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CONTINUING EDUCATION

Approach to the Pediatric Prescription in a Community Pharmacy

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Pediatric patients are more susceptible to medication errors for a variety of reasons including physical and social differences and the necessity for patient-specific dosing. As such, community pharmacists may feel uncomfortable in verifying or dispensing a prescription for a pediatric patient. However, the use of a systematic approach to the pediatric prescription can provide confidence to pharmacists and minimize the possibility of a medication error. The objective of this article is to provide the community pharmacist with an overview of the potential areas of medication errors in a prescription for a pediatric patient. Additionally, the article guides the community pharmacist through a pediatric prescription, highlighting common areas of medication errors.

INDEX TERMS drug compounding, medication errors, pediatrics, pharmacies, prescription

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INTRODUCTION

Pediatric prescriptions are often a source of anxiety for community pharmacists. Reasons for this may be due to the lack of pediatric education in pharmacy school[1,2] or infrequent dispensing of pediatric prescriptions. Additionally, the medical management of the pediatric patient presents unique challenges throughout the medication use process due to physical and social differences. Pediatric patients encompass a variety of ages, weights, and body surface areas which require patient-specific dosing calculations. Also, a suitable formulation is not always available for a pediatric patient, requiring the pharmacist to extemporaneously compound a specific product. In addition, medication administration is typically dependent upon a parent or caregiver. Therefore, it is important that the pharmacist provide proper patient education to both the patient and caregiver regarding strategies to aid with administration such as how to use an appropriate measuring device.

Pediatric patients are also more vulnerable to the effects of a medication error and may experience a more serious adverse drug reaction than an adult, due to differences in weight or body surface area and because of the varying ability to metabolize and excrete medications.[3] Furthermore, children may not be able to recognize and communicate the initial signs and symptoms of a medication adverse effect.[4]

The objective of this article is to provide an overview of potential areas of medication errors in a prescription for a pediatric patient. Additionally, the article provides guidance to the community pharmacist on the medication use process for a pediatric patient, which includes an approach to reviewing and verifying prescriptions, in an effort to minimize medication errors in this patient population.

MEDICATION ERRORS

Medication errors may occur in any of the steps of the medication use process: prescribing, preparation (especially with extemporaneously-prepared products), dispensing, and administration. Minimal data are available regarding the frequency of pediatric medication errors in the community setting. In one study, which included 1933 prescriptions dispensed to the same number of children, a total of 15% of the dispensed medications contained a medication error.[5] Of the medication errors identified, 8% were considered overdoses, and 7% were considered subtherapeutic dosing. In children younger than 4 years of age, 20% of medications dispensed had an over- or underdose medication

Table 1. Common Pediatric Prescription Prescribing Errors[6,7]

• Calculation errors
• Total daily dose prescribed instead of dividing into recommended frequencies
• Ten-fold dosing errors due to trailing zeros
• Dose written in milliliters rather than milligrams (with no strength specified)
• Failure to recognize maximum or standard adult dosing
• Lack of specifying which component the dose is based on for a multi-ingredient medication

error. This study measured only prescribing errors; therefore, the true rate of all medication errors (e.g., dispensing, administration) is likely to be higher. The study also included only select medications, such as those commonly used in pediatric patients and most commonly reported to the Food and Drug Administration MedWatch system. In this study, the three drug classes associated with the most errors were antiepileptics, asthma/allergy medications, and analgesics.

Prescribing Errors

The types of prescribing errors that may occur in pediatric prescriptions are listed in Table 1. Reasons for such errors include the necessity to calculate patient-specific doses and the high extent of off-label medication use in children. In an effort to increase the number of clinical studies conducted in pediatrics, the Food and Drug Administration Modernization Act (FDAMA) was passed in 1997. This legislation provides patent exclusivity for 6 months to companies conducting research in pediatric patients and has been instrumental in increasing clinical trials in pediatric patients and resulted in additional dosing, pharmacokinetic, and safety data.[8] Even so, of all the medications used in pediatric patients, approximately 75% still lack appropriate dosing and safety labeling information.[9] This may lead to incomplete or insufficient drug information in various clinical resources necessary to identify a prescribing error. For example, during the verification stage of a medication without Food and Drug Administration labeling, a program may alert the pharmacist to verify the dose for a pediatric patient. Without appropriate resources or data about specific medication use in pediatrics, the pharmacist may not be able to adequately evaluate the dose. Therefore, a pediatric-specific resource that includes dosing information of nonapproved medications should be readily accessible. Such references may include *Pediatric Dosage Handbook* (Lexi-Comp)[10] or the *Harriet Lane Handbook* (Mosby Elsevier).[11] The *Pediatric Dosage Handbook* is updated often to reflect the most common dosages used by pediatricians, based on clinical trials, case reports, or clinical experience. Additionally, the *Pediatric Dosage Handbook* provides primary references for doses, which may prove beneficial to any pharmacist evaluating a dose for a pediatric prescription. The *Harriet Lane Handbook* is somewhat limited in regard to drug information but can provide a reference for commonly prescribed medications.

Dispensing Errors

A dispensing error can be defined as any deviation between the prescriber's written order and the prescription dispensed by the pharmacist.[12] Pharmacist surveyors visited 50 community pharmacies in 6 cities across the United States and observed selected pharmacists at each pharmacy for 1 day.[12] Seventy-seven dispensing errors were documented among 4481 prescriptions, with an overall dispensing accuracy rate of 98.3%.[12] The different types of errors observed during this study in order of frequency were inaccurate label instructions, other deviations between the prescription label and written prescription besides label instructions, incorrect quantity, incorrect strength, incorrect drug, omitted drug, and incorrect dosage formulation.[12] Although errors in dosage formulations were the least frequently documented among the different types of dispensing errors, the unique needs of pediatric patients make the selection of an appropriate dosage formulation by prescribers more complex. Pharmacists should always verify that the prescribed dosage formulation is suitable for the pediatric patient.

Most medications are often commercially available in either tablets or capsules. However, many children are unable or unwilling to swallow these dosage formulations. Solid dosage formulations are also fixed doses and do not provide flexibility in dosing. This becomes problematic when trying to use these formulations in the pediatric population as most medications used in children are dosed based on their body weight or body surface area, which can vary greatly. Therefore oral liquid formulations are preferred due to their flexibility in dosing and increased ease of administration. However, many drugs are not available in the liquid formulation and need to be extemporaneously prepared and the quality of these preparations is dependent on many factors.[13]

Table 2. Common Pediatric Specific References

Reference	Dosing Information	Information on Extemporaneous Formulations
Allen's Compounded Formulations[15]		•
Children's Hospital of Philadelphia: Extemporaneous Formulations for Oral Administration[16]		•
Harriet Lane Handbook[11]	•	
Pediatric Dosage Handbook[10]	•	•
Neofax[17]	•	
Pediatric Drug Formulations[18]		•
Trissel's Stability of Compounded Formulations[19]		•

It is important to use formulas that have been peer reviewed and contain stability data. Unfortunately, adequate stability data for different oral extemporaneous preparations of medications are often lacking. A survey was conducted in health systems pharmacies that requested them to identify medications that were extemporaneously prepared which lacked stability data.[14] Of 233 hospitals surveyed, 57 responded and identified only 76 formulations as having adequate stability data and 212 formulations as requiring more stability data or missing stability data.[14] Alterations to formulas should be minimized during the compounding process as this may impact the stability of the final preparation. Table 2 contains some drug information resources that contain referenced formulas.

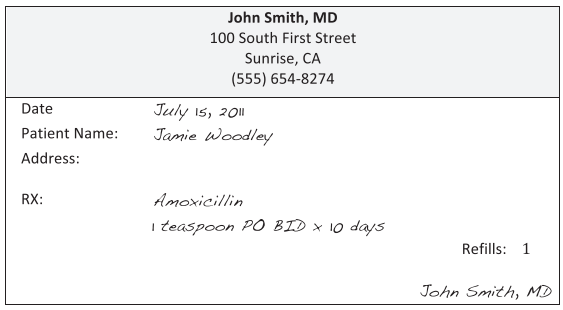
In addition to using an appropriate formula, pharmacists should also be cognizant of potential errors that could occur during the compounding process, such as improper medication/excipient selection or incorrect quantity calculations. For example, one child developed clonidine intoxication as a result of a pharmacist misinterpreting the amount of clonidine necessary to make the oral suspension in milligrams instead of micrograms which resulted in a 1000-fold increase in concentration.[20] In that particular case, instructions were relayed verbally rather than in written form to the compounding pharmacist, which may have contributed to the error.[20]

To help minimize errors during the compounding process, pharmacists should use written instructions that could be obtained from references listed in Table 2. A written or electronic log should be maintained that details the lot numbers of the ingredients used as well as the quantity of each ingredient. Another individual, preferably a pharmacist, should double-check the calculations and measurements of each ingredient prior to mixing to ensure the appropriate quantity of ingredients are used. After the extemporaneous formulation has been created, pharmacists could use the "smell check" as an additional method to inspect the liquid formulations, if they are familiar with the odor of the product.[12] They should also inspect the product for consistency because these products are usually suspensions. In addition, it is important for pharmacists to be familiar with both federal and state compounding regulations.

If it is necessary to dispense a different concentration of a suspension than that prescribed, it is critical that the pharmacist recalculate the appropriate amount to be administered. In one case, an infant received a supra-therapeutic dose of phenytoin as the result of a calculation error when a pharmacist modified the prescribed formulation from 30 mg/5 mL to 125 mg/5 mL.[21] According to the physician's order, the patient was supposed to receive 2.5 mL of phenytoin (30 mg/5 mL) by mouth 3 times per day, but the pharmacist dispensed phenytoin (125 mg/5 mL) at 1.6 mL by mouth 3 times per day. As a result of this error, the patient received doses that were 2.6 times her intended dose. In addition to ensuring there are no calculation errors, the pharmacist should also counsel patients and their caregivers regarding the change in concentration and highlight the new volume to administer.

Administration Errors

In 1975, the American Academy of Pediatrics published a statement about the inaccuracies of administering liquid medications to children.[22] Because household teaspoons measure anywhere from 2.5 to 7.8 mL, the statement recommended


John Smith, MD
100 South First Street
Sunrise, CA
(555) 654-8274

Date July 15, 2011
Patient Name: Jamie Woodley
Address:

RX: Amoxicillin
1 teaspoon PO BID x 10 days
Refills: 1

John Smith, MD

Figure 1. Indicate the missing information necessary to fill this prescription.

that oral syringes be used to measure liquid medication doses.[22] Despite these efforts, administration errors noted with liquid medications continue to have an error rate of 50% to 60% because parents incorrectly measure the dose of a medication.[23,24]

Medication cups have been associated with a statistically significant increased number of errors compared to oral syringes.[25] Errors include assuming the whole dosing cup was the prescribed dose. [25] Researchers also noted the lack of eye-level dose verification with plastic dosing cups.[25] Another study evaluated the ability of 96 adults to measure 5 mL, using either an oral syringe or a dose cup provided by the manufacturer.[26] In a survey completed at the beginning of the study, participants were asked about measuring devices they had previously used. The survey revealed that 67% of participants had used dose cups, and only 49% of participants had used oral syringes previously at home. In this study, 66.7% measured a dose correctly by using the oral syringe versus 14.6% with the dose cup. It is interesting to note that more people thought the dose cup was easier to manipulate than the oral syringe (87% versus 63%, respectively). Also, approximately 30% of participants were unable to correctly measure a dose by using the oral syringe.

Another study found that parents were able to correctly measure liquid doses if given a demonstration, verbal instructions, and a marked, oral syringe with a line.[23] For parents given verbal instructions, 37% measured a correct dose. When given verbal instructions and a demonstration, 83% were able to measure the correct dose. For parents who received verbal instructions, a demonstration, and a marked syringe, 100% of the parents measured the correct dose.

Because research repeatedly shows increased accuracy with the use of an oral syringe, prescriptions should be dispensed with an oral syringe marked with the correct volume to be administered. Color-coded syringes can help to decrease confusion if there is more than one medication or child at home on medications. Parents and caregivers must be taught how to measure the dose in an oral syringe with verbal instructions and a demonstration. The pharmacist should also consider recommending the use of bottle adaptors to make the manipulations of the oral syringe easier for parents and to decrease medication loss.

Computerized Physician Order Entry

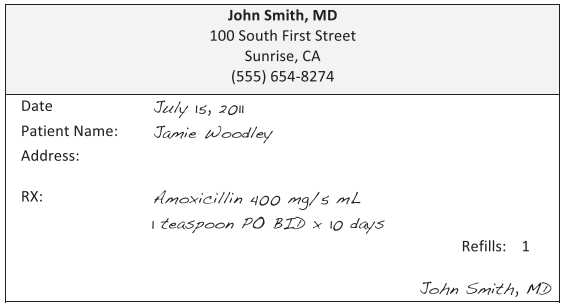
It is important to note that many hospitals, clinics, and physicians in private practice are moving to computerized physician order entry (CPOE), in an attempt to minimize prescribing errors. In a study conducted at an outpatient pediatric nephrology clinic, the rate of prescriptions with an error decreased from 77.4% to 4.8%.[27] However, CPOE prescriptions are not free of prescribing errors. One study measured the incidence of prescribing errors in 2610 electronic prescriptions at various community pharmacies and found 3.8% of electronic prescriptions required clarification by the pharmacist.[28] Most of the errors were missing information (specifically directions) and dosing errors. Some types of errors with CPOE reported in this study included drug duplication, omission of route, and incorrect dosing. As more prescribers implement CPOE, new types of errors may be identified.

APPROACHING THE PEDIATRIC PRESCRIPTION

Case 1

In the prescription shown in Figure 1, what information is missing? Accurately dispensing a pediatric prescription requires additional information not commonly found on a prescription for an adult, most notably the weight of the patient. Although most medications used in pediatrics are dosed based on weight, the weight of a child is often not included on the prescription. Although other desired information may be omitted from a prescription, the weight is critical to verify the appropriate dose for the patient. Other necessary information that may be omitted includes: allergies, date of birth, and strength of the medication (particularly the concentration for liquids), which are also not present in the example illustrated in Figure 1.

To ensure a weight is obtained for each pediatric prescription, one strategy used by a community pharmacy could be to educate all pharmacy personnel to screen all prescriptions and identify any prescription for a pediatric patient at the drop-


John Smith, MD
100 South First Street
Sunrise, CA
(555) 654-8274

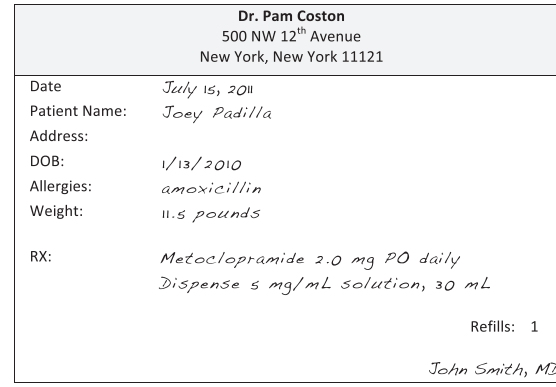
Date July 15, 2011
Patient Name: Jamie Woodley
Address:

RX: Amoxicillin 400 mg/5 mL
1 teaspoon PO BID x 10 days

Refills: 1

John Smith, MD

Figure 2. Example of a prescription for a pediatric patient that contains all the pertinent information necessary to process and dispense the prescription.


Dr. Pam Coston
500 NW 12th Avenue
New York, New York 11121

Date July 15, 2011
Patient Name: Joey Padilla
Address:
DOB: 1/13/2010
Allergies: amoxicillin
Weight: 11.5 pounds

RX: Metoclopramide 2.0 mg PO daily
Dispense 5 mg/mL solution, 30 mL

Refills: 1

John Smith, MD

Figure 3. Identify any existing or potential medication errors on the prescription.

off window. Upon receiving such a prescription, the pharmacist, intern, or technician can request any missing information such as the weight of the child and allergies. Of note, some caregivers may not know the accurate weight of a child; therefore, it is important to exercise caution in using such a weight with medications that have a narrow therapeutic window. In such instances, a phone call to the prescriber may be necessary to verify the weight of the pediatric patient. The prescription could then be "tagged" or "highlighted" to alert the pharmacist that the prescription is for a pediatric patient. Another strategy is to request the weight from the prescriber or have a prompt in the voice-mail recording reminding the physician to leave a weight if the prescription is phoned into the pharmacy.

Case 2

The technician verified the patient's weight and medication allergies, as illustrated in Figure 2. Jamie's mother states Jamie weighs 20 pounds and has no known drug allergies. This is the first time Jamie has been prescribed a medication. Jamie's mother tells the technician the prescription is for an ear infection. The pharmacist contacts Dr. Smith to obtain the strength of the amoxicillin suspension, which is 400 mg/5mL. The amoxicillin dose for acute otitis media is 80-90 mg/kg/day divided into two doses. Is the dose for this patient appropriate?

The first step in verifying the dose for this prescription is to convert the weight from pounds to kilograms. The patient's parent or guardian will most often report the weight in pounds, whereas most dosing is based on weight in kilograms. One kilogram is equal to 2.2 pounds. Therefore, in the prescription illustrated in Figure 2, the patient weighs 9 kilograms. The total daily dose of amoxicillin in this prescription is 800 mg/day or 88 mg/kg/day. The prescription is appropriate for the treatment of acute otitis media.

Each dose for a pediatric patient should be converted to milligram-per-kilogram per dose or per day. The milligram-per-kilogram calculation can then be verified with a pediatric-specific resource to ensure it is appropriate. Special attention should be paid to whether the recommended dose is provided on a total daily dose or on a single-dose basis. Additionally, a pharmacist should recalculate the dose for any prescription listing a milligram-per-kilogram dose and the total dose to ensure no calculation errors were made.

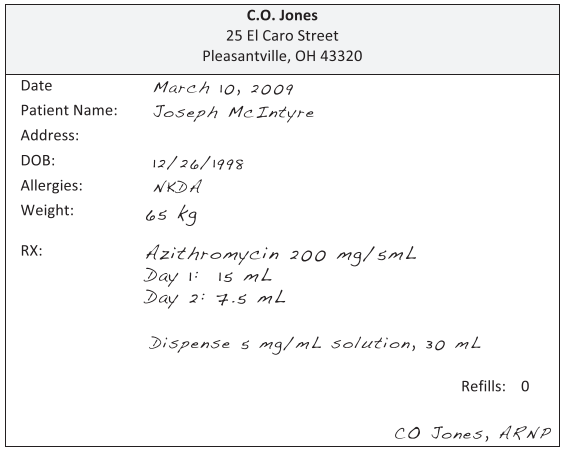
Case 3

The pharmacist is verifying the dose for the prescription in Figure 3. The father of the patient informs the pharmacist that the prescription is for "heartburn." The *Pediatric Dosage Handbook* states that the dose for metoclopramide is 0.4 mg/kg/day divided into 4 daily doses. Is the prescription in Figure 3 an appropriate dose for the patient?

In this prescription, the total daily dose is 2 mg; however, it should be divided into 4 daily doses. Thus, the prescription should have been written as 0.5 mg given by mouth 4 times per day and warrants a phone call to the prescriber to clarify. Double-checking the prescribers calculation will help minimize errors. Additionally, in this prescription, the use of a trailing zero (i.e., 2.0) could result in a 10-fold error. For instance, the pharmacist may not see the decimal and dispense 20 mg rather than the intended 2 mg dose, which would result in an overdose in the patient.

Case 4

The usual pediatric dosage for azithromycin for pneumonia is 10 mg/kg/dose on day 1 and 5 mg/kg/dose on days 2-5. The patient's grandmother, who dropped off the prescription, states the medication


C.O. Jones
25 El Caro Street
Pleasantville, OH 43320

Date: March 10, 2009
Patient Name: Joseph McIntyre
Address:
DOB: 12/26/1998
Allergies: NKDA
Weight: 65 kg

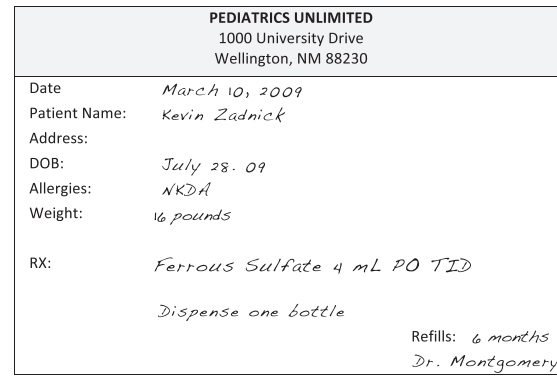
RX: Azithromycin 200 mg/5mL
Day 1: 15 mL
Day 2: 7.5 mL

Dispense 5 mg/mL solution, 30 mL

Refills: 0

CO Jones, ARNP

Figure 4. Determine the appropriateness of the dosing of azithromycin for this patient.


PEDIATRICS UNLIMITED
1000 University Drive
Wellington, NM 88230

Date: March 10, 2009
Patient Name: Kevin Zadnick
Address:
DOB: July 28. 09
Allergies: NKDA
Weight: 16 pounds

RX: Ferrous Sulfate 4 mL PO TID

Dispense one bottle

Refills: 6 months

Dr. Montgomery

Figure 5. Indicate why the prescription is not appropriate as written.

is for "walking pneumonia." Is the dose in Figure 4 appropriate for the patient?

In the prescription, the dose was calculated based on the pediatric dosing recommendations. However, in adults, the recommended dosing for azithromycin is 500 mg on day 1, followed by 250 mg on days 2-5 for atypical pneumonia. In this patient, it would be appropriate to prescribe the adult maximum dose. It is important to recognize standard adult doses as the maximum dose for most pediatric patients. Failure to recognize the standard adult dose and dosing solely on weight could result in an overdose in the pediatric patient. In practice, once a pediatric patient weighs more than 40 kg, a standard adult dose can be used, in most cases.

Case 5

Ferrous sulfate is available in the following concentrations: 15 mg elemental iron/0.6 mL and 15 mg/mL drops; 75 mg/0.6 mL and 75 mg/mL drops; 220 mg/5 mL; and 300 mg/5 mL. In the prescription shown in Figure 5, which product should be dispensed?

Not only are multiple concentrations available, but also some of the strengths are listed as the amount of ferrous sulfate per volume and others are listed as the amount of elemental iron per volume. This occurs with other elemental supplements, such as calcium, which is available in multiple salt formulations, too. The dispense quantity is also unclear as there are various manufacturers who market several different bottle sizes depending on the strength. The duration of therapy or days' supply should be included. In this situation, it is necessary to contact the prescriber for clarification.

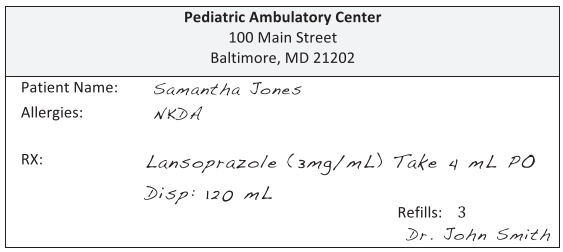
Prescriptions written for liquids may have a higher rate of medication errors because prescribers may write in terms of volume (milliliters) instead of milligrams. If the strength of the product is missing and the dose is written in milliliters, the pharmacist cannot verify the dose, particularly if the product is available in multiple concentrations. Only when the strength of the product is provided is it acceptable to write the dose in volume. Ideally, both the dose in milligrams and volume in milliliters should be listed on the prescription.

If modifications to the medication concentration are required, then it is also important to double-check the volume to ensure that the new volume provides the same prescribed dose. In some states, pharmacists are required to obtain physician authorization in order to make modifications to the dosage formulation or strength. Pharmacists should contact their state board of pharmacy to determine what actions, if any, are needed prior to making changes in dosage formulations or strengths on a prescription.

With products that have multiple ingredients (e.g., sulfamethoxazole/trimethoprim, over-the-counter combination products), it is important to note which component the dosing is based upon. The lack of this information on the prescription warrants a phone call to the prescriber. For example, with sulfamethoxazole/trimethoprim, most references will typically provide dosing for the trimethoprim component, so it is important to verify what is written on the prescription against that specific ingredient.

Case 6

A parent brings in the prescription shown in Figure 6 for her daughter Samantha. After some inquiry, the pharmacist determines that Samantha is 20 months old, weighs 12 kg, and is receiving


Pediatric Ambulatory Center
100 Main Street
Baltimore, MD 21202

Patient Name: Samantha Jones
Allergies: NKDA

RX: Lansoprazole (3mg/mL) Take 4 mL PO
Disp: 120 mL
Refills: 3
Dr. John Smith

Figure 6. Based on appropriate extemporaneous preparation information, is the dispense quantity appropriate?

lansoprazole for gastroesophageal reflux disease. Because lansoprazole is not commercially available as a suspension, the pharmacist will need to find a formula to compound this suspension. The *Pediatric Dosage Handbook* provides the following information, "A 3 mg/mL suspension of lansoprazole is prepared by emptying the contents of ten 30 mg capsules and adding 100 mL 8.4% sodium bicarbonate solution; stir for 30 minutes; protect from light; stable for 8 hours at room temperature and for 14 days refrigerated."[10]

Because the lansoprazole suspension is only stable for 14 days under refrigeration, the pharmacist should only dispense a 14-day supply, which would be approximately 60 mL in this case. According to the formula, the pharmacist will need to open six 30-mg lansoprazole capsules and mix the contents in 60 mL of 8.4% sodium bicarbonate. The pharmacist should ensure that the product is appropriately mixed and should affix both a "shake well" and "refrigerate" label on the amber prescription bottle. Also, it is important to educate the family members so they know the expiration date so that refills are obtained at the proper time (i.e., 14 days versus 1 month).

PATIENT EDUCATION

Pharmacists should counsel parents and children about their medications. Each pharmacist must develop a method and style for delivering patient education. The education style may differ based on patient's age, educational background, and baseline literacy level. Regardless of the education style chosen, the following information should be conveyed in each counseling session: the indication for use, directions on how to administer the drug (including taking it with or without food) and how often, patient-specific drug interactions, special storage instructions, and potential side effect information. Explain the difference between common adverse reactions and rare serious adverse reactions that are possible. It is important for parents to know how to handle an adverse event and when to involve the physician. Also, for prescription products, it is important to highlight to parents and caregivers that if any adverse drug event occurs they can call the toll-free number listed on the product labeling. Last, explain when the medication should take effect or when a child should see improvement and what to do if this does not happen.

Counseling needs to be directed to the child even if the child might not understand all of the information shared. The education materials should be tailored to the developmental stage of the child. Materials for young children, who only remember 2-3 words, should not contain medical jargon, and should explain terms using a child's language. They should consist mainly of pictures. On the contrary, older children and adolescents can have more complex information in their education materials. Therefore, the material should contain both pictures and text. Generally, educational materials should not surpass a 6th grade reading level.

A variety of methods are available to help improve understanding of medical information shared during the counseling session. Pictograms have been shown to improve medication knowledge in patients with 7 years of schooling and English as a second language.[29] The Health Education and Literacy for Parents (HELP) project developed medication instruction sheets (HELP pictograms or HELPix) that are patient-specific with plain language and pictograms for medication preparation, route, frequency, storage, and duration. This program was developed to help patients with low literacy. Researchers evaluated this program and found that the pictogram-based medication information sheets used in conjunction with a counseling program decreased medication errors and increased adherence in children treated at an urban emergency department.[30] Samples of medication information sheets can be located at the HELPix website: http://helpix.med.nyu.edu/the-helpix-intervention/overview-helpix. Another patient-friendly site for patient education handouts is www.safemedication.com. Also, pictograms can be downloaded for free from www.usp.org. Figure 7 illustrates a sample pictogram from *United States Pharmacopeia*.

Assessing knowledge taught in counseling sessions can be done by having patients repeat back what information was shared.[31] This process may be very helpful in gauging the parent's and child's understanding of the information delivered in the counseling session.

Counseling sessions should also reinforce the importance of adherence. Encourage the parents and child to track adherence. This can be done with

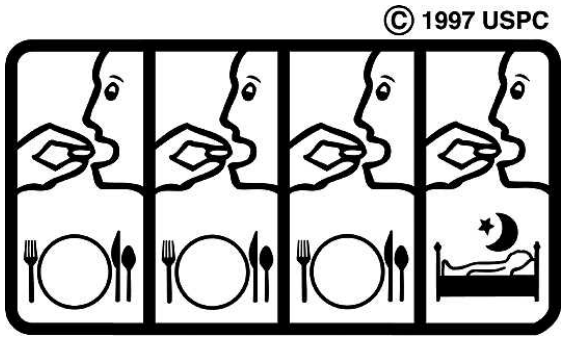


Figure 7. Sample of a pictogram (Take 4 times a day, with meals and at bedtime), provided by *United States Pharmacopeia*, which is available for use in patient education.

charts or calendars. A child can color or place a sticker on the chart after administration of a dose. For complicated tapers or patients taking chronic medications, calendars that can be marked off as doses are administered can be developed. Pharmacists should recommend that parents keep the charts near the medications (for example on the refrigerator door).

Adherence can be linked to the palatability of the medication. This can be increased using products such as Flavor Rx (FLAVORx, Inc, Columbia, MD), to flavor medications that are undesirable. Also, a child can numb their taste buds with a frozen treat such as a Popsicle (Unilever, London, UK) or a piece of ice before taking a medication. The metallic after-taste from some medications such as metronidazole and clarithromycin can be reduced with orange juice or chocolate. Another recommendation is to squirt the liquid medicine to the side of the mouth to avoid the taste buds. After the administration of a poor tasting medication, encourage eating some peanut butter (check for allergies first), drinking a carbonated beverage or chocolate sauce to remove the taste from the tongue. In general, bitter medications can be masked with chocolate flavors, citrus can be used for sour medications, and salty can be masked with peanut butter, cinnamon, or butterscotch.

CONCLUSIONS

Medication errors occur more frequently in the pediatric population due to the need for weight-based dosing, lack of pediatric friendly dosage formulations, and the reliance on others for proper medication administration. As such, it is important for pharmacists to verify that all pediatric prescriptions contain the patient's weight in addition to the other components required for an adult prescription. Medication errors can occur during each step of the medication use process including prescribing, dispensing, and administration. To mitigate these errors, pharmacists should follow a general approach to pediatric prescriptions that includes:

(1) ensuring that all components of a pediatric prescription are provided, including concentrations of liquid medications; (2) obtaining the patient's weight and converting it to kilograms; (3) calculating the dose and comparing it to the recommended dosing information provided in pediatric-specific drug references; (4) using referenced, written instructions for products that require extemporaneous preparations and having another individual double-check quantities of drug and excipients prior to compounding; (5) providing a demonstration of how to use the syringe for liquid medications and dispensing a marked, oral syringe; and (6) counseling patients and caregivers about indication for use, directions on how to administer and how often, patient-specific drug interactions, special storage instructions, and side effects, while tailoring instructions based on the patient's cognitive development, using more pictograms for the younger patients and texts for older patients.

A systematic approach to the pediatric prescription may require additional time commitment from the pharmacist; however, the approach is an effort to provide safe medication use for a child. The extra time devoted to the pediatric prescription may avert a harmful medication error.

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Continuing pharmacy education credit course title: Approach to the Pediatric Prescription in a Community Pharmacy; course number: 0180-000-12-001-01-P;

credit hours: 1.5. To receive credit for this article, you are required to take a post-test. For continuing education information, learning objectives, and the post-test, please go to http://www.ppag.org/en/courses/view.asp?courseid=39.

The Pediatric Pharmacy Advocacy Group is accredited by the Accreditation Council for Pharmacy Education as a provider of continuing pharmacy education.

ABBREVIATIONS CPOE, computerized physician order entry; FDAMA, Food and Drug Administration Modernization Act

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