Calculations for Pharmacy Technicians

Presented by: Antonia Kraljevic
PGY2 Pharmacy Practice Resident

The speaker has no actual or potential conflict of interest in relation to this presentation.

Pharmacy Technician Objectives

- Discuss the differences between ratios and proportions.
- Describe powder volume and the impact during vial reconstitution while doing dilution calculations.
- Review flow rate calculations for infusions.

Ratios and Proportions

Ratio

- A ratio is a quantitative relation between two amounts
- Can be represented by a colon (:) or as a fraction (x/y)
- Example
  - There are 3 apples to every orange
  - 3:1 (apple:orange)

Proportion

- A proportion is two ratios that are equal
- Can also be represented by a colon (:) or fraction (x/y)
- Example
  - $\frac{2}{3}$ is equal to $\frac{4}{6}$
- Proportions are most often used to solve dosage calculations

Example

The pharmacist asks you to make a 480mL tacrolimus 1mg/mL suspension. The following recipe is found under the pharmacy compounding formulations.

Tacrolimus Oral Suspension 1 mg/mL

FORMULATION: Tacrolimus Oral Suspension

INGREDIENTS:		
	Tacrolimus 5mg capsules	6 capsules
	Sterile Water	5 mL
	Ora-Plus and Ora Sweet	aa qs 30mL

Example

Tacrolimus Oral Suspension 1 mg/mL

FORMULATION: Tacrolimus Oral Suspension

INGREDIENTS:		
	Tacrolimus 5mg capsules	6 capsules
	Sterile Water	5 mL
	Ora-Plus and Ora Sweet	aa qs 30mL

How many capsules are needed to create the 480mL suspension?

First, set up the proportion.

$$\frac{6 \text{ capsules}}{30\text{mL}} = \frac{\mathbf{x}}{480\text{mL}}$$

Example

Tacrolimus Oral Suspension 1 mg/mL

FORMULATION: Tacrolimus Oral Suspension

INGREDIENTS:		
	Tacrolimus 5mg capsules	6 capsules
	Sterile Water	5 mL
	Ora-Plus and Ora Sweet	aa qs 30mL

How many capsules are needed to create the 480mL suspension?

First, set up the proportion.

$$\frac{6 \text{ capsules}}{30\text{mL}} = \frac{\mathbf{x}}{480\text{mL}}$$

How do we find x? Rearrange the equation.

$$\frac{480\text{mL} \times 6 \text{ capsules}}{30\text{mL}} = x$$

x=96 capsules

Example

Tacrolimus Oral Suspension 1 mg/mL

FORMULATION: Tacrolimus Oral Suspension

INGREDIENTS:		
	Tacrolimus 5mg capsules	6 capsules
	Sterile Water	5 mL
	Ora-Plus and Ora Sweet	aa qs 30mL

How many capsules are needed to create the 480mL suspension?
First, set up the proportion.

$$\frac{6 \text{ capsules}}{30\text{mL}} = \frac{\mathbf{x}}{480\text{mL}}$$

How do we find x? Rearrange the equation.

$$\frac{480\text{mL} \times 6 \text{ capsules}}{30\text{mL}} = x$$

x=96 capsules

How many mg of tacrolimus are needed to create this suspension.

$$96 \text{ capsules} \times \frac{5\text{mg}}{1 \text{ capsule}} = 480\text{mg}$$

Assessment Question

Patient AJ has an order for

Levetiracetam 750mg

Sodium Chloride 100mL

You are the pharmacy technician in the cleanroom and find the drug with the following concentration.

How many mL of levetiracetam must be drawn up in order to make this IV infusion?

a) 7.5mL

b) 5.5mL

c) 14mL

d) 11mL

Assessment Question

First, set up the ratio to determine the concentration of the vial.

$$\frac{500\text{mg}}{5\text{mL}} = \frac{\mathbf{x}}{1\text{mL}}$$

Assessment Question

First, set up the ratio to determine the concentration of the vial.

$$\frac{500\text{mg}}{5\text{mL}} = \frac{\mathbf{x}}{1\text{mL}}$$

Then we find x.

$$\frac{500\text{mg} \times 1\text{mL}}{5\text{mL}} = x$$

$$\mathbf{x = 100mg}$$

Assessment Question

First, set up the ratio to determine the concentration of the vial.

$$\frac{500\text{mg}}{5\text{mL}}=\frac{\mathbf{x}}{1\text{mL}}$$

Then we find x.

$$\frac{500\text{mg x } 1\text{mL}}{5\text{mL}}=\text{x}$$

$$\mathbf{x=100mg}$$

The concentration is 100mg/mL. The infusion calls for 750mg of levetiracetam. Setting up another proportion will help us determine how many mLs are needed.

$$750\text{mg x}\frac{1\text{mL}}{100\text{mg}}=7.5mL$$

Assessment Question

Patient AJ has an order for

Levetiracetam 750mg

Sodium Chloride 100mL

You are the pharmacy technician in the cleanroom and find the drug with the following concentration.

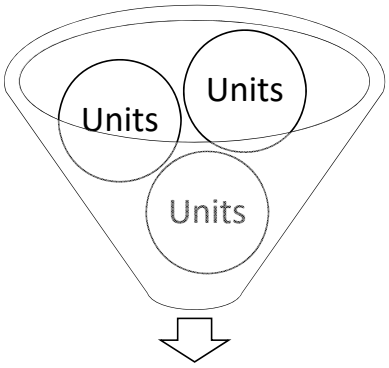
How many mL of levetiracetam must be drawn up in order to make this IV infusion?

a) 7.5mL
b) 5.5mL
c) 14mL
d) 11mL

Flow Rate Calculations

What are flow rates?

- A flow rate is the rate at which the infusion is being delivered to a patient
- A function of volume over time
- Flow rate= $\frac{\text{volume}}{\text{time}}$



Very important!

Example

A patient is receiving 2L of 0.9% sodium chloride every 20 hours. Calculate the flow rate (mL/hr).

Example

A patient is receiving 2L of 0.9% sodium chloride every 20 hours. Calculate the flow rate (mL/hr).

1. Convert liters to milliliters.

$$2\text{L} \times \frac{1000\text{mL}}{1\text{L}} = 2000\text{mL}$$

Example

A patient is receiving 2L of 0.9% sodium chloride every 20 hours. Calculate the flow rate (mL/hr).

1. Convert liters to milliliters.

$$2\text{L} \times \frac{1000\text{mL}}{1\text{L}} = 2000\text{mL}$$

2. Calculate the flow rate (mL/hr)

Flow rate= $\frac{\text{volume}}{\text{time}}$

Flow rate= $\frac{2000\text{mL}}{20\text{ hours}} = 100\text{mL/hr}$

Assessment Question

The nurse calls the pharmacy for CVVH bags for a patient in 711. You check the profile, and determine that the flow rate of the bag is 2.5L/hr. She asks you to fill enough bags to last her 12 hour shift. How many 5L CVVH bags do you need to dispense?

a) 10 bags
b) 12 bags
c) 5 bags
d) 6 bags

Assessment Question

Flow rate= 2.5L/hr

Assessment Question

Flow rate= 2.5L/hr

The nurse asks to cover for 12 hours.

$$\frac{2.5\text{L}}{\text{hr}} \times 12\text{hrs} = 30 \text{ Liters}$$

Assessment Question

Flow rate= 2.5L/hr

The nurse asks to cover for 12 hours.

$$\frac{2.5\text{L}}{\text{hr}} \times 12\text{hrs} = 30 \text{ Liters}$$

The pharmacy only carries 5L CVVH bags.

$$\frac{30 \text{ Liters}}{5 \text{ Liters/bag}} = 6 \text{ CVVH bags}$$

Assessment Question

The nurse calls the pharmacy for CVVH bags for a patient in 711. You check the profile, and determine that the flow rate of the bag is 2.5L/hr. She asks you to fill enough bags to last her 12 hour shift. How many 5L CVVH bags do you need to dispense?

a) 10 bags
b) 12 bags
c) 5 bags
d) 6 bags

Assessment Question

Another nurse calls and says that she wants to know how long the 9 CVVH bags at bedside will last her. You look into the profile and notice that the bag is running at 3L/hr. Does she have enough for the remainder of her 12 hour shift?

a) Yes
b) No

Assessment Question

Flow rate= 3L/hr

The nurse says she only has 9 bags at the bedside. How many hours will the 9 bags last her?

Assessment Question

Flow rate= 3L/hr

The nurse says she only has 9 bags at the bedside. How many hours will the 9 bags last her?

$9 \text{ bags} \times 5\text{L} = 45\text{L}$

Assessment Question

Flow rate= 3L/hr

The nurse says she only has 9 bags at the bedside. How many hours will the 9 bags last her?

$9 \text{ bags} \times 5\text{L} = 45\text{L}$

$45\text{L} \times \frac{1\text{hr}}{3\text{L}} = 15\text{hrs}$

Assessment Question

Another nurse calls and says that she wants to know how long the 9 CVVH bags at bedside will last her. You look into the profile and notice that the bag is running at 3L/hr. Does she have enough for the remainder of her 12 hour shift?

a) Yes
b) No

Powder Volume

What is powder volume?

- The volume that is occupied by the powder once it is dispersed into a liquid
- For some drugs, the powder volume can be negligible
- For others, the powder volume must be calculated before making a suspension or a solution

Example

Ceftriaxone 2g vials are reconstituted with 7.2mL of sterile water to create a concentration of 250mg/mL. Calculate the powder volume.

Example

Ceftriaxone 2g vials are reconstituted with 7.2mL of sterile water to create a concentration of 250mg/mL. Calculate the powder volume.

First, set up the proportion.

$$\frac{250\text{mg}}{1\text{mL}} = \frac{2000\text{mg}}{\text{x}}$$

Example

Ceftriaxone 2g vials are reconstituted with 7.2mL of sterile water to create a concentration of 250mg/mL. Calculate the powder volume.

First, set up the proportion.

$$\frac{250\text{mg}}{1\text{mL}} = \frac{2000\text{mg}}{\text{x}}$$

Next, rearrange the equation to find x.

$$\frac{2000\text{mg x } 1\text{mL}}{250\text{mg}} = \text{x}$$

X=8mL

Example

Ceftriaxone 2g vials are reconstituted with 7.2mL of sterile water to create a concentration of 250mg/mL. Calculate the powder volume.

First, set up the proportion.

$$\frac{250\text{mg}}{1\text{mL}} = \frac{2000\text{mg}}{\text{x}}$$

Next, rearrange the equation to find x.

$$\frac{2000\text{mg x } 1\text{mL}}{250\text{mg}} = \text{x}$$

X=8mL

Powder volume can then be found by subtracting the total volume by the volume used for reconstitution.

$$8\text{mL} - 7.2\text{mL} = 0.6\text{mL}$$

The powder volume of ceftriaxone is 0.6mL.

Assessment Question

An order for amoxicillin 250mg/mL oral suspension is filled. The directions on the bottle indicate that 88mL of purified water must be added to create a total of 150mL. What is the powder volume of the suspension?

a) 60mL
b) 23mL
c) 62mL
d) 162mL

Dilution Calculations

Dilution Calculations

- The formula below can often be used to change the strength or quantity of an existing product

$$C_1V_1=C_2V_2$$

- These calculations are especially useful during TPN formulations

Example

A pharmacist has an order for parenteral nutrition that includes 550mL of D70%. The pharmacist checks the supplies and finds the closest strength he has available is D50%. How many mL of D50% will provide the equivalent concentration.

Example

A pharmacist has an order for parenteral nutrition that includes 550mL of D70%. The pharmacist checks the supplies and finds the closest strength he has available is D50%. How many mL of D50% will provide the equivalent concentration.

First, set up the equation.

$$(70\%)(550\text{mL})=(50\%)(x)$$

Example

A pharmacist has an order for parenteral nutrition that includes 550mL of D70%. The pharmacist checks the supplies and finds the closest strength he has available is D50%. How many mL of D50% will provide the equivalent concentration.

First, set up the equation.

$$(70\%)(550\text{mL})=(50\%)(x)$$

Solve for x by rearranging the equation.

$$x=\frac{(70\%)(550\text{mL})}{(50\%)}$$

x= 770mL

More Problems

Assessment Question

A pharmacist asks you to make an ursodiol suspension with a total volume of 180mL using the following instructions.

Ursodiol Suspension

FORMULATION:	Ursodiol 60 mg/mL oral suspension	60 mL
INGREDIENTS:	Ursodiol 300mg capsules	12 caps
	Glycerin	to wet
	Simple Syrup	qsad 60mL

Example

Ursodiol Suspension

FORMULATION: Ursodiol 60 mg/mL oral suspension 60 mL

INGREDIENTS: Ursodiol 300mg capsules 12 caps
Glycerin to wet
Simple Syrup qsad 60mL

How many capsules are needed to create the 180mL suspension?

First, set up the proportion.

$$\frac{12 \text{ capsules}}{60\text{mL}} = \frac{\mathbf{x}}{180\text{mL}}$$

How do we find x? Rearrange the equation.

$$\frac{180\text{mL} \times 12 \text{ capsules}}{60\text{mL}} = x$$

x=36 capsules

How many milligrams of ursodiol are needed to create this suspension.

$$36 \text{ capsules} \times \frac{300\text{mg}}{1 \text{ capsule}} = 10{,}800\text{mg}$$

Assessment Question

You look in the Talyst machine, and there are only 600mg capsules available. How many 600mg ursodiol capsules are needed?

a) 45 capsules
b) 30 capsules
c) 36 capsules
d) 18 capsules

Example

Ursodiol Suspension

FORMULATION:	Ursodiol 60 mg/mL oral suspension	60 mL
INGREDIENTS:	Ursodiol 300mg capsules	12 caps
	Glycerin	to wet
	Simple Syrup	qsad 60mL

We know that the suspension calls for 10,800mg ursodiol. If the pharmacy only carries 600mg capsules, divide the total by the capsule size carried to determine the amount of capsules needed.

$$\frac{10{,}800\text{mg}}{600\text{mg capsules}} = x$$

x=18 capsules

Flow rate calculation

A patient's furosemide gtt is being infused at 6mL/hr. How many mg/hr does the infusion rate correlate to?

Furosemide 40mg

Sodium Chloride 100mL

a) 2.4mg/hr
b) 2.8mg/hr
c) 2.4mL/hr
d) 7.6mg/hr

Flow rate calculation

First, find the concentration of the furosemide drip.

$$\frac{40\text{mg}}{100\text{m}L} = \frac{0.4\text{mg}}{\text{mL}}$$

Next, convert rate (mL/hr) to (mg/hr).

$$\frac{6\text{mL}}{\text{hr}} \text{x} \frac{0.4\text{mg}}{\text{mL}} = 2.4\text{mg/hr}$$

References

- Shapiro K, Brown SA, Garrett S. RxPrep Course Book. 2016
- Gilleo R. PTCB Exam Study Guide. 2017.
- American Society of Health-System Pharmacists. Basics of Aseptic Compounding Technique. Video Training Program, 2006.

Calculations for Pharmacy Technicians

Presented by: Antonia Kraljevic

PGY2 Pharmacy Practice Resident

The speaker has no actual or potential conflict of interest in relation to this presentation.