Prescribing Medicine & Preventing Errors

MATH TOPICS ADDRESSED:
- Constructing and solving proportions
- Making conversions between customary units and metric units
- Converting among metric units
- Estimating and using order of magnitude

When doctors write prescriptions for medicine, they must make sure the dose is correct by taking into account the patient's weight and age. Pharmacists then measure the medicine and write directions for its use.

It is important to catch any errors before the patient takes the medicine.

However, mistakes can happen.

Errors may occur because the doctor must not only consider weight and age but also calculate a child's weight in pounds (a customary measurement) against standard dosages that are measured in metric units. Because taking too much medication must be avoided, using estimation to recognize reasonable dosages will help find errors.

This department highlights math concepts in the context of problem solving in the real world. Readers are encouraged to submit ideas or work with someone they know to create a manuscript. Submit your ideas to **mtms@nctm.org**.

PROBLEM

Dr. Rather often prescribes amoxicillin (a generic name for a common antibiotic) to youngsters (ages 4 months to 5 years) for ear infections. For this age group, amoxicillin is often prescribed according to the weight (in kilograms) of the patient. The standard amount of medicine given to this age of individual is 45 mg/kg per day, which should be administered in two doses per day for 7 days. It is important not to exceed the recommended dosage.

1. Dr. Rather asked a health volunteer in the office, Jana, to show her calculations when writing a prescription for amoxicillin for any individual between the ages of 4 months and 5 years. Dr. Rather noticed that each step contained an error. The doctor is asking you to find and correct each error.

Step 1: Since 1 kilogram contains about 2.2 pounds, convert the person's weight in pounds to kilograms by multiplying the number of pounds by 2.2.

Step 2: Using the value from the first step, use this proportion to solve for x, the daily dosage in mg:

$$\frac{x \text{ mg}}{\text{child's weight in kg}} = \frac{1 \text{ kg}}{45 \text{ mg}}$$

Step 3: Write the prescription in this way: "Give the child x mg per day for 7 days."

2. If a patient takes a 1.5 g pill in the morning and a 2.0 g pill in the evening, how many mg did the patient take in 1 day? How many mg will the patient take over 7 days?

3. The doctor is prescribing amoxicillin for Pat's ear infection. Pat weighs 80 pounds.

   a. The doctor calculates that Pat should be given 3600 mg of amoxicillin per day. Is this correct? If not, calculate the correct dosage; otherwise, show that this prescription is the correct dosage.

   b. The pharmacist, Chris, has amoxicillin pills in 0.5 g, 1.0 g, and 2.0 g sizes. When dispensing Pat's prescription, Chris writes these directions: Take a 0.5 g dose in the morning and a 1.0 g dose in the evening. Explain why this is the correct dosage.

   c. Pat's parent thinks that there is an error and that Pat should be getting a 1.0 g and a 0.5 g dose in the morning, followed by another 1.0 g and 0.5 g dose in the evening. Write a note to Pat's parent explaining why this thinking is incorrect.

Source: antibiotics.emedtv.com

The solutions are appended to the online version of "Math for Real" at www.nctm.org/mtms.

(Continued from page 64)

1. Step 1: Jana should have divided the child's weight in pounds by 2.2.

Step 2: The proportion is set up incorrectly. Put 45 mg over 1 kg on the right side, or put x mg per day under the child's weight in kg (from step 1) on the left side.

Step 3: Jana should have divided the x mg per day by 2 and prescribed two doses per day that will total the amount that should be taken per day.

2. 1.5 g and 2.0 g sum to 3.5 g, or 3500 mg. Over the course of 7 days, this will be 24,500 mg, or 24.5 g.

3a. The doctor did not convert the pounds to kg, which would be about 36 kg. Therefore, the dose is 1636, which rounds to approximately 1600 mg.

3b. The pharmacist converted mg to g (1000 mg to 1 g), then rounded the needed 1600 mg to 1500 to fit the dosages available. This figure is important because it is close to but does not exceed the prescribed dosage.

3c. Pat's parent does not realize that the 1500 mg per day needs to be split over two doses.

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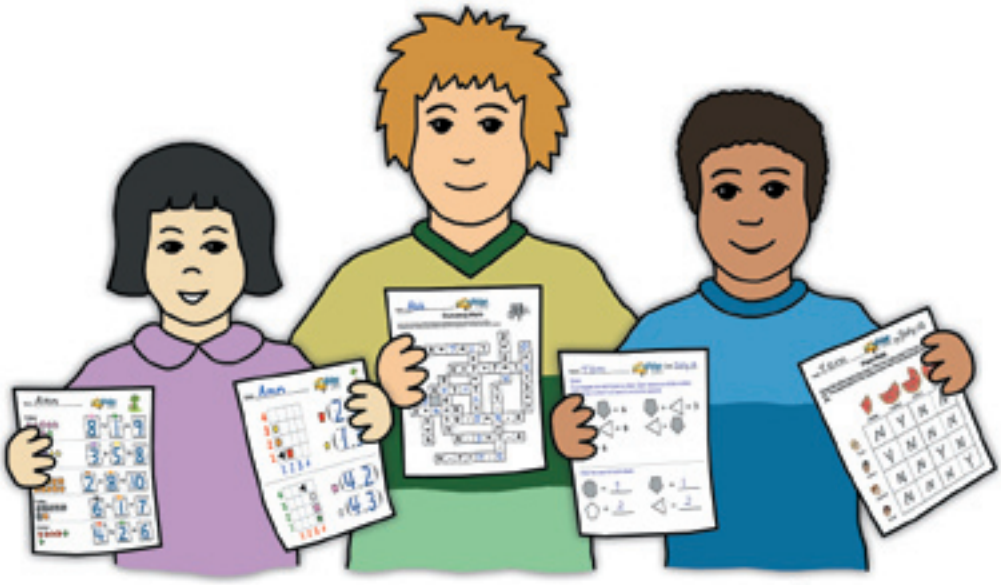

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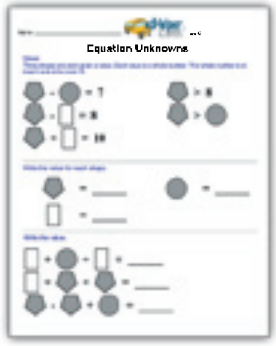

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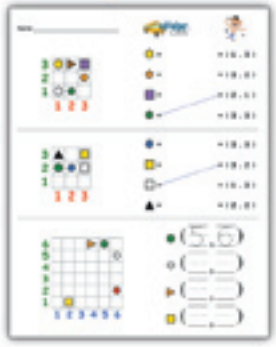

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