.07	Pharmacy has a system to evaluate medication errors (proactively from other sources, and retrospectively in the institution's error reporting system) to determine interventions and prevent medication errors for ED pediatric patients.
8.08	A pharmacist with pediatric training is devoted to antimicrobial stewardship for the ED pediatric population.
Standard IX: Research	
9.01	The pharmacy has included the ED pediatric population in research efforts, including medication use evaluations, in the past 3 years.

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