Dosage Calculation Review

Review based on required readings selected from:


Upon completion of this learning activity the student should be able to:

1. Perform ratio proportion to solve equations for “X”.
2. Convert using ratio proportion between systems of measurement as well as within the metric system.
4. Calculate intravenous drip rates using an IV administration set versus an electronic delivery device.
5. Calculate advanced Intravenous calculations for medicated infusions.
6. Analyze physician orders prescribing medicated intravenous infusions.

How to use this activity:

- In order to complete this activity you will need the following:
  - Calculator
  - Practice math test
  - Dosage Calculation textbook
- Select the action button for the topic you are interested in from the main menu on the next slide....

Let’s Begin...
Ratio Proportion

1. According to Pickar, a ratio proportion is defined as:

   an equation of two equal ratios that can be expressed as fraction (Pickar, 2007 pg 49)

   It is used to solve an unknown through the use of cross multiplication and isolating “x” and helps us to solve calculation problems wherein you are provided and prescribed dose and a dosage on hand.

   \[
   \frac{1}{4} = \frac{x}{8}
   \]

   \[
   4 \times x = 1 \times 8
   \]

   \[
   4x = 8
   \]

   \[
   x = 2
   \]

   Replacing X with 2 in the original equation confirms the answer:

   \[
   \frac{1}{4} = \frac{2}{8}
   \]

   Review set 9 for additional practice on page 49-50.
Steps for Ratio Proportion

1. Convert to like units or measure
2. If weight adjusted, calculate the dose
3. If a continuous IV infusion is prescribed in the order (ex 2 mg/min), calculate dose per hour (ex 120 mg/hr)
4. Set up your ratio proportion
   \[ \frac{\text{dosage on hand}}{\text{amount on hand}} = \frac{\text{dosage desired}}{\text{x amount desired}} \]
5. Cross multiply
6. Solve for x
7. Label x
8. Recheck your answer

Ratio Proportion Example

Example from practice math sheet:

Lopressor 25 mg is ordered and Lopressor 50 mg is provided.

\[
\frac{50 \text{ mg}}{1 \text{ tablet}} = \frac{25 \text{ mg}}{x \text{ tablet}}
\]
\[
50 \times x = 25 \\
50 \quad 50
\]
\[x = 0.5 \text{ tablets} \]

For more practice refer to Pickar review set 24 on page 180 and the practice math sheets provided at the college.

Converting using Ratio Proportion cont’d

Review of common equivalents

1 mg = 1000 mcg  
1 oz = 30 ml
1 gm = 1000 mg  
1 tsp = 5 ml
1 kg = 1000 gm  
1 lb = 2.2 kg
1 L = 1000 ml
1 grain = 60 mg or 65 mg
Converting using Ratio Proportion: mg/g cont’d

Look at page 74 example #1:

Solumedrol 500 mg is ordered while 1 gram is supplied.
This required a conversion. Follow the steps outlined on page 75:
1. Recall the equivalents
2. Set up the ratio proportion of equivalents
3. Cross multiply and solve for x

\[
\frac{1000 \text{ mg}}{1 \text{ gram}} = \frac{500 \text{ mg}}{x \text{ grams}}
\]

\[
1000x = 500
\]

\[
x = 0.5 \text{ grams}
\]

Converting using Ratio Proportion: grain/mg cont’d

Look at page 74 example #2:

Codeine gr 1/2 is ordered. Codeine 30 mg is available.
This required a conversion. Follow the steps outlined on page 75:
1. Recall the equivalents
2. Set up the ratio proportion of equivalents
3. Cross multiply and solve for x

\[
\frac{60 \text{ mg}}{1 \text{ grain}} = \frac{30 \text{ mg}}{x \text{ grains}}
\]

\[
60x = 30
\]

\[
x = 0.5 \text{ grains}
\]

Converting using Ratio Proportion: mcg/mg cont’d

Look at page 83 problem #23:

You have 18 mcg and you need to convert to mg.
This required a conversion. Follow the steps outlined on page 75:
1. Recall the equivalents
2. Set up the ratio proportion of equivalents
3. Cross multiply and solve for x

\[
\frac{1000 \text{ mcg}}{1 \text{ mg}} = \frac{18 \text{ mcg}}{x \text{ mg}}
\]

\[
1000x = 18
\]

\[
x = 0.018 \text{ mg}
\]
Converting using Ratio Proportion: lb/kg cont’d

Look at page 87 problem #37:
The weight is 110 lbs and you need to convert to kg.
This required a conversion. Follow the steps outlined on page 75:
1. Recall the equivalents
2. Set up the ratio proportion of equivalents
3. Cross multiply and solve for x

\[
\begin{align*}
2.2 \text{ lb} & = 110 \text{ lbs} \\
1 \text{ kg} & = x \text{ kg} \\
2.2x & = 110 \\
x & = 50 \text{ kg}
\end{align*}
\]

Parenteral Doses

When administering a parenteral dose you will follow the same steps for ratio proportion but recall the rules for rounding when drawing up medication in a syringe as explained on page 202.
1. Round to the nearest tenth when using a 3 ml syringe for a volume greater than 1 ml
2. Round to the nearest one hundredth when using a 1 ml syringe for volumes smaller than 1 ml.
3. If a volume is calculated in tenths, you can draw it up in a 1 ml or 3 ml syringe.

Lets practice...

Parenteral dose practice

Look at example # 6 on page 206
Order: Robinul 150 mcg, Supplied: 0.2mg/ml, What would you administer?
First convert:

\[
\begin{align*}
0.2 \text{ mg} & = 150 \text{ mcg} \\
100 \text{ mcg} & = x \text{ mcg} \\
x & = 200 \text{ mcg}
\end{align*}
\]

Next set up ratio proportion:

\[
\begin{align*}
150 \text{ mcg} & = 200 \text{ mcg} \\
x \text{ ml} & = 1 \text{ ml} \\
200 \times & = 150 \\
x & = 0.75 \text{ ml}
\end{align*}
\]

Then think rules and select equipment before deciding to round.
Since the volume is less than 1 ml and the volume is solved to the nearest hundredth, select a one ml syringe and no further rounding would be required. \( x = 0.75 \text{ ml} \) is the answer. Review practice questions starting on page 208.
Calculating weight based doses

- Look at examples on page 284, then review the rules:
  - Convert weight first using ratio proportion
    \[
    \frac{2.2 \text{ lb}}{1 \text{ kg}} = \frac{79 \text{ lbs}}{x \text{ kg}}
    \]
    \[x = 35.9 \text{ kg}
    \]
    Tip: always use a calculator so as not to reenter the weight for the next part.
  - Set up ratio proportion for dose (use example on page 285)
    \[
    \frac{0.05 \text{ mg}}{1 \text{ kg}} = \frac{x \text{ mg}}{35.9 \text{ kg}}
    \]
    Cross multiply and solve for \(x\): \(x = 1.79 \text{ mg}\)

Practice

Administer 0.5 mg/kg of a drug to a client weighing 79 lbs. The vial supplied contains 10 mg/ml

1. Convert weight first using ratio proportion
   \[
   \frac{2.2 \text{ lb}}{1 \text{ kg}} = \frac{79 \text{ lbs}}{x \text{ kg}}
   \]
   \[x = 35.9 \text{ kg}
   \]

2. Calculate dose by multiplying weight by ordered dose:
   \[35.9 \times 0.5 \text{ mg} = 17.95 \text{ mg}\]

3. Set up ratio proportion
   \[
   \frac{17.95 \text{ mg}}{35.9 \text{ kg}} = \frac{x \text{ mg}}{1 \text{ ml}}
   \]
   Cross multiply and solve for \(x\): \(x = 1.795 \text{ mg}\)

Think volume and use a 3 ml syringe and round to the nearest tenth. \(x = 1.8 \text{ ml}\)

Practice 2

Look at problems from the practice math sheet:

Administer heparin 64 units/kg to a client weighing 110 lbs rounding to the nearest 100 units. The vial supplied contains 10000 units/ml

1. Convert weight first using ratio proportion
   \[
   \frac{2.2 \text{ lb}}{1 \text{ kg}} = \frac{110 \text{ lbs}}{x \text{ kg}}
   \]
   \[x = 50 \text{ kg}
   \]

2. Calculate dose by multiplying weight by ordered dose:
   \[50 \times 64 \text{ units} = 3200 \text{ units}\]
   (no further rounding of dose is required)

3. Set up ratio proportion
   \[
   \frac{3200 \text{ units}}{50 \text{ kg}} = \frac{x \text{ units}}{1 \text{ ml}}
   \]
   Cross multiply and solve for \(x\): \(x = 0.32 \text{ ml}\)

Think volume and use a 1 ml syringe and round to the nearest hundredth. \(x = 0.32 \text{ ml}\)
Calculating IV drips

- Review of formulas:
  \[
  \text{rate} = \frac{\text{Volume} \times \text{drop factor}}{\text{time in minutes}}
  \]
  - All administration sets are calculated as gtt/min where the drop factor calibration is provided on the packaging.
  - All electronic delivery devices are calculated as ml/hr with a drop factor calibration of 60.
  \[
  \text{Total ml ordered} = \text{ml/hr} \times \# \text{ of hours}
  \]
- All that is required is to plug in the values.

Using electronic delivery devices

- All medicated IV drips; heparin, nitroglycerin, dopamine, etc are administered on an IV pump in ml/hr and rounded to the nearest tenth
- For IV piggybacks and non medicated IVs round to the nearest whole number.

Let's practice...

Calculating IV drips practice

See page 345:
1. 1000 ml D5W over 10 hours on a pump
   \[
   \frac{1000\text{ml}}{10 \text{ hrs}} = 100 \text{ ml/hr}
   \]
2. Lactated ringers at 150 ml/hr using a 15 drop factor administration set
   \[
   \frac{150 \text{ ml}}{60 \text{ minutes}} \times 15 \text{ gtt/ml} = 37.5 \text{ gtt/min} \]
   Rounded to 38 gtt/min

Continue practice on page 351 and on your practice math sheets.
Advanced IV calculations

1. Convert to like tags or units of measure
2. If weight adjusted, calculate the dose by multiplying prescribed dose by kg weight
3. If a continuous IV infusion is prescribed in the order (ex 2 mg/min), calculate dose per hour (ex 120 mg/hr)
4. Set up your ratio proportion
   \[ \frac{\text{Dosage on hand}}{\text{Dosage desired}} = \frac{\text{amount on hand}}{x \text{ amount desired}} \]
5. Cross multiply
6. Solve for x
7. Label x
8. Recheck your answer

Advanced IV calculation example

Heparin is ordered at 12 units/kg/hour to a client weighing 220 lbs. The available IV solution is labeled Heparin 25000 units 250 ml D5W. How would you program the pump?

1. Don't need to convert to like tags or units of measure
2. If weight adjusted, calculate the dose
   \[ 12 \text{ units/kg/hr} \times 100 \text{ kg} = 1200 \text{ units/hr} \]
3. Don't need to calculate dose per hour

Advanced IV calculation example

4. Set up your ratio proportion
   \[ \frac{25000 \text{ units}}{250 \text{ ml}} = \frac{1200 \text{ units/hr}}{x \text{ ml/hr}} \]
   \[ x = 12 \text{ ml/hr} \]
   If there was a decimal point it would be rounded to the nearest tenth.
5. Recheck your answer
   \[ \frac{100 \text{ units}}{1 \text{ ml}} = \frac{x \text{ units/hr}}{12 \text{ ml/hr}} \]
   \[ x = 1200 \text{ units/hr} \]
Advanced IV calculation example

Dopamine is ordered at 2.5 mcg/kg/minute to a client weighing 220 lbs. The available IV solution is labeled Dopamine 400mg in 500 ml D5W. How would you program the pump?

1. Convert to like tags or units of measure
   $2.5 \, \text{mcg/kg/min} = \frac{1000 \, \text{mcg}}{1 \, \text{mg}} \times \frac{\text{mg}}{\text{kg/min}} = 0.0025 \, \text{mg/kg/min}$

2. If weight adjusted, calculate the dose
   $0.0025 \, \text{mg/kg/min} \times 100 \, \text{kg} = 0.25 \, \text{mg/min}$

3. Calculate dose per hour
   $0.25 \, \text{mg/min} \times 60 \, \text{minutes} = 15 \, \text{mg/hr}$

Continued

4. Set up your ratio proportion
   $\frac{400 \, \text{mg}}{500 \, \text{ml}} = \frac{x \, \text{mg/hr}}{18.75 \, \text{ml/hr}}$
   $400 \times 18.75 = 7500 \times x$
   $x = \frac{7500}{400} = 18.75 \, \text{mg/hr}$

5. Recheck your answer
   $\frac{400 \, \text{mg}}{500 \, \text{ml}} = \frac{x \, \text{mg/hr}}{18.75 \, \text{ml/hr}}$
   $500 \times x = 7500$
   $x = \frac{7500}{500} = 15 \, \text{mg/hr}$

Analyzing physician orders

1. Read through the orders completely before answering questions.
2. Read twice before answering questions.
3. Review rules for advanced IV calculations and parenteral dosing before answering.
4. Carefully scrutinize for questions asking you to check all that apply.
5. Review ratio proportion to isolate concentration in 1 ml/hr

$\frac{25000 \, \text{units}}{250 \, \text{ml}} = \frac{x \, \text{units/hr}}{1 \, \text{ml/hr}}$
   $250 \times x = 25000$
   $x = 100 \, \text{units/hr}$