

# Drug Calculations 2015

Coventry and Warwickshire  
Partnership Trust



# Objectives

1. Be able to work out a drug calculation
2. Understand the importance of getting calculations right
3. How to convert units and measures safely
4. Be able to access and use appropriate resources when carrying out a drug calculation

# Introduction

Drug calculation errors are a significant problem in any area of clinical practice and can potentially be very harmful to your patient.

**Studies suggest that most mistakes were made because of slips in attention, or because basic rules are not applied (Dean et al, 2002)**

# Common Errors

**In order to prevent deskilling registered nurses should practice different types of drug calculations as often as possible and have their ability tested either through self assessment or assessment by the employer (McMullan, Jones and Lea, 2010).**

# So to start us off . . . . .

Sally has been prescribed 500mg of Amoxicillin three times a day. Sally can't swallow tablets so has been prescribed Amoxicillin suspension 125mg/ 5mls.

How many millilitres of the Amoxicillin suspension do you need to give to Sally for each dose?

- 20mls three times a day

## Practice Test

Hand out tests and ask attendees to attempt  
it over coffee break

**Send to coffee**

# Where things go wrong ....

- Moving the decimal point in the wrong direction when converting dosages, for example, milligrams to grams
- Miscalculating the quantities of tablets to be administered over a period of time
- Miscalculating the time interval between doses
- Miscalculation of the volume of a drug in a solution
- Miscalculating the rate of administration
- Drugs with a narrow therapeutic range .

## Three incident types-

- Unclear/ wrong dose or frequency
- Wrong and omitted medicines
- Delayed medicines



Account for 71% of fatal and serious harms from medication incidents (NPSA, 2007)



# Key Situations

## Converting Units

One of the most common errors occurs when moving the decimal point. It is easy to move it in the wrong direction or not far enough.

Remember that micrograms are smaller than milligrams and milligrams are smaller than grams (but bigger than micrograms).

- 1000 micrograms = 1 milligram
- 1000 milligrams = 1 gram
- 1,000,000 micrograms = 1 gram

# Unit Conversion Questions

## Practice Question

Convert **360 micrograms** to milligrams.

- 0.036mg
- 0.36mg
- 3.6mg

**Answer 0.36mg**

# Unit Conversion Questions (cont)

## Practice Question

Convert **15 grams** to milligrams.

- b. 150mg
- c. 1500mg
- d. 15000mg

**Answer 15000mg**

Depending on whether the measure is larger or smaller you need to multiple or divide by 1000 so

- $200 \text{ mg} / 1000 = 0.2 \text{ grams}$
- $0.003 \text{ g} \times 1000 = 3\text{mgs}$  (which is a better way of expressing the quantity)
- Demonstrate moving 3 decimal points up or down on board

## Decimal points

- Which of these is correctly written?

.5 mg OR 500micrograms

0.005g OR 5mg

# Rounding Decimal points

When rounding decimals to 1 decimal place, look at the second decimal point and if it is 5 or above then round up, if less than 5 then round down.

Example :  $1.274 = 1.3$  (Round up)

$1.234 = 1.2$  (Round down)

## Now try these .....

1. Work out 20% of 65

- Answer- 13

2. A patient is to receive IV Fluids over 8 hours.

- What % would be administered after 6hrs?

- Answer- 75%

3. How long would it take to administer 50%?

- Answer- 4 hours

## Injections - Practice Question

# Zucloperthixol - test dose

The test dose of zucloperthixol decanoate is **50mg**. Zucloperthixol decanoate is available in 1ml ampoules containing **200mg in 1ml** and you want to give **50mg**.

*What volume should you draw up?*

**0.25ml**

**Could you show a colleague how you worked it out?**



# The Line Method

- Start with the product in front of you:
- E.g.
- Zuclopenthixol - 200mg in 1ml
- You want to give 50mg
- 200mg in 1ml
- $\div 2$  100mg in 0.5ml
- $\div 2$  50mg in 0.25ml

## Zuclopenthixol – regular dose

What volume of zuclopenthixol decanoate is required to administer a **350mg** dose using the **200mg in 1ml** ampoule?

**1.75ml**

You start with:            200mg in 1ml  
   ÷2                    = 100mg in 0.5ml  
   ÷2                    = **50mg in 0.25ml**

You need 350mg:     $350 \div 50 = 7$

$350\text{mg} = 7 \times 0.25 = 1.75\text{ml}$

**350mg is contained in 1.75ml of the 200mg/ml solution**

# Alternative Method

What you want (W)

What You've got (G)

Imagine you have **got** an ampoule containing **G**mg of APD in 1ml  
You **want** to administer a dose of **W**mg

>You need to know the volume to draw up

The volume required =  $\frac{W}{G}$  x (the volume **G**mg is contained in)

Putting the figures from the example into this equation:

The volume required =  $\frac{350\text{mg}}{200\text{mg}}$  x 1ml = 1.75ml

**OR remember as –**

W = “what you want”

G = “what you’ve got”

So .....

## Question

Digoxin 125 micrograms in 100 ml sodium chloride 0.9% is prescribed over 1 hour. 500 micrograms digoxin in 2 ml ampoules are available.

The volume to be added to 100ml sodium chloride 0.9% is?

$$\frac{125 \text{ micrograms} \times 2\text{ml}}{500 \text{ micrograms}} = 0.5\text{ml}$$

## Question

300mg aminophylline injection is prescribed.  
250mg in 10ml ampoules are available.

The volume of injection required is?

$$\frac{300\text{mg} \times 10\text{ml}}{250 \text{ mg}} = 12\text{ml}$$

**Top Tip-** Typically many adult volumes of parenteral drugs are between 1ml and 3mls. **Therefore if the volume is higher (or lower) then check your calculation**

# Principles when calculating injectable drug doses

1. For drugs already in solution, check the amount of the drug in each ml **and** the total amount of the drug in the container.
2. Make sure you are clear about the dose units used. Most commonly prescribed are milligrams and micrograms.
3. Beware of drugs such as insulin and heparin, for which doses are prescribed in international units (IU). The abbreviation is poor practice and should never be used, because it can be mistaken as 10.

4. Check the dose on the prescription and that it is expressed in the same units as on the medicine label.

$$\text{Volume required} = \frac{\text{Dose} \times \text{Volume of solution in ampoule}}{\text{Amount of drug in ampoule}}$$

# Injectables- pre-filled syringes

Pre-filled syringes have many advantages:

- They are labeled with the drug name and dose thus reducing the risk of errors.
- Dose is easier to record
- **Usually** eliminates the need to work out how much drug is needed

However, when the dose prescribed **doesn't match** the dose in the syringe you will need to calculate how much needs to be given



## Example

Enoxaparin prefilled syringes are available in various strengths. You have the **100mg/ml (10 000 units)** prefilled syringes.

*What volume is needed to give a dose of **85mg** enoxaparin?*

–8.5ml

–1ml

–0.85ml

**Answer 0.85ml**

### Note:

- Prefilled syringes may contain more than the dose prescribed. Please **discard** excess before administration of the correct dose.
- *This should be witnessed by another responsible person e.g. qualified nurse/doctor.*

- An injectable drug is prescribed for a 54kg child, after cancer treatment. The dose per day is 1 microgram/kg/day. The medication comes in a graduated pre-filled syringe containing 120 micrograms/0.2ml.
- Calculate the dose per day

**54 kg x 1 microgram = 54 micrograms.**

- How many mls would you administer?

$$\frac{54 \text{ micrograms}}{120 \text{ micrograms}} \times 0.2\text{ml} = 0.09 \text{ ml}$$

[www.hull.ac.uk/injectionguide](http://www.hull.ac.uk/injectionguide) for further information

# How do I calculate an oral liquid dose?

Amount of drug prescribed x the volume the drug is in (ml)  
Amount of drug in each unit

## Practice Question

A patient is prescribed **45 mg** mirtazapine.  
Mirtazapine oral solution is **15mg/ml**.

*What volume will you require?*

- 0.33ml
- 3ml
- 15ml

**Answer 3ml**

## Question

A child is prescribed amoxicillin 250mg every 6 hours. You have amoxicillin suspension 125mg in 5mls. How many millilitres should you give?

Answer – 10ml of amoxicillin suspension 125mg in 5mls

$$\frac{250\text{mg}}{125\text{mg}} \times 5\text{ml} = \frac{2}{1} \times 5\text{ml} = \mathbf{10\text{mls}}$$

OR

125mg in 5mls

$$250 / 125 = 2$$

$$5\text{mls} \times 2 = \mathbf{10\text{mls}}$$

## Question Haloperidol

A patient is prescribed **500micrograms** haloperidol. Haloperidol liquid is **1mg/ml**.

*What volume will you require?*

- 0.5ml
- 5ml
- 10ml

**Answer 0.5ml**

# TOP TIP

- Is it a reasonable dose?
- If the dose is more than **4 tablets**, **check your calculation**.
- The same rule can be applied to liquids, if the quantity is more than **20mls** **check!**
- If you ask a colleague to check your calculation ensure they **make their own calculation**, rather than simply checking what you have already calculated.
- **What does our Trust policy say on who can be the second checker?**

# Maths Test

Now review your drug calculation questions using what you have learnt and then we can go through them together



# Conclusions

- Drug calculations are an essential part of your role
- Errors can have a significant impact on the patient
- If you are struggling with drug calculations then ask for support

# The End!



**More practice required?**

[www.qub.ac.uk/elearning/public/NumeracySkillsforDrugCalculations](http://www.qub.ac.uk/elearning/public/NumeracySkillsforDrugCalculations)

[www.testandcalc.com](http://www.testandcalc.com)

## References/ Sources of information

- Latest addition of the BNF
- Dose Calculations made Incredibly Easy 2<sup>nd</sup> Edition
- Dosage Calculations made Incredibly Easy First UK Edition
- Numeracy in Nursing and Healthcare; Calculations and Practice. Pearl Shihab.
- MCMULLAN M., JONES R. & LEA S. (2010) Patient safety: numerical skills and drug calculation abilities of nursing students and Registered Nurses. *Journal of Advanced Nursing* **66**(4), 891–899.