Dosage Calculations Based on Body Weight

LEARNING OBJECTIVES
After completing this chapter, the student will be able to:

1 List three examples of when dosing based on body weight is important
2 Calculate medication doses based on body weight

The body weight of a patient is used in calculating accurate doses of medications, especially for pediatric and geriatric patients and also for potent drugs such as chemotherapy agents. This method of calculation is considered more reliable than doses based on age. Doses are expressed as milligrams per kilogram (kg) or micrograms per kilogram or milligrams per pound of body weight: mg/kg or mcg/kg or mg/lb. Conversions from pounds to kilograms or kilograms to pounds must be made when necessary. The conversion factor is 1 kilogram (kg) = 2.2 pounds (lbs.).

\[ \text{Use the conversion factor } 2.2 \text{ lb./kg for calculating doses based on body weight in kg.} \]

EXAMPLE
A patient weighs 121 pounds. What is her weight in kilograms?

1 kg = 2.2 lb.

Set up a ratio and proportion problem.

\[ \frac{1 \text{ kg}}{2.2 \text{ lb.}} = \frac{X}{121 \text{ lb.}} \quad \Rightarrow \quad X = \frac{1 \text{ kg} \times 121 \text{ lb.}}{2.2 \text{ lb.}} = \frac{121}{2.2} = 55 \quad \text{kg} \quad \text{answer} \]

EXAMPLE
A patient weighs 90 kg. The dosage is based on mg/lb. body weight. What does this patient weigh in pounds?

1 kg = 2.2 lb.

Set up a ratio and proportion.

\[ \frac{1 \text{ kg}}{2.2 \text{ lb.}} = \frac{90 \text{ kg}}{X} \quad \Rightarrow \quad X = \frac{90 \text{ kg} \times 2.2 \text{ lb.}}{1 \text{ kg}} = 198 \text{ lb.} \quad \text{answer} \]

KEY TERMS
mcg/kg: micrograms of drug per kilogram of body weight
mg/kg: milligrams of drug per kilogram of body weight
mg/lb: milligrams of drug per pound of body weight
EXAMPLE
A pediatric patient is ordered a 2 mg/kg single dose of a chemotherapy drug. The child weighs 44 pounds. How many mg will the child receive in the single dose?

Convert the weight from pounds to kilograms: 1 kg = 2.2 lb.

\[
\frac{1 \text{ kg}}{2.2 \text{ lb.}} = \frac{X}{44 \text{ lb.}} = \frac{1 \text{ kg} \times 44 \text{ lb.}}{2.2 \text{ lb.}} \rightarrow X = 20 \text{ kg answer}
\]

The dose is 2 mg/kg.
Set up a ratio and proportion.

\[
\frac{2 \text{ mg}}{1 \text{ kg}} = \frac{X}{20 \text{ kg}} \rightarrow \frac{X \times 2 \text{ kg}}{1 \text{ kg}} = \frac{2 \text{ mg} \times 20 \text{ kg}}{1 \text{ kg}} \rightarrow X = 40 \text{ mg answer}
\]

Rx Use special care when calculating doses based on body weight for children. Many serious dosing errors for pediatric patients are caused by errors in calculations.

EXAMPLE
An infant weighs 6 pounds. The dose of vancomycin to be given is 15 mg/kg/day divided into two doses. What is the dose, in mg, for one dose?

Convert 6 lb. to kg 1 kg = 2.2 lb.
Set up a ratio and proportion:

\[
\frac{1 \text{ kg}}{2.2 \text{ lb.}} = \frac{X}{6 \text{ lb.}} \rightarrow \frac{X \times 2 \text{ kg}}{2.2 \text{ lb.}} = \frac{1 \text{ kg} \times 6 \text{ lb.}}{2.2 \text{ lb.}} \rightarrow X = 2.7 \text{ kg}
\]

The dose is 15 mg for each kg per day.
Set up a ratio and proportion:

\[
\frac{15 \text{ mg}}{1 \text{ kg}} = \frac{X}{2.7 \text{ kg}} \rightarrow \frac{X \times 1 \text{ kg}}{1 \text{ kg}} = \frac{15 \text{ mg} \times 2.7 \text{ kg}}{1 \text{ kg}} \rightarrow X = 40.5 \text{ mg per day}
\]

The vancomycin is divided into two doses.

40.5 mg/2 = 20.25 mg per dose. answer
Doses in milliliters, for addition to infusions, can then be calculated using the concentration found on the vial label of the particular drug ordered by the physician.
EXAMPLE
A patient weighs 110 lbs. The physician orders 5 mg/kg of medication per day in 1,000 ml NS. The drug is available as 50 mg/ml. How many ml will be added to the 1 L bag?

Convert 110 lbs. to kg.

You may set up a ratio and proportion problem, but from previous examples, it is known that lbs. divided by 2.2 = kg.

\[ \frac{110 \text{ lbs.}}{2.2} \rightarrow 50 \text{ kg for patient weight} \]

The dose is 5 mg/kg \[ \rightarrow 5 \text{ mg} \times 50 \text{ kg} = 250 \text{ mg}. \]

The medication is available as 50 mg/ml.

Set up a ratio and proportion to calculate the ml needed.

\[ \frac{50 \text{ mg}}{1 \text{ ml}} = \frac{250 \text{ mg}}{x} \rightarrow x = \frac{250 \text{ mg} \times 1 \text{ ml}}{50 \text{ mg}} \]

\[ \rightarrow 5 \text{ ml answer} \]
1. Cefuroxime is to be administered 20 mg per kg IV q4h. How many mg per dose should a child weighing 30 kg receive?

2. A physician orders a medication available as 500 mg tablets for a 110-pound patient. The recommended dose for the drug is 20 mg/kg per dose. How many tablets should be given to the patient for each dose?

3. The doctor orders vancomycin 10 mg/kg q12h IV for a newborn. The infant weighs 4,000 g. How many mg should be given per dose?

4. A physician orders cyclophosphamide to be given 5 mg/kg qid in 50 ml D5W. The patient weighs 132 pounds. If the concentration of the drug available is 500 mg/10 ml, how many ml should be added to each bag?

5. A physician requests an aminophyllin infusion. The order is for 1,000 mg aminophyllin in 500 ml of D5W. If the patient weighs 182 pounds and is to receive 0.6 mg/kg, how many ml will deliver the required dose?

6. An adult intravenous dose of zidovudine is 2 mg/kg every four hours six times daily. How many mg will a 180-pound patient receive daily?
7. The dose of vincristine, based on the patient’s body weight, is 25 mcg/kg. The drug is available as 500 mcg/ml. The patient weighs 110 pounds. How many ml are used for a dose?

8. A patient weighs 44 pounds and is receiving ampicillin at a rate of 100 mg/kg/day. What is the total daily dose in grams?

9. Calculate a single dose, in milliliters, for a 20-pound child receiving gentamicin 2 mg/kg of body weight IVPB q8h. Gentamicin is available in 20 mg/2 ml concentration.

10. Immune globulin is available in a concentration of 6 g/100 ml. The order for a 55-pound child is 0.2 g/kg IV. How many ml are needed for this dose?

11. A 26-pound child is to receive ampicillin at a dose of 50 mg/kg/day in four equally divided doses. The ampicillin is available in a concentration of 125 mg/5 ml. How many ml are needed for one dose?

12. A medication order for a patient weighing 154 pounds calls for 0.25 mg of amphotericin B per kg of body weight to be added to 500 ml of 5% dextrose injection. If the amphotericin B is to be obtained from a 10 ml vial containing 50 mg, how many ml should be added to the dextrose injection?
13. The infusion rate for theophylline for acute bronchospasm is 0.5 mg/kg/hour. How many mg of the drug will the patient receive in 24 hours, if the body weight of the patient is 100 pounds?

14. A physician orders a drug 5 mg/kg three times a day for one week. What is the total daily dose, in grams, for a patient weighing 120 pounds?

15. A 160-pound man is admitted to the hospital. The order states that the patient is to receive 7.5 mg/kg of acyclovir in 1,000 ml of D5W over 24 hours. The drug comes in 500 mg vials, which are diluted with 10 ml of sterile water (assume no powder volume). How many ml are to be added to the bag?

16. A pediatrician has prescribed penicillin VK oral suspension for a 66-pound patient. The prescription states that the patient is to receive 50,000 units/kg/day in four equal divided doses for 10 days. On the shelf is penicillin VK 250 mg/5 ml (1,500 units penicillin VK/mg). How many ml are needed for one dose?

17. A five-year-old child weighing 45 pounds is to be given an oral dose of Tylenol Elixir. The literature states that a child of this age and weight should not exceed 71 mg/kg per day. If this daily maximum is to be divided into six doses, how much is each dose in mg? Tylenol Elixir contains 120 mg/5 ml. How many ml are needed for each of the six doses to be given?

18. A 176-pound patient requires a dose of 5 mcg/kg/min of dopamine. How many mg will the patient receive in 20 minutes?
19. A physician orders a bolus dose of a chemotherapy drug at a rate of 2 mg/kg. The patient weighs 200 pounds. The syringe is labeled 100 mg/5 ml. How many ml are needed for the bolus dose?

20. A patient weighs 130 pounds. The physician orders gentamicin at 3 mg/kg per day in three 50 ml piggyback bags. How many mg will be added to each bag?

21. Gentamycin is ordered 1.5 mg/kg/dose for a patient who weighs 135 pounds. Gentamycin is available in a 1 ml vial with a concentration of 40 mg/ml. How many ml of Gentamycin should the patient receive?

22. A patient is to receive a drug IM 0.6 mg/kg every 4 hours as needed. The patient weighs 28 pounds. The drug concentration is 2.5 mg/ml. How many ml will the patient need per dose?

23. A 64-pound child is to receive 300 mg/kg/day divided into 4 equal doses. The concentration of the drug solution available is 500 mg per ml. How many ml will the child receive for each dose?

24. A physician writes an order for a 52-pound child for 400,000 units/kg/day in divided doses every 6 hours. Each dose is administered in a 50 ml bag of D5W IVPB. The drug is available as 500,000 units per ml. How many ml will be used in each IVPB?
25. A patient, weighing 80 pounds, is ordered phenobarbital 5 mg/kg at bedtime. The phenobarbital injection solution is available in 1 ml vials with a concentration of 65 mg/ml. How many ml will the patient need for this dose?

26. An order is received in the pharmacy for a 172-pound patient for an IV infusion of 5 mcg/kg/day in 100 ml NS. The ordered drug is available in a concentration of 300 mcg/ml in 1 ml or 1.6 ml vials. How many ml will the patient receive per day?

27. Insulin is available in a concentration of 100 units/ml. A patient order reads 0.8 units/kg/day in divided doses. The patient weighs 102 pounds. How many ml should the patient receive each day?

28. A neonate weighs 3 1/2 pounds. She is ordered a medication dose of 20 mg/kg every 12 hours. The medication is available in a concentration of 33.3 mg/ml. How many ml will the infant require per 12 hours?

29. Succinylcholine is available in a concentration of 20 mg/ml in a 10 ml vial. The order reads 40 mcg/kg every 5 to 10 minutes as a maintenance dose for the patient who weighs 190 pounds. How many ml will the patient receive for each dose?

30. The drug ordered is available in the pharmacy in a concentration of 0.5 mg/ml. The physician orders a dose of 25 mcg/kg for a patient who weighs 160 pounds. How many ml will be needed to fill the order?
31. Herceptin is ordered as follows:
   
   Dose 1: 4 mg/kg/week (1st week)
   Dose 2, 3, 4: 2 mg/kg/week (2nd, 3rd, and 4th week)

   The patient weighs 70 kg. How many mg of Herceptin has the patient received after 4 weeks?

32. A physician orders a medication for a patient who weighs 130 pounds. The order reads 300 mg/kg in 50 ml D5W q4h. How many grams of the medication will the patient receive in 24 hours?

33. A patient order is for 1.5 g/kg by slow infusion. The patient weighs 145 pounds. The drug concentration is 40 g/150 ml. How many ml will the patient need?

34. A patient needs 4,400 units/kg/hour of a drug for a 12-hour infusion. The patient weighs 172 pounds. What is the total number of units the patient will receive over the 12-hour infusion?

35. Zinc sulfate injection is available in a concentration of 1 mg/ml. An order is received in the pharmacy for a five-year-old child who weighs 49 pounds. The order reads 100 mcg/kg per day. How many ml will the child receive in one day?
36. A patient is to receive a course of treatment over 3 days. The patient weighs 122 pounds. The dosage is as follows:

- Day 1: 10 mg/kg
- 5 mg/kg 6 hours later
- Day 2, 3: 5 mg/kg

What is the total amount of drug in grams that the patient will need over the course of the treatment?

37. Ceftazidime is ordered for a 52-pound patient at a dosage of 50 mg/kg/dose every 8 hours. The drug in solution is available in a concentration of 100 mg/ml. How many ml are required for each dose?

38. The dose for a newborn is 800 mg/kg/day as a continuous infusion. The infant weighs 7.5 pounds. The drug is available as a 100 mg/ml solution. How many ml are needed for the dose?

39. A drug is available as 39.55 mg/ml in a 10 ml vial. The patient order received in the pharmacy is for 35 mg/kg/day. The patient weighs 109 pounds. How many ml are required to fill the order?

40. A 139-pound patient is ordered a medication dose of 125 mg/kg/24 hours. The concentration of the medication to be used is 425 mg/2 ml. How many ml are needed for the patient dose?
41. A pediatric patient order is 75 mcg/kg q12h. The patient weighs 33 lbs. The medication is available as 1 mg/ml. How many ml will be needed over 24 hours?

42. Potassium chloride is ordered 0.5 mEq/kg/hr for a patient who weighs 154 lbs. The potassium chloride label reads 2 mEq/ml. How many ml are needed for a 4-hour infusion in 1,000 ml D5W?

43. A patient weighing 132 lbs. is ordered theophylline 0.55 mg/kg/hr for 12 hours. What is the total amount of theophylline in mg that will be administered?

44. A neonate order is 0.03 mg/kg of a 1:10,000 solution. The patient weighs 4.4 lbs. How many ml of the solution will be needed?

45. Cimetidine is available as an injection solution with a concentration of 150 mg/ml. The patient weighs 66 lbs. The dose ordered is 20 mg/kg/day in divided doses q6h. How many ml will be needed for each dose?