OverView

The misuse of prescription and over-the-counter medications in children is a critical area in which community healthcare providers, and pharmacists in particular, can have great impact. Medications can be misused unintentionally or maliciously by parents and other caregivers, or abused by children and teens themselves. Parents may unintentionally medicate their child with an inappropriate drug or dose, putting the child at risk for severe consequences. For example, without proper education, parents may accidentally overdose a child on acetaminophen by administering the same measured dose (e.g., 5 ml) of infant drops as is recommended for the child’s suspension, thinking that the infant drops contain a lower dose.

Healthcare providers can help parents understand that infants and children have complex and changing physiology and anatomy, especially in the newborn period, which can dramatically affect the distribution of medications and their clearance from the body. These factors impact dosing, which is often not as simple as adjusting an adult dose for the weight of a child. Furthermore, pharmacists can be instrumental in making recommendations to parents and prescribers, educating parents and children, and identifying health conditions that warrant a referral to a prescriber.

Intentional abuse of prescription and over-the-counter (OTC) drugs by adolescents is also a problem that community providers may encounter. In recent years, studies have shown that an alarming number of adolescents abuse prescription pain relievers such as Vicodin® for recreational purposes. They fail to understand that all medications - whether prescription or OTC -

Continuing Education Objectives

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1. Describe the physiological differences in children that can affect drug disposition.
2. Identify sources of dosing confusion for parents that may lead to unintentional misuse of OTC medications.
3. Describe the prevalence of intentional medication misuse among adolescents. List 2 drug classes caregivers have maliciously misused in children.

The Bottom Line

- The changing physiology and anatomy of children complicates drug dosing. Infants clear drugs via the kidneys and liver more slowly and require lower weight-adjusted doses than adults.
- Older children clear some drugs, notably those metabolized by CYP3A4, more rapidly than adults and require higher weight-adjusted doses.
- Serious unintentional medication errors are more common in children under the age of one year and most often involve overdoses.
- The most common type of unintentional drug misuse is a dosing error; specifically, a 10-fold error. Both the appropriate dose and the intended use of OTC products for children should be reviewed with caregivers.
- Providing caregivers with both dosing instructions and a dosing device reduces errors.
- Malicious misuse of medications is the nontherapeutic use of drugs in children, often for the purpose of sedating them.
- The most common medications used maliciously in children include benzodiazepines and combination cough and cold products.
- Among teens, 40% believe OTC and prescription drugs are safer for recreational use than illegal drugs, and 30% believe prescription pain relievers are not addictive.
- The legal drugs most commonly abused by teens include hydrocodone/ acetaminophen (e.g., Vicodin®), oxycodone (e.g., Oxycontin®), dextromethorphan, and stimulants such as dextroamphetamine and amphetamine.
can be dangerous, especially when used inappropriately. This is another area where community providers can intervene and promote the safe use of medications by educating the public.

A clear understanding of the common causes of medication misuse in children will enable providers to improve the safety and efficacy of medications in this age group.

**Background**

The misuse of medications in children is often due to parents’ lack of knowledge or understanding of their child’s complex physiology and disease state(s). The unique and changing physiology and anatomy of pediatric patients complicates identification of the optimal dose. Weight-based reduction of the adult dose is often inappropriate because drug clearance is variable in children. For example, kidney function is not fully developed at birth and drugs eliminated by the kidneys are cleared more slowly. Additionally, the infant’s ability to concentrate urine is reduced, putting them at greater risk of severe dehydration. It is important for parents to know how to detect symptoms of severe dehydration, when it is appropriate to give a child commercial rehydration solutions, and when to seek professional medical attention. (See Inset, page 6) Kidney function fully matures by about 1 year of age.

Similar to kidney function, neonatal drug-metabolizing systems are not yet fully developed, resulting in slower elimination of drugs cleared by certain enzymes (e.g., the enzymes responsible for glucuronidation). Drugs cleared by immature enzyme systems will have a longer half-life and develop higher serum levels in a neonate (birth to 4 weeks of age) compared to a 2-year old. The time line for enzyme system development varies. Cytochrome P450 3A4, which is involved in the metabolism of more than 50% of drugs, reaches 72% of adult activity at 1 year of age, while the glucuronidation enzymes reach adult activity at 2-4 years of age. In older children, the activity of some enzymes (e.g., CYP3A4) actually exceeds adult levels. Older children require higher weight-corrected doses than adults for drugs metabolized solely by these enzymes. Furthermore, as children grow and develop their body density changes, causing a change in the volume of distribution of many drugs.

There are also anatomical differences in infants and young children that account for common complaints, such as earache. The high incidence of earache in this population may be due to the small size of the Eustachian tube. Nasal blockage prevents equalization of the inner ear pressure to atmospheric pressure, which puts pressure on the eardrum, causing ear pain. Earaches can also be caused by otitis media, a common condition in young children that may require antibiotic therapy. Parents seeking OTC treatment for a young child’s cold symptoms should be asked about ear pain. A child less than 6 months old with signs of ear pain should be referred to a primary care provider for evaluation. If the child is at least 2 years old and has a temperature less than 102°, short-term treatment with an OTC analgesic alone is acceptable if adequate follow-up can be insured. This approach is also acceptable for children 6 months to 2 years old with mild symptoms (low fever, mild ear pain). If symptoms worsen or do not improve within 48 hours, the child should be evaluated by a primary care provider.

Community healthcare providers must understand the physiological and anatomical differences in children in order to help parents determine when to self-treat a child and when to consult a prescriber.

Table 1. Common Medication Administration Errors By Caregivers

<table>
<thead>
<tr>
<th>Error</th>
<th>Possible Reason</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unintentional Overdose or Underdose</td>
<td>• Selection of the wrong formulation (e.g., use of an acetaminophen product with a higher or lower concentration than the caregiver intended)</td>
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<tr>
<td></td>
<td>• Poor understanding of measuring devices (e.g., using tablespoons instead of teaspoons, using dose cups without regard to the markings on the cups, misunderstanding &quot;ml&quot; as a unit of measure)</td>
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<td></td>
<td>• Administering more than one product that contains the same ingredient, resulting in overdose; for example, many cough/cold products contain an antihistamine [diphenhydramine, brompheniramine], decongestant [phenylephrine, pseudoephedrine], and cough suppressant [dextromethorphan]; adding another separate product can lead to overdose of one of the active ingredients</td>
</tr>
<tr>
<td>Incorrect Frequency of Medication</td>
<td>• Medication labeled to be given “three times daily” or “every 6 hours” is given at 8 AM, 11 AM and 3PM, or 3 doses are given at once; medication that should be given multiple times per day is only given once daily; incomplete adherence to prescribed course of treatment</td>
</tr>
<tr>
<td>Inappropriate Use of OTC Medications in Infants and Young Children</td>
<td>• Caregivers may not be aware that manufacturers of cough and cold medications have changed the product labeling to state that these products should not be used in children younger than 4 years of age. Previously, the labels stated a lower age limit of 2 years.</td>
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Table 2. Ten Potentially Dangerous OTC Products in Children

<table>
<thead>
<tr>
<th>Drug</th>
<th>Concern</th>
<th>Recommendation for Parents/Caregivers</th>
</tr>
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<tbody>
<tr>
<td>Aspirin, salicylate products</td>
<td>Increased risk for Reye’s syndrome</td>
<td>Products containing aspirin or related salicylates should not be given to children under 19 yrs old who have viral or fever-causing illnesses; use an alternative fever/pain reducer.</td>
</tr>
<tr>
<td>Dextromethorphan</td>
<td>Ineffective for cough due to cold and flu;</td>
<td>Do not give to children younger than 4 yrs old; if used for older children follow dosing instructions carefully; ask a healthcare provider if you are unsure of the dose. Monitor dextromethorphan-containing products in the house if teens are present.</td>
</tr>
<tr>
<td>Decongestants (pseudoephedrine, phenylephrine)</td>
<td>No evidence to support use. Products are commonly dosed incorrectly, leading to potential overdose. Children are more sensitive to sympathomimetic effects of decongestants.</td>
<td>Consider non-drug remedies (e.g., rest, drinking plenty of fluids, saline nose drops, gargling with salt water [adolescents], throat lozenges, humidifier); do not give to children younger than 4 yrs old; if used for older children follow the instructions on the label carefully; check the active ingredients and do not give 2 products that contain the same type of ingredient.</td>
</tr>
<tr>
<td>Combination cough/cold/fever products</td>
<td>Poor and erratic absorption can cause sub-therapeutic or occasionally toxic levels.</td>
<td>Avoid rectal acetaminophen unless specifically discussed with the child’s primary care provider.</td>
</tr>
<tr>
<td>Acetaminophen suppositories</td>
<td>Iron can cause life-threatening toxicity in children in an overdose situation.</td>
<td>Store iron tablets out of sight and reach of children; children may mistake them for candy. Liquid iron is available in multiple concentrations; make sure you know the correct dose in milligrams (mg) and the correct volume in milliliters (ml).</td>
</tr>
<tr>
<td>Iron-containing products</td>
<td>Ineffective and may be toxic (e.g., seizures, liver toxicity) in children.</td>
<td>Avoid these products in children; for congestion consider non-drug remedies (e.g., nasal suctioning, saline nose drops, humidifier); do not apply these products around the nostrils.</td>
</tr>
<tr>
<td>Vicks® VapoRub® (camphor, menthol, eucalyptus oil)</td>
<td>Inappropriate for routine diaper rash; a baby’s thin skin may allow increased systemic absorption.</td>
<td>Do not use in children less than 2 yrs old. In older children, use only under the supervision of a primary care provider. Do not apply more than recommended by your primary care provider.</td>
</tr>
<tr>
<td>Hydrocortisone cream</td>
<td>May cause renal toxicity in dehydrated children.</td>
<td>Do not use in children less than 6 mo. old without a prescriber’s advice. Follow directions on the label carefully and keep the child well hydrated; consult your primary care provider if symptoms do not improve or if use for more than 3 days is needed.</td>
</tr>
<tr>
<td>Ibuprofen (Advil®, Motrin®, others)</td>
<td>Gel is toxic in children when ingested orally.</td>
<td>Do not use oral or topical products in children less than 4 years old; use cautiously and follow labeled directions carefully in all others; do not use to make a child sleepy; do not use topical products for chickenpox, poison ivy, or sunburn, on large areas of the body, or on blistered or oozing skin, due to potential for absorbing toxic amounts into the body.</td>
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**Unintentional Misuse**

The most common type of unintentional drug misuse is a dosing error. The American Academy of Pediatrics does not endorse use in children. Overweight children appear to be at greater risk for overdose than children of age-appropriate weight. It’s important to consider the child’s age, and for older children, not to exceed the maximum adult dose. Inappropriate use is particularly problematic with OTC medications. Since OTC and herbal products can be purchased without the advice or supervision of a healthcare professional, parents may use these products for the wrong indication or administer the medication to their children inappropriately. For example, a major cause of accidental overdose in children is the variety in concentration of acetaminophen (APAP) products. The concentration of APAP in an infant formulation differs significantly from that of a toddler formulation. The infant liquid formulation is designed to allow the administration of smaller volumes to infants and provides a higher concentration of APAP (80 mg/0.8 ml). The liquid and suspension formulations for toddlers and older children are more dilute (160 mg/5 ml) in order to provide more measurable doses. This is a source of confusion for parents, who may not understand that 1.6
ml of the liquid drops formulation has the same dose as 5 ml (1 teaspoon) of the children’s formulation. Common administration errors are listed in Table 1.

Serious unintentional medication errors are more common in children under the age of 1 year and most often involve overdoses. Educating parents on the proper use of dosing devices is crucial. Numerous studies have reported the inaccuracy of liquid dose measurements by parents. Most often, errors result when parents use a kitchen spoon to dose medications for their child or confuse teaspoons with tablespoons (“tsp” and “tbsp” markings on dosing devices are similar). Providing both education and a dosing device has been shown to reduce errors. Researchers compared 3 different levels of dosing instructions for children treated with an antibiotic suspension: 1) verbal instructions only, 2) verbal instructions plus a syringe, and 3) verbal instructions, a syringe, and a line marking the correct dose on the syringe. While only 37% of parents in group 1 measured the dose correctly, that number increased to 83% in group 2, and group 3 had 100% accuracy. What’s more, some dosing devices appear to be used more accurately than others. A recent study found a much higher error rate with dosing cups (50-70%) compared with a dropper, dosing spoon or syringe (15%). Community providers, and pharmacists in particular, can help prevent dosing errors by reviewing the appropriate dose and how to measure it with caregiv-

Case 1 - Selecting the Appropriate Acetaminophen Formulation

A mother approaches the pharmacy counter to pick up her child’s antibiotics. She is also purchasing a bottle of infant’s acetaminophen. Her ill child stands beside her and is clearly not an infant but a 7 year old boy.

Next steps...

• Counsel the mother on the antibiotics and ask about her acetaminophen purchase.
• If the acetaminophen is for her 7 year old, discuss with her the differences in strength between the infant formulation and the pediatric formulation. Make sure she understands that giving infant drops in the volume recommended for the pediatric formulation (e.g., 2 teaspoons) would be an overdose.
• Advise her to use the pediatric formulation for her son to prevent any dosing confusion.
• Clarify with her the proper dose for her child based on his age and weight.
• Using an open box of the pediatric formulation you have on hand for demonstration purposes, show her the line on the dosing cup that indicates the proper dose.
• Make sure she understands the recommended dosing frequency and the maximum dose in a 24 hour period.

Case 2 - Accurate Dose Measurement

A father brings a bottle of pediatric diphenhydramine liquid formulation to the pharmacy counter for purchase. His 4 year old son had an allergic reaction to something and the physician instructed him to give diphenhydramine to the child. He asks about the dosing cup that accompanies the product and states that he does not plan to use it; since the dose is a teaspoon, he will use a kitchen spoon at home.

Next steps...

• Instruct the parent on the difference between a teaspoon measured with a dosing device and a typical kitchen spoon. Explain the risk of overdose linked with imprecise measurements.
• Urge the parent to use the measuring device that accompanies the product, purchase a measuring device that he prefers, or use a teaspoon that accurately measures the dose.
• Clarify the proper dose with the father, based on his child’s age and weight.
• Show him how to measure the proper dose on the dosing device he selects.
• Make sure he understands the recommended dosing frequency and the appropriate duration of therapy.
• Counsel the parent on the side effects of diphenhydramine.

ers when they purchase OTC products for children. A number of OTC medications commonly used in children are potentially dangerous. (Table 2) Two examples are combination cough and cold medicines and analgesics such as aspirin, ibuprofen, and acetaminophen. Safety concerns with these products stem from reports of misuse, unintentional overdose, and excessive dosing. Multiple ingredient cough and cold products heighten the risk of overdose because children may inadvertently be given more than one product with the same ingredient. A recent study attributed over 7,000 annual emergency department (ED) visits by children less than 12 years old to cough and cold medications. Overdoses in children have been linked to convulsions, adverse cardiovascular effects, and death. Recommendations from expert groups concerning the use of cough and cold medicines (decongestants, antihistamines, antitussives, combination products) vary. The American Academy of Pediatrics does not recommend use in children of any age, and explicitly recommends against use in children younger than 4 years of age. Members of the Consumer Healthcare Products Association, which represents most manufacturers of OTC cough and cold medicines for children, have voluntarily changed the product labels for many OTC cough and cold medicines to state “do not use” in children under 4 years of age. The FDA currently recommends that OTC cough and cold products not be used to treat infants and
children less than 2 years of age. This less restrictive recommendation was made in 2008 despite input from the FDA’s own advisory committees, which recommended that decongestants, antihistamines, and antitussives NOT be used for the common cold in children less than 6 years old. The advisory committee’s recommendation was based on the lack of evidence supporting safety and efficacy in children.

In contrast to cough and cold medications, OTC analgesics clearly have a role in relieving pain among children. The potential dangers with these products arise from overdose, as discussed above, and inappropriate use. Analgesics are the most common class of medications causing ED visits for unintentional overdoses in children. Overdoses are more common with acetaminophen than with aspirin or ibuprofen, and are most often due to parental dosing errors. The main concern with acetaminophen overdose is liver toxicity. Ibuprofen has the potential to cause kidney toxicity; children who are dehydrated are at increased risk for this uncommon adverse effect. Parents should be cautioned to avoid ibuprofen in children with illnesses accompanied by vomiting, diarrhea, or decreased fluid intake. Aspirin and other salicylate-containing products should not be used in children and teens with symptoms of viral infection, due to the increased risk of Reye’s syndrome.

Community providers have a great opportunity to improve the appropriate use of OTC and prescription medications in children through caregiver education. When recommending an appropriate age- and weight-based dose, healthcare providers can also make sure parents understand the dosing interval and treatment duration. Caregivers should be informed about monitoring the child for response as well as medication side effects. Providers can give parents guidance regarding when to take their child to a pediatrician; for example, if symptoms are severe or no improvement is seen within an appropriate time frame. Potentially dangerous uses of OTC medications can be avoided by asking caregivers about the condition they intend to treat and the child’s age and symptoms. Caregivers should be alerted to the lack of evidence supporting cough and cold medication use in children, particularly those less than 6 years of age.

Malicious Misuse
Malicious misuse of medications is the nontherapeutic use of pharmaceuticals in children, often for the purpose of sedating them. Possible motives include stopping a child from crying or taking a respite from childcare. More onerous possibilities are enabling physical abuse and sedating a child after inflicting an injury. The most common medications used maliciously in children include benzodiazepines and combination products containing acetaminophen, dextromethorphan and a decongestant and/or antihistamine.

A subset of this type of medication use is known as “social medication,” where parents use OTC medications to control children’s behavior that they consider irritating with the belief that medications calm, sedate, and lift the mood of their children. About 14% of the malicious medication misuse cases in children less than 7 years old that were reported to the U.S. National Poisoning data system between 2000 and 2008 resulted in moderate or major adverse outcomes, including death. This is more than 14 times the rate of serious outcomes from all drug exposures (mostly nonmalicious) reported in young children during 2007. Of 18 deaths resulting from malicious
Case 3 - Dehydration Assessment & Treatment

A mother is searching through the OTC aisle and appears very confused. You approach her to offer assistance and she states that her 8-year-old daughter is battling a stomach illness and has been suffering from vomiting and diarrhea for 2 days. She is looking for an OTC product to help relieve these symptoms and she is worried about dehydration.

Next steps...

- Ask the mother for additional information on the child’s status to help determine the severity of dehydration.
- Mild dehydration: normal skin turgor (fullness), moist mucosa on the inner lining of the cheeks, moist lips, normal pulse, normal urine output – consider oral rehydration solutions such as Pedialyte®.
  Note: Skin turgor is checked by grasping the skin on the back of the hand, lower arm, or abdomen between two fingers so that it is tented up. The skin is held for a few seconds then released. Skin with normal turgor snaps rapidly back to its normal position. Skin with decreased turgor remains elevated and returns slowly to its normal position.
- Moderate dehydration: skin tenting present, dry mucosa on the inner lining of the cheeks, dry lips, slightly increased pulse, decreased urine output – consult a primary care provider.
- Severe dehydration: clammy skin, cracked lips, sunken eyes, lethargic, increased pulse, no urine output – consult a primary care provider urgently or go to emergency room for immediate evaluation and treatment.
- Tell the mother that OTC antidiarrheal products such as loperamide (Imodium®) and bismuth subsalicylate (Kaopectate®) and Pepto-Bismol® are not recommended for use in children. (See the Patient Connection insert for details).

medication use in children (average age 1.6 years), 94% of the victims were exposed to sedating agents such as antihistamines or opioids. Clearly, malicious misuse poses a much greater risk than unintentional misuse.

Experts consider the malicious misuse of medications by adults a form of child abuse17, even when caregivers have the misconception that OTC and prescription drugs are completely safe. Community healthcare providers can educate parents about the potentially dangerous effects of using pediatric OTC or prescription drugs for nontherapeutic purposes. Parents who ask about giving their children medication for nonmedical reasons should be encouraged to seek help with the problematic behavior from a family member, friend, or primary care provider.

Intentional Misuse

Intentional misuse of both prescription and OTC medications by adolescents has resulted in our youth being referred to as “Generation Rx”. In a 2005 survey of more than 7,000 teenagers, nearly 20% admitted to using prescription medications to get high and 10% reported abusing cough medicines to get high.20 In 2009, the percentage of teens abusing prescription medications remained stable at 20%, with 15% reporting abuse of a prescription pain reliever in the past year.21

Most recently, there has been a shift in attitude regarding the abuse of prescription drugs. More teens agree that “being high feels good” (45% in 2008 vs. 51% in 2009) and report that “friends usually get high at parties” (69% in 2008 vs. 75% in 2009). Their negative perception of “drug user” has fallen, with 35% agreeing that they “don’t want to hang around drug users” in 2008 compared to 30% in 2009.21

The drugs most commonly abused by teens include prescription pain relievers such as OxyContin® and Vicodin®, the OTC cough suppressant dextromethorphan, and prescription stimulants such as dextroamphetamine and amphetamine.22 Adolescents fail to realize the dangers of abusing prescription medications, with 40% reporting the belief that it is much safer to use prescription medication than illegal drugs, even if they are not prescribed by a doctor.22 Nearly one third of surveyed teens believe that prescription pain relievers are not addictive, and 33% think there is “nothing wrong” with occasionally using prescription medicines without a prescription.22 The CDC reported that during the years 1999-2004, nearly all deaths in the U.S. due to poisoning were attributable to drugs, mainly prescription and illegal drugs taken for nonmedical reasons.23

One example of intentional medication misuse is the increase in dextromethorphan abuse in recent years. A U.S. Government report released on August 30, 2010 (www.deadiversion.usdoj.gov/drugs_concern/dextro_m/dextro_m.htm) found that there were almost 8,000 emergency department visits for dextromethorphan misuse in 2008, an increase from about 6,000 visits in 2004. Teens refer to this misuse as “robo-tripping” (a reference to Robitussin®) or “skittling” (a reference to the candy-like appearance of Coricidin® HBP Cough and Cold tablets). The DEA and FDA are considering making dextromethorphan a controlled substance because of the high prevalence of abuse by adolescents.

Another troubling example is the misuse of prescription pain relievers like Vicodin® and OxyContin®. According to the 2009 National Survey on Drug Use and Health, there was a significant increase among youths in the nonmedical use of prescription pain relievers between 2008 and 2009.24 The problem is compounded by the accessibility of these medications. More than half of all persons over age 12 who used pain relievers nonmedically got their most recent supply from a friend or relative for free. An-
other 10% bought them from a friend or relative, and 5% took them from a friend or relative without asking.24 Larger strides must be taken toward decreasing the prevalence of intentional medication misuse. Community healthcare providers can help educate the public about the dangers of both prescription and OTC drug abuse and advocate for the safe use of medications. Pharmacists can restrict access to OTC products known to be abused by teens. Parents should be encouraged to include prescription and OTC drugs in their discussions with children about drug abuse. Parents should be advised to lock up drugs that are commonly abused by youth. In the case of a child taking a stimulant for ADHD, parents should educate the child and control drug access to assure that other children will not have access to prescription stimulants.

**Summary**

Community healthcare providers can help reduce the prevalence of medication misuse by educating parents, children, and other healthcare professionals regarding the extent of the problem and ways to prevent both unintentional and intentional misuse. Pharmacists, in particular, can help insure that caregivers use OTC medications safely and effectively, and refer them to a primary care provider when self-care is inappropriate. (See Table 4.)

**References**

• Can I give my baby cough and cold products for her cold symptoms?
  Cough and cold products containing antihistamines, decongestants, antitussives (cough suppressants), and expectorants are not recommended for infants and children with colds, especially children less than 4 years old. There is no proven benefit from using them and they can be harmful.

• What medication can I give my baby for her cold?
  Acetaminophen (Tylenol®, others) can help with cold symptoms like body aches and fever. Ibuprofen (Advil®, Motrin®, others) is an option for children over 6 months of age. Discuss selection of the appropriate product for your child with your pharmacist. There is no advantage to alternating doses of acetaminophen and ibuprofen. In fact, it can be confusing and result in dosing errors.
  To avoid overdosing or underdosing, it is important to get the right strength and formulation of the product based on your child’s age and weight. Overdoses resulting from choosing the wrong strength of a children’s product have led to hospitalization and even death.

• What can I do to help relieve congestion and cough in my child?
  To help relieve nasal congestion in infants, try saline nose drops followed by bulb suction to remove excess mucus. For older children who prefer not to use saline drops, a saline nose spray may help. Keeping the child well hydrated can also help thin mucus and prevent dehydration. A cool-mist humidifier (vaporizer) can make nasal secretions more liquid and keep the child more comfortable. Use only water in the humidifier. Adding medication is not helpful and may be dangerous. In order to get the full benefit, place the humidifier close to the child but beyond their reach. Clean and dry the humidifier each day in order to prevent bacterial or mold growth. Because of the potential for serious burns, hot-water humidifiers are not recommended.
  Gargling with saltwater (1/4 to 1/2 teaspoon salt dissolved in an 8-ounce glass of warm water) may temporarily relieve a sore or scratchy throat in adolescents.

• I think my child has a fever, but the thermometer says her temperature is normal. Am I measuring correctly?
  There are a few different ways to measure a child’s temperature. The American Academy of Pediatrics no longer recommends the use of glass mercury thermometers because if they break, the mercury is poisonous. Both glass and digital thermometers can measure temperatures in the mouth, rectum, or armpit, although the armpit is considered the least accurate. Ear thermometers are another acceptable choice. However, the accuracy may be reduced by wax or a small, curved ear

### Measuring Temperature

**Rectal Temperature**
- The child or infant should lie down on their stomach across an adult’s lap.
- Apply a small amount of petroleum jelly (eg, Vaseline) to the end of the thermometer.
- Gently insert the thermometer into the child’s rectum about 1/2 to 1 inch.
- Hold the thermometer in place. A glass thermometer requires 2 minutes while most digital thermometers need less than 1 minute.
- A child has a fever if the temperature is at or above 100.4 °F (38 °C).
- Label the digital thermometer as “rectal” so this thermometer is never used orally (have a 2nd thermometer for “oral” use).

**Oral Temperature**
- Do not measure the temperature in a child’s mouth if he or she has consumed a hot or cold food or drink in the last 30 minutes.
- Clean the thermometer with cool water and soap. Rinse with water.
- Place the tip of the thermometer under the child’s tongue towards the back. Ask the child to hold the thermometer with his or her lips. Keep the lips sealed around the thermometer.
- A glass thermometer requires about 3 minutes while most digital thermometers need less than 1 minute.
- A child has a fever if the temperature is at or above 99.5 °F (37.5 °C).

**Armpit Temperature**
- Place the tip of the thermometer in the child’s dry armpit.
- Hold the thermometer in place by holding the child’s elbow against the chest for 4 to 5 minutes.
- A child has a fever if the temperature is at or above 99.5 °F (37.5 °C).

**Ear Temperature**
- Ear thermometers are not reliable in infants less than 3 months old.
- Ear tubes and ear infections do not affect accuracy.
- To measure temperature accurately, pull the child’s outer ear backwards before inserting the thermometer.
- If the child has been outside on a cold day, wait 15 minutes before measuring the ear temperature.
- Hold the ear probe in the child’s ear for about 2 seconds.
- Check the product information supplied with the thermometer for the temperature that indicates a fever.
concerned about teens potentially abusing OTC medications? •

• What OTC product should I use to treat my child’s diarrhea? What is causing it?

Rotavirus is the most common cause of diarrhea in infants and children. The use of antibiotics, consuming too much fruit or fruit juice, food sensitivities, and other viruses or bacteria are also common causes of diarrhea in children.

The mainstay of treatment for diarrhea is to provide enough fluid intake to prevent dehydration. The American Academy of Pediatrics recommends special fluids for infants and children called electrolyte solutions. These fluids help replace the water and salts lost during diarrhea. Do not try to prepare these yourself. Use commercially available products (e.g., Pedialyte®, Ricelyte®).

To replace fluid loss, give the child about 2 teaspoons (10 ml) of fluid per 2 lbs (~1 kg) of body weight for each watery stool. As an alternative, children weighing less than 22 lbs should be given 2-4 ounces (60-120 ml) for each diarrheal stool, and those weighing more than 22 lbs should be given 4-8 ounces (120-240 ml).

If you suspect moderate or severe dehydration, contact your healthcare provider for hydration instructions.

OTC antidiarrheal medications such as loperamide (Imodium®) and bismuth subsalicylate (Kaopectate®, Pepto-Bismol®) are not recommended for use in children or infants because there is little evidence that they are effective and serious side effects are possible. Children and teenagers with a fever or viral illness should not take bismuth subsalicylate due to the potential for Reye’s syndrome, a rare but serious disorder. Diarrhea caused by antibiotics may be reduced by giving the child yogurt with live active cultures (probiotics).

• Which antihistamine is recommended to help my toddler sleep through the night?

Antihistamines are typically used to treat seasonal allergies and allergic reactions. Antihistamines and other OTC products are not recommended for use as sleep aids in children because serious side effects are possible. The FDA has stated that cough and cold products should never be used to make a child sleepy.

If your child is having trouble sleeping, consider other methods that may help. Adjust schedules to include good sleep habits and routines, such as a regular, daily nap time. Consider calming activities such as reading before bedtime to help your child wind down.

• I have a teenager. Which OTC medications should I be concerned about teens potentially abusing?

In addition to prescription drugs such as pain relievers and stimulant medications taken for ADHD, the OTC cough suppressant dextromethorphan, or DXM, is a favorite of teens. Dextromethorphan is contained in more than 100 OTC products: syrups, tablets, capsules, lozenges, and gelatin capsules. It is usually combined with other medications such as antihistamines, expectorants, decongestants, and/or simple pain relievers.

Talk with your teen about prescription and OTC drug abuse. Check resources such as www.drugfree.org for more information and be medicine cabinet savvy:

• Do an inventory of the contents of your medicine cabinet, or anywhere in the house where you store medicines.
• Monitor the pill quantities and medicine levels in your prescription and OTC drug containers.
• Put drugs away. Keep drugs you are currently using in a place where you can get to them easily, but where your child is unlikely to look.
• If drugs in your house are left over from a previous condition or ailment, get rid of them.

When to Contact a Primary Care Provider

Contact a pediatrician or primary healthcare provider for evaluation of an illness when a child has:

• a rectal temperature of 100.4°F (38°C) or higher in a baby younger than 3 months
• a fever of 102.2 °F (39 °C) or higher in a child 3-12 months old
• a fever that lasts longer than 24 - 48 hours (under age 2)
• a fever for longer than 48 - 72 hours (older than 2 years old)
• fever and repeated vomiting at the same time
• vomiting and diarrhea that lasts for more than a few hours (in a child of any age)
• an unexpected rash, especially if there is also a fever
• any cough or cold that does not get better in several days, or a cold that gets worse and is accompanied by a fever
• ear pain with fever
• drainage from an ear
• severe sore throat or problems swallowing
• sharp or persistent pains in the abdomen or stomach
• blood in the urine
• not been drinking fluids for more than 12 hours
• medication side effects, or if you suspect them

1. Which of the following is true regarding medication distribution and clearance in infants younger than 1 year of age?
   a. The kidney’s ability to clear drugs matures by about 4 weeks old.
   b. Dosing based on weight is recommended as long as the infant is over 5 months of age.
   c. CYP450 3A4 liver enzymes reach 100% of adult activity by 12 months.
   d. Infants require lower weight-adjusted doses than adults.

2. Which of the following is true of ear pain in an infant or toddler?
   a. It is always an indication of an ear infection or otitis media.
   b. It is typically mistaken for a headache in younger children.
   c. Smaller eustachian tubes may be blocked, causing pressure and pain.
   d. Ear pain in a toddler should always be referred to an allergist.

3. Which of the following is an appropriate age to consider use of OTC cough and cold medicines?
   a. 6 months, depending on weight
   b. 3 years, depending on weight
   c. 2 years
   d. 6 years

4. What is the most common type of unintentional drug misuse?
   a. Using adult OTC products
   b. Giving the wrong medication
   c. Making a dosing error
   d. Using too many medications

5. What is one reason both age and weight should be considered when dosing medications for children?
   a. Most medications have a maximum weight requirement.
   b. Underweight children tend not to be treated due to a fear of overdosing.
   c. Underweight children appear more vulnerable to dosing errors.
   d. Overweight children appear more vulnerable to dosing errors.

6. Why are Vicks VapoRub®-type products a poor choice for children?
   a. They are ineffective for congestion and have caused toxicity.
   b. They increase the blood level and potential toxicity of acetaminophen.
   c. They are effective for congestion but have caused skin burns.
   d. Children commonly mistake these products for peppermint candy.

7. Why are acetaminophen products often accidentally overdosed in children?
   a. Caregivers ignore the administration instructions on the package.
   b. The toddler suspension is commonly given to infants in a dropper.
   c. The high concentration of the infant drops is not understood by caregivers.
   d. Children are attracted to the red color and the droppers look like toys.

8. Which of the following measuring devices for liquids has the highest error rate?
   a. A dropper
   b. A dosing cup
   c. A syringe
   d. A dosing spoon

9. Which of the following is true regarding the potential for toxicity from ibuprofen products in children?
   a. Significant vomiting or diarrhea increases the risk for kidney toxicity.
   b. Dehydrated children are at increased risk for liver toxicity.
   c. Children with significant vomiting can safely use ibuprofen suppositories.
   d. They should be avoided due to the increased risk of Reye’s syndrome.

10. About how many teenagers believe that prescription pain relievers are not addictive and there is nothing wrong with taking them occasionally without a prescription?
    a. About one-tenth
    b. 20%
    c. 80%
    d. About one-third

11. Which OTC medication is most likely to be abused by teens?
    a. Phenylephrine
    b. Ibuprofen
    c. Dextromethorphan
    d. Hydrocortisone cream

12. Which of the following is true regarding malicious misuse of drugs in children?
    a. Malicious medication misuse in children has not resulted in a fatality.
    b. Benzodiazepines are among the most common drugs used maliciously.
    c. It is not considered abusive since OTC drugs are usually used.
    d. Providers should call the police rather than educate the caregivers.