Handling Medication and Avoiding Drug Errors. (Level 2)


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INTRODUCTION

Medicinal products are defined as:

'*any substance or combination of substances presented for treating or preventing disease. Any substance or combination of substances which may be administered to human beings or animals with a view to making a medical diagnosis or to restoring, correcting or modifying physiological functions in human beings or animals is likewise considered a medicinal product*" (Council Directive 65/65/EEC).

The components of medicinal products can be from natural sources such as herbs/plants or can be manufactured and/or even genetically engineered. There are several indications for the use of medicines such as;

- Disease Control
- Disease Prevention
- Fighting Illness
- Improvement in general health
- Nutritional benefits
- Fighting illness
- Pain Management

According to a recent study (2018), more than 230 million medication errors per year occur within the NHS. It is difficult to assess the extent of damage to patient outcomes, but it is estimated that medication errors may be a factor in anywhere between 1,700 to 22,300 deaths per year. Medication errors are broadly considered to be avoidable, and every effort must be made at all levels of healthcare, including national, organisational, and individual, to prevent them from happening.

AIMS AND OBJECTIVES

The purpose of this module is to provide guidance on the minimum standards required for a healthcare provider to deliver the safe and effective administration of medication and to meet the compliance regulations and legislation as stipulated under the Medicines Act 1968. It will discuss the variety of routes of administering medication, expected duties and responsibilities of healthcare professionals and the provisions that are in place to minimise the incidence of drug errors.

Its aim is to provide those healthcare workers with insight of current regulations and standards regarding the safe handling and administration of medicines and the processes put in place to minimise drug errors. It will also discuss and provide useful information regarding the Learners however must ensure that they familiarise themselves with legislation, internal policies and procedures applicable to their current place of work and these vary between Trusts and organisations across the UK. It is not possible to describe every possible situation that may arise and to give hard and fast rules.

Please note that all healthcare workers who are expected to handle and administer medications are responsible to ensure they have received appropriate training, have been assessed and deemed competent by a suitable clinician. As an e-learning course provider, we cannot accept responsibility nor confirm an individual's competency. This can only be assessed through direct observation and 'signed off' by another competent clinician in a practical clinical setting.

KEY LEARNING OUTCOMES

The following learning outcomes reflect a minimum standard which should be incorporated into medication education and training for all relevant staff groups. At the end of the training learners should be able to:

- know the three classes of medicinal products, including general sale, pharmacy, and prescription-only medicines
- know what is meant by the term medication error
- understand the importance of preventing medication errors and their potential consequences
- know what factors may contribute to the occurrence of medication errors
- understand the different types of medication errors and how they can be prevented
- understand the principles of safe transport and storage of medication
- understand the importance of providing adequate information for patients
- understand the importance of individual professional responsibility in preventing medication errors, or preventing harm from medication errors
- understand the importance of reporting medication errors know the process that should follow the discovery of an error
- know what is meant by the term “controlled drugs” (or controlled medicine/medication/substances) and be aware of related issues
- know the additional safety measures that must be taken when prescribing, administering, and storing controlled drugs
- know the process involved in safe disposal of controlled drugs
- know how concerns can be reported
- be aware of relevant legislation

MEDICINES ACT 1968

Classifies medicines into three main categories

Prescription-Only Medicines (POM)

These are medicines, which may only be supplied or administered to a patient:-

- On the instruction of an authorised prescriber such as a doctor, dentist, nurse or pharmacist prescriber in the form of a prescription
- Or under the direction of an authorised patient specific direction (PSD) or a patient group direction (PGD)

Pharmacy-Only Medicines (P)

These medicines can be purchased from a registered primary care pharmacy, provided the pharmacist supervises the sale

General Sale List Medicines (GSL)

These medicines need neither a prescription nor the supervision of a pharmacist and can be obtained from retail outlets

IMPORTANT:

It is important for healthcare professionals, particularly those whose duties include administration of medication, to be aware of the need for a prescription for certain medicines. Administering prescription-only medicines to a patient who has not been prescribed the medicine is a significant error.

PRINCIPLES OF SAFE AND APPROPRIATE HANDLING OF MEDICINES IN SOCIAL CARE SETTING/ DOMICILIARY CARE

We have identified eight core principles relating to the safe and appropriate handling of medicines that apply to all health and social care settings.

Principle 1: People who use social care services have freedom of choice in relation to their provider of pharmaceutical care and services including dispensed medicines.

In relation to medicines this means:

- Choosing to look after and take their own medicines with help and support from care staff
- Care staff only give medicines with the person's consent
- People are included in decisions about their own treatment, for example, whether to have an annual 'flu' vaccination
- People have a say about which pharmacy (or dispensing doctor) supplies their medicines
- The social care service accommodates personal and cultural preferences

Principle 2: Care staff know which medicines each person has, and the social care service keeps a complete account of medicines.

Medicine records such as Medical Kardex and Medicine Administration Record (MAR) are essential in every health care service. If you look after medicines for the people you care for, at any given time you should be able to identify the medicines prescribed for each person and how much they have left.

- Even when care staff do not routinely give medicines, it is important to know:
  - Whether the person has any medicines
  - What the medicines are and how they should be taken
  - What conditions the medicines are intended to treat

- Non prescribed medication such as over the counter, herbal and alternative medication are still classed as drugs and **SHOULD NOT** be administered unless:
    - You are trained and competent
    - Has been authorised by an appropriate professional (doctor, pharmacist)
    - All medication and recording procedures are satisfied
    -Formal consent is obtained from the patient/client

In residential care for adults and children where care staff request medicines for the people they look after, it is essential to keep a complete record of all medicines - what comes in, what is used, what goes out. This is often described as an 'audit trail'.

For those individuals who have carers but can manage to take their own medication, care staff to remain observant and ensure the correct dose/ amount is taken.

Principle 3: Care staff who help people with their medicines are competent.

In social care settings, people who are unable to manage their own medicines are entitled to have someone who is adequately trained and knowledgeable to give medicines to them. Only staff who have been given appropriate training and have demonstrated they are competent should do so.

As a health care provider deemed competent in administering medication, you should be able to do the following;

- Be able to advise what the medication is used for. i.e. condition/symptoms
- The dose that is to be administered and via which route (oral, topical, sublingual, rectal, vaginal, intramuscular or intravenously)
- Advise what the normal dose is
- Advise of possible side effects
- Identify if any contra-indications with other medication or underlying health condition/disability

Principle 4: Medicines are given safely and correctly, and care staff should preserve the dignity and privacy of the individual when they give medicines to them.

- Medicines are given safely and correctly, and care staff preserve the dignity and privacy of the individuals when they give medicines to them
- Safe administration of medicines means that medicines are given in a way that avoids causing harm to a person. This is a key element of good practice and has a direct link to ***Principle 3***
- Only give medicines to the person they were prescribed for
- People should receive the right medicine at the right time and in the right way
- The care provider must also support care workers by written procedures that set out exactly how to give medicines and it is good practice to monitor that care workers follow these procedures. Some medicines such as methotrexate need special care to protect the person who is giving the medicines
- Covert Medicating (disguising medication in food/drink without the patient/client being made aware and formally consenting) is NOT allowed unless there are clear, documented instructions from health professionals on MAR/ patient care plan
- Every effort should be made to preserve the dignity and privacy of individuals in relation to medicine-taking. This means being tactful and sensitive, for example, asking about bowel and bladder function should always be handled discreetly — do not shout across the room so that everyone can hear. It also means keeping personal medical information confidential, for example, a person's medicines administration record (MAR) should not be kept where everyone can see it
- If efforts are not made to preserve the dignity and privacy of the individual, in relation to their medicine, that person can be humiliated, and other people can be embarrassed. This can affect the person's emotional security and stability and, in turn, their behaviour. It is a key indicator in the quality of the relationship between carer and the person being cared for

Principle 5: Medicines are available when the individual needs them and the care provider makes sure that unwanted medicines are disposed of safely.

- Medicines are available when the individual needs them and the care provider makes sure that unwanted medicines are disposed of safely. People expect that the medicines a doctor has prescribed will be available when they need them and in residential care, it is important to retain only those medicines that the current residents need
- When a care service is responsible for requesting a supply of medicines, it is up to the manager to ensure that there is a system in place to get them in a reasonable time frame. Where care workers visit the person's home, they may need to clarify who will be responsible for requesting repeat prescriptions — the person or a relative — unless this forms part of the care package
- Continuity of supply of medicines for on-going treatment is essential. In order to do this, arrangements with a local pharmacy or dispensing doctor should be made in advance. This situation is more likely in a care home but when care is given in the person's home, the care worker may need to prompt the person or their relatives when medicines are running out
- Out-of-date, damaged or part-used medicines that are no longer required should be disposed of safely so that they cannot accidentally be taken by other people — particularly children — or stolen

NEVER dispose medications without the consent of the patient/client as they are the legal owner of the medication. To dispose medication, take it back to the pharmacy who will destroy medication appropriately. Do not put out of date/unused medication in domestic/clinical waste units or flush down a toilet.

Principle 6: Medicines are stored safely

- Medicines need to be stored so that the products are not damaged by:
  - Heat or dampness
  - They cannot be mixed up with other people's medicines
  - They cannot be stolen
  - They do not pose a risk to anyone else

- Ideally, all medicines should be stored in a secure room, designated lock store is preferable, kept off the floor and below 25°C unless requires cold storage such as topical eye drops, insulin or liquid antibiotics. Where cold storage is required, medicines must be stored in a medicine specific fridge and temperature to be checked daily.

Principle 7: The social care service has access to advice from a pharmacist

- Care workers who are handling medicines should ensure that they have access to advice from a pharmacist. Pharmacists are the experts in medicines. Every pharmacist has several years of university education concerned with medicines
- Pharmacists know how medicines work in the body and they understand the practical problems too. Pharmacists can find out a lot of information and respond quickly to your questions
- Every care setting should ensure that it has the contact numbers for their local pharmacy readily available together with a named person to contact

Principle 8: Medicines are used to cure or prevent disease, or to relieve symptoms, and not to punish or control behaviour.

- Medicines should not be used unnecessarily to sedate or restrain people. This has been referred to as a 'chemical cosh'. This principle is closely related to ***Principle 1*** regarding 'choice'. The medicines that have the side effect of sedating people are very important in the treatment of disease, for example, epilepsy. In such cases it is important for the care workers to support the person and when necessary give medicines as the doctor prescribes
- A clear instruction about when the medicine should be given will support care workers, especially if the direction is to 'take when required'
- Prescribing medicines is the responsibility of healthcare professionals. This process is abused if healthcare professionals are put under pressure to prescribe medicines purely for the convenience of the care service instead of clinical necessity

STORAGE OF MEDICINAL PRODUCTS

When social care is provided in a person's own home, they will decide where and how to store medicines. In residential care, you can choose to provide medicine storage for individuals in their own rooms and this is essential when the person looks after and takes their own medicines. If you choose to store medicines centrally, the cupboards must be big enough, well-constructed and have a good quality lock. If the people you care for have bottles of liquid medicines, make sure that the shelf height is suitable or have adjustable shelving. You should not store anything other than medicines in these cupboards. Health care workers working in a hospital/clinical area should carefully read and follow procedures of in- house procedures where manuals/policies should be made available to all staff competent in doing so. You should also consider storage of:

- Controlled drugs
- Nutritional supplements
- Medicines that need refrigeration
- Dressings, ostomy products, PEG, Nasogastric accessories and catheters
- Medicines supplied in monitored dosage systems, which need much more storage space to cover the change-over period each month.

Storage of medicines needs to be in the right place. Filing cabinets are not suitable for storing medicines, neither are:

- Kitchens
- Bathrooms
- Toilets, sluices
- Windowsills or areas next to heaters

These places are too damp or too warm (or both) or unhygienic for storing medicines. Some storage rooms become too hot for medicine storage unless there is good ventilation or an air conditioning unit. If the temperature is more than 25°C, it is too hot.

The designated place for storing medicines must be secure, off the floor and only those staff who handle medicines should have access. It is good practice to make sure that nothing else is stored in same locked medicine cupboard. The medicine cupboard should not be used as a safe for valuables and should not be used as a food cupboard. The only reason to open the medicine cupboard should be to get access medicines.

Key security is an important part of medication security therefore only authorised members of staff should have access to them.

- The keys for the medicine area or cupboard should not be part of the master system
- Where medicines are stored centrally, there should be a procedure that says who keeps the keys. There is no point in having a locked cupboard if the key is left on top of it

Medication that requires to be kept in cold storage must be stored in a separate medicine fridge and temperature of the fridge must be checked and recorded daily. Such medications include Insulin, eye drops, vaccinations etc.

- In residential care, there should be a separate secure fridge that is only used for medicines that require cold storage
- A separate fridge may not be necessary in a small home unless there is a constant need to refrigerate medicines that a resident takes regularly, for example, insulin
- If someone has care at home, a separate fridge is not necessary.
- The temperature of the medicine refrigerator should be monitored daily when it is in use and recorded. A maximum/minimum thermometer is recommended for this
- The care service should have a written procedure of action to take if the temperature is outside the normal range — usually between 2 and 8 °C
- If the fridge breaks down, it is important to identify the fault quickly, otherwise medicines may be wasted
- Clean and defrost the fridge regularly
- Care workers who provide home care should check that the person's fridge appears to be working correctly if there are medicines stored in it

MEDICATION ERRORS

Medication errors can be described as any preventable events that may cause inappropriate medication use and/or harm to the patient. Such events can take place at any point during the process, including prescribing, transcribing, dispensing, administration, and monitoring. It is important to note that medication errors are not defined by the presence of actual harm to a patient, but by the existence of the potential for harm. This means that even when an error does not result in harm, it remains an error and should not have occurred.

Examples of medication errors include, but are not limited to:

- Omissions – where a prescribed dose has not been administered to the patient by mistake (without a reason)
- Wrong dose administered – either too high or too low
- Extra dose given – for example, as a result of forgetfulness or miscommunication between staff members, or due to inaccurate record keeping
- Unprescribed medicine – where medication which has not been prescribed is administered to a patient
- Wrong dose interval
- Wrong administration route
- Wrong time for administration
- Failing to follow medication advice and warnings when administering (e.g. medication that should be taken with or after food administered at the wrong time)
- Administration of a drug to which the patient has a known allergy or other contraindications
- Administration of a drug past its expiry date
- Administration of a drug which has been stored incorrectly

Medication errors occur with worrying frequency. Covering just medication errors related to prescribing and monitoring, one UK study found that in the course of a year:

- 12% of all primary care patients may be affected by a prescribing or monitoring error
- 38% of patients aged 75 and over may be affected by a prescribing or monitoring error
- 30% of patients receiving five drugs or more may be affected by a prescribing or monitoring error
- 5% of prescriptions have prescribing errors

Although not every medication error will result in serious complications or consequences, every mistake has the potential to cause real harm to a patient. Medication errors can potentially result in:

- Adverse reactions to the medicine – due to contraindications related to pre-existing conditions, allergies, etc.
- Adverse interactions between two medicines taken by the same patient
- Lack of efficacy – if the right medication is not prescribed to the right patient, they may find no improvement in their condition
- Poor adherence of the patient to the treatment plan – if the medication is ineffective or causing severely negative side effects, the patient may not wish to take it
- Poor quality of life and patient experience
- Increased use of health services, including medication-related hospital admissions

In some cases, medication errors may result in the death of a patient, due to taking ineffective medication or medication that has serious contraindications to their condition, any pre-existing conditions, and other medication being taken.

Factors associated with **healthcare professionals**, such as:

- Inadequate drug knowledge and experience
- Inadequate knowledge of the patient
- Inadequate perception of risk
- Lack of appropriate training
- Poor communication between members of staff and between healthcare professionals and patients
- Fatigue or feeling overworked
- Physical and emotional health issues
- Factors associated with patients, such as:
- Personal characteristics that may result in difficulties, including literacy and language barriers
- Complexity of clinical case, including multiple health conditions, polypharmacy (taking many medications at once), and high-risk medication

Factors associated with the **work environment**, such as:

- Workload and time pressures
- Distractions and interruptions
- Lack of standardised policies and procedures
- Insufficient resources
- Issues with the physical work environment, e.g. poor lighting

Factors associated with **medicines**, such as incorrect labelling and/or packaging

Factors associated with **computerised information systems**, such as:

- Difficult processes for generating prescriptions and repeat prescriptions
- Lack of accuracy of patient records
- Inadequate design that allows for human error

PRESCRIBING RESPONSIBILITIES

- Medicines will only be prescribed by suitably trained and qualified healthcare professionals (e.g. medical practitioner or authorised non-medical prescriber) according to the terms of their qualification and acting within their skills, knowledge and competence.
- All prescribers should adhere to local formularies and where available recognised national guidance from NHS affiliated organisations. The British National Formulary (BNF) is the main reference source for prescribers and staff administering medicines.
- Prescribers must ensure there is an allocated budget with the Head of Service prior to initiating any new prescribing.
- Each Non-Medical prescriber is required to complete an Approval to Practice Form that outlines the therapeutic areas that the prescriber will prescribe. This must be signed and agreed with the relevant line manager at annual appraisals.

Responsibilities of Prescriber of Unlicensed Medicines

- Medical Prescribers of unlicensed products carry their own responsibility and are professionally accountable for their judgement in so doing. Prescribers are responsible for the patient's welfare and in the case of adverse events they maybe called upon to justify their actions.
- Following amendments to the Medicines for Human Use Regulations 2009, independent nurse or pharmacist non-medical prescribers are now permitted to prescribe unlicensed medicines. Where this is the case this must be recorded on the Approval to Practice Form
- Non-medical prescribers should only prescribe unlicensed medicines in justifiable, exceptional and approved circumstances

PRESCRIBING ERRORS

Prescribing errors may include:

- Incorrect or incomplete patient or medicine details on the prescription
- Inappropriate medicine, dose, route, or rate
- Illegible prescribing (handwriting is unreadable or a cause for confusion)
- Inappropriate indication
- Prescribing without considering the patient's clinical condition (including past medical history, past drug history, etc.) and contraindications such as allergies
- Incorrect length of medication course for the patient
- Medication prescribed to the wrong patient
- Transcription errors
- Lack of signature, which renders the prescription invalid

Prescribing errors must be discussed with the prescriber as soon as they are discovered. How the error is dealt with will depend on how serious the error is and whether any harm has been caused to the patient. If the error is particularly severe in consequences, or if repeated errors are made by the same member of staff, the prescriber may be required to undergo a formal competency review.

To avoid prescription errors, healthcare professionals must ensure that they only prescribe medication that they have adequate knowledge of the patient's health and are satisfied that the treatment will serve the patient's needs. This includes checking whether the medication prescribed is compatible with any other treatments the patient is receiving (including over-the-counter medication) and ensuring, based on the best available evidence, that there are no contraindications for the proposed treatment. It should be noted that patients may not always be forthcoming about their use of alternative remedies, illegal substances, or medicines obtained online or through otherwise unauthorised channels. It is therefore important to encourage patients to discuss these issues and be open about them, in order to ensure that the proposed medication is appropriate for their condition and has no contraindications with their self-treatment or recreational drug use.

It is also important for healthcare professionals who are authorised to prescribe medication to ensure that their skills and knowledge are up to date. If in any doubt regarding some aspect of medication considered for prescription, or the best form of treatment for the patient's condition, healthcare professionals should consult senior members of staff or relevant evidence-based information from another source (e.g. NICE guidelines, BNF).

DISPENSING ERRORS

Dispensing errors may include:

- Dispensing the wrong medication, dose, formulation, strength, or quantity to the patient
- Dispensing medication to the wrong patient
- Dispensing expired medicine
- Incorrect or absent label on the container

In the event of discovering a dispensing error, the priority is to establish whether the patient has taken any of the incorrect medicine and to ensure they do not take further doses. It must also be established whether the patient has been harmed by the incorrect medication, which may involve a medical examination or diagnostic testing. If it transpires that the patient has suffered harm, healthcare professionals must address any issues caused by the medication with further treatment in order to ensure patient safety. A pharmacist may also be consulted for advice regarding the effects of the incorrect medicine and the management of symptoms.

Regardless of whether any harm has been caused to the patient by a dispensing error, the prescriber responsible for the patient (e.g. the GP who prescribed the medication) must be informed.

TRANSPORTATION OF MEDICINES

- It is not normal practice for Trust employed staff to collect dispensed medicines from community pharmacies, except in justifiable exceptional circumstances. In such cases a risk assessment should be undertaken, and any risks managed accordingly
- Patients/carers should collect dispensed medicines themselves. Where this is not possible, most local pharmacies operate a delivery service
- If using medicine trolleys, they must be secured to the wall when not in use and must never be used for storing controlled drugs
- Medicine trolleys must never be left unattended during a medicine round (i.e. when not secured to the wall)
- If trolleys are not used, a separate section of a medicine storage cupboard should be designated for medicines currently in use
- Pharmacy boxes for the transportation of medicines must always be locked when containing medicines
- If an inpatient is issued medicine for self-administration, they must have access to a lockable container (e.g. drawer) which is not easily removed

ADMINISTRATION OF MEDICATION

Medicinal products as previously discussed are the product or any substance or combination of different products presented for the treatment or prevention of disease. They can be manufactured from natural resources such as herbal and plants, man- made or genetically engineered. Medicines are also produced in different forms including tablets, powder, sprays, inhalers, capsules, liquid/syrup, pessary, injection or topical creams/ointments and the prescribed method will be dependent on the preferable route of administration, dose, frequency, how fast the medicine will take effect, if food or drink is required with or after administration and also interaction with other medications if applicable.

You should only give medicines that you have been trained to give. Health Care workers can give or assist people in:

- Taking tablets, capsules, oral mixtures
- Applying a medicated cream/ointment
- Inserting drops to ear, nose or eye
- Administering inhaled medication

Healthcare workers should not undertake the following unless they have satisfactorily completed additional training:

- Rectal administration, e.g. suppositories, diazepam (for epileptic seizure)
- Injectable drugs such as insulin
- Administration through a Percutaneous Endoscopic Gastrostomy (PEG)
- Giving oxygen

Some medicines need to be given at specific times, for example:

- Before, with or after food — the absence/presence of food in the stomach can affect how the medicine works and may cause unwanted effects
- Some illness can only be controlled with very precise dose timings, e.g. some medicines for Parkinson's disease have to be taken five times during the day, some people's fits are only controlled if they take their tablets at set times

Where an individual is independently able to administer their own medication, this should be encouraged as it promotes privacy and independence. Monitored dosage systems (MDS) or compliance aids can sometimes be used to help people to take their own medicines safely.

PROCEDURES FOR ADMINISTERING MEDICATION

Safe administration of medicines means that medicines are given in such a way as to maximise benefit and to avoid causing harm. The following is a process for selecting the right medicines, preparing the right dose and giving in the right way to the right person:

Before approaching the patient, ALWAYS check the prescription to ensure there are no discrepancies and that the drug is prescribed for the right condition, with the correct dose, to be administered the right route to the right person. If any of this information is omitted or appears to be incorrect STOP!! Liaise with Line Manager/Nurse in Charge, or if available medical staff to clarify the details. Should there be no doubt or queries regarding the prescription, then proceed to the following steps:

1. **Check you are giving the medicines to the right person.**
   Recently, care homes have attached photographs of their residents to their MAR charts which is a useful tool to ensure you have the right individual. If this is not possible, consider use of recent photographs, cross reference of name and room number on the MAR chart,
   or make sure that the care worker really knows the residents by name. In clinical areas such as hospitals, patients should be provided with an identity band with their unique CHI number, name, date of birth and consultant they are under. If patient/client is orientated and
   can communicate, ask them to verify their name and date of birth for extra re- assurance.

2. **Ensure no interruption unless deemed an emergency**.
   Make staff and visitors aware that you are on the drug round or administering medication. Some clinical areas now have the drug administrating staff member wearing a specific colour of apron to acknowledge on drug round and to prompt no interruption.

3. **Select all the correct medicines for this time of day for that person.**
   Even when medicines are supplied in MDS, there may be other medicines in the fridge and remember that this person may have different medicines since the last time you were on duty. It is so important to refer to the MAR chart instead of relying on memory. Do not advance prep medication. This will most likely incur errors to be made and cause confusion.

4. **Check the prescription**

Is it legible, clearly written?
Is the dose accurate?
Has the route of administration been entered correctly?
Is there clear indication of the frequency the medication should be administered?
Is there details of when this should be given and if to be taken on an empty stomach, with/after food?
Any adverse effects to be noted and observed?
Special precautions, if any?
Has the client/patient's allergies been considered and clearly documented on the MARS care plan?

5. **Ask the person if they want their medicines before you take them out of the pack (formal consent)**

People can refuse medicines for different reasons. When this is an important medicine, it may be better to wait a little while and ask them later. If the person continues to refuse, you must never force the medicine on them, and this means that hiding medicine in food or drink is not acceptable practice in any setting. Should they refuse, ensure this is clearly documented in the MAR care plan/ Medical Kardex with your initials, date and time of refusal.

6. **Check the label of the drug container/box.**

Ensure the details are for:

- Right person
- Right medication
- Right strength
- Right dose
- Right frequency
- Right Time
- Not expired or packaging damaged

7. **Medications that are prescribed '*as and when required*'.**
   Some medicines are meant to be taken occasionally when there is a specific need, for example, tablets for pain. If the directions say 'to be taken as required', somehow you need to find out whether the person has any pain before you prepare and offer the tablets. Other medicines like this include treatments for constipation, indigestion, and anxiety.

8. **Make sure that there is a glass (tumbler) of water to wash the tablets or capsules down.**

9. **Encourage the person to sit upright or to stand**
   If the tablets/capsules are in a monitored dosage or compliance pack open the appropriate section and dispense the tablets/capsules into a medicine pot and hand it to the person. If the medicine is a syrup or mixture make sure that you use the medicine spoon/cup that the pharmacist has provided — do not just guess or estimate or allow the person to drink from the bottle. It is almost impossible to swallow tablets or capsules without drinking some water. Even if people say they can manage without, taking tablets and capsules with a drink of water is a good habit to encourage. A hot cup of tea instead of water is not a good idea because many medicines are badly affected by heat. It is very difficult to swallow tablets or capsules when lying down. It is very likely that the table or capsule could get stuck in the throat or gullet where it could cause difficulty with swallowing or could cause the individual to aspirate.

10. **The dose of some medicines depends on the results of blood tests**.
    An example is warfarin. Each area has a system to let the person or people who provide care know what the correct dose is. The latest information/blood result needs to be kept with the MAR chart.

11. **Applying medicines to the skin**
    It is important that you use gloves both for your own protection and to prevent cross-infection. These medicines are directly absorbed through the skin. If you do not protect yourself, your body will also absorb the medicine.

12. **Always make a record of exactly what you have done at the time.**
    This includes a record when the person refuses the medicine or if been withheld due to contraindication or under the advice from physician/pharmacist.

13. **Giving medicines to people who cannot swallow or need to have their medicines given via their feeding tube**
    If a patient cannot swallow tablets or capsules, then the problem should be discussed with a healthcare professional who will be able to find out whether a suitable liquid product is available. This could be a liquid version of the original medicine or a different medicine that has the same effect. In either case, this will have to be discussed with the prescriber or pharmacist.
    Normally tablets should not be crushed, and capsules should not be opened either to make them easier to swallow or to hide them
    from the patient because this may affect the way that the medicine works. For patients with PEG tubes/Nasogastric tubes, further training will be required and only those deemed competent with relevant training should administer via this method.

To re-cap, the following precautionary methods must be adhered to when administering medication:

- Do not advance prepare medication
- Ensure good hand hygiene is carried out before and after each individual and where necessary, wear gloves
- Ensure no interruption during administration of medications/drug round
- Ensure label is clear/legible/printed with supplier details evident and medication is not expired
- Ensure name/drug name/dose/frequency/route of administration are clearly documented on the MAR record
- Never make alterations to the prescription/label/packaging. If unsure, acknowledge query on MAR care plan and notify Line Manager to discuss further

ADMINISTRATION ERRORS

Common errors that occur at the administration stage include:

- Administration without a valid prescription
- Administration of the wrong medication, at the wrong dose, or via the wrong route
- Administration to the wrong patient
- Administration of expired medication
- Omission of a dose without a clinical reason
- Dose administered late or early

In order to ensure safe practice and avoid medication errors, when administering medication healthcare professionals must:

- Be certain of the identity of the patient to whom the medicine is to be administered
- Check that the patient is not allergic to the medicine before administering it
- Know the therapeutic uses of the medicine to be administered
- Know the normal dosage, side effects, precautions, and contraindications of the medicine to be administered
- Be aware of the patient's care plan
- Check that the prescription and the label on the medicine dispensed are clearly written and unambiguous
- Check the expiry date (if applicable) of the medicine to be administered
- Consider the dosage and weight of the patient (since some medications may have to be administered in smaller doses depending on the patient's age and weight)
- Consider the appropriateness of the method of administration, route, and timing
- Administer medication or withhold medication in relation to the patient's condition and co-existing therapies (e.g. certain medications usually should not be administered if the patient's pulse is below a certain level)

Contact the member of staff who prescribed the medication (or another authorised prescriber) if:

- Contraindications to the prescribed medicine are discovered
- The patient develops a reaction to the medicine
- Assessment of the patient indicates that the medicine is no longer suitable
- Make a clear, accurate, and immediate record of:
  - Medicine administered
  - Medicine intentionally withheld and reasons behind it
  - Medicine refused by the patient
  - Any situations where the administration of medicine is delegated to another member of staff

CONTROLLED DRUGS

Controlled drugs (CDs) are prescribed medicines that are usually used to treat severe pain, induce anaesthesia or treat drug dependence and they have additional safety precautions and requirements. Some are also used in other situations, for example, methylphenidate (Ritalin™) is used in the treatment of attention deficit hyperactivity disorder (ADHD). Some people abuse CDs by taking them when there is no clinical reason to do so.

There are legal requirements for the storage, administration, records and disposal of CDs. These are set out in the Misuse of Drugs Act Regulations 2001 (as amended). They do not apply to every social care service and they do not apply when a person looks after and takes their own medicines. There has been a high profile given to managing CDs since the Shipman Inquiry published the fourth report in 2004. All social care services are recommended to have special arrangements for CDs even though the law does not currently require it.

In clinical settings such as hospitals and care homes, Controlled Drugs listed in the current Misuse of Drugs Regulations are subject to more stringent controls (see current BNF, section on Controlled Drugs and Dependence). The Accountable Officer is ultimately responsible for ensuring the policies relating to Controlled Drugs are always adhered to. In some instances, this responsibility may be delegated to appropriate senior personnel within the organisation.

Examples of CDs are morphine, fentanyl, benzodiazepines and methylphenidate. Over recent years, night sedation such as Zopiclone and Zimovane have been stored in CD cupboards/secure store units.

Storage cupboards for CDs are available commercially. Secure storage is required when a care home looks after CDs and keeps them centrally.

- Hard bound registers are recommended for CD records
- Obtaining controlled drugs CDs are prescribed and dispensed for individually named people, in the same way as other medicines
- There are special legal requirements for CD prescriptions so you should always allow extra time for these to be written
- A prescription that does not comply with these requirements may have to be sent back to the prescriber for altering before it can be dispensed
- If care workers collect CDs from a pharmacy on behalf of someone else, they may be asked to provide identification

In exercising professional accountability, in the best interests of the patients, staff who are authorised to administer medicines must:

- Be certain of the identity of the patient to whom the medicine is to be administered
- Ascertain that the prescribed dose has not already been given
- Know the therapeutic uses of the medicine to be administered, its normal dosage, side effects, precautions and contra-indications
- Where it is appropriate for a care plan to be in place, know the current contents of the patients care plan/MAR chart
- Check that the prescription, patient group direction or the label on a medicine dispensed by a pharmacist, is clearly written and unambiguous with clear information on: -
  - The name of medication
  - The dosage
  - The name of the patient for whom the medicine is prescribed
  - Frequency of administration
  - Route of administration
  - Have considered the dosage, method of administration, route and timing of the administration in the context of the patient and co-existing therapies

- Check the expiry date of the medication to be administered
- Check that the patient is not allergic to the medication before administering it
- Administer or withhold in the context of the patient's condition (e.g. digoxin is not usually given to patients if their pulse is below 60)
- Contact the doctor or another authorised prescriber without delay where contraindications to the prescribed medication are discovered, where the patient develops a reaction to the medication, or where assessment of the patient indicates that the medication is no longer suitable
- Make a clear, accurate and immediate record of all medicines administered, intentionally withheld or refused by the patient, ensuring that any written entries including the signature are clear and legible together with the date of administration
- Where medication is not given the reason for not doing so must be recorded
- When supervising a student nurse in the administration of medicines, clearly countersign the signature of the student
- Certain medicines such as cytotoxic or warfarin require special consideration, in the event of care-worker/ clinician being requested to administer these medications, departmental procedures must be followed
- When using syringes there is a risk of „wrong route" errors if the correct syringe is not used. When administering oral or enteral doses ensure that an appropriate purple coloured oral/ enteral syringe is used
- When administering insulin ensure that an insulin syringe or commercial insulin pen is used. This is essential, because the use of intravenous syringes to administer insulin can lead to incidences of overdose
- When administering medication via the intravenous route, two appropriately trained staff members are required to check the medication to be administered (one of whom must be a registered nurse who then administers the intravenous medication)

RECORD-KEEPING

It is important to record what you do when you do it on the MAR. Do not rely on your memory to write information accurately at a later time and if you record giving medicines to people as this increases the incidence of drug errors and potentially administering the wrong medication to the wrong person.
From your records, anyone should be able to understand exactly what you, the care worker has done and be able to account for all of the medicines you have managed for an individual. The service provider needs to decide on the way in which a care service keeps records. Whatever format is chosen, the records must be complete, legible, up to date, written in ink, dated and signed to show who has made the record.

All MAR/care plans must be update and it is essential that there are clear instructions to advise if assistance is required or support is needed to ensure medications are stored efficiently. Written confirmation of the medicine a person is taking should also be obtained from an authoritative source if possible.

If you are responsible for requesting and/or collecting medicines for a child or adult, you must record:

- What you received including the name and strength of the medicine
- How much you received
- When you received it

Clear records will help to prevent drug errors. Problems are more likely to occur when:

- People have long lists of prescribed medicines
- Some medicines are taken regularly, and some are taken only when required for specific reasons, e.g. for pain relief
- Labels state, 'take as directed' and the person is unable to explain or cannot remember what this means
- The dose of a medicine is not constant but depends on the results of blood tests, e.g. warfarin (a medicine given to thin the blood to avoid the risk of stroke or thrombosis)

- More than one prescriber is involved. More than one doctor might prescribe medicines for the same person; dentists and a range of other healthcare professionals such as some nurses and pharmacists can also prescribe medicines
- People have hoarded medicines that the doctor has told them to stop taking
- People are confused about what they should be taking
- An individual is also taking complementary medicines
- When a new medicine is introduced or the dose changes
- There are frequent changes to treatment.

Everyone involved in looking after medicines for other people is responsible for keeping good records and should comply to their professional body's Code of Conduct such as GMC and NMC. Further information can be found on the following links;

http://www.gmc-uk.org/guidance/ethical_guidance/13427.asp and https://www.nmc.org.uk/globalassets/sitedocuments/nmc-publications/nmc-code.pdf

MEDICATION ERRORS

A medication/ drug error is defined as:
'an error in the process of prescribing, dispensing, preparing, administering, monitoring or providing advice, regardless of whether harm has occurred.' (National Patient Safety Agency, 2006)

Approximately 1:10 patients experience harm or even death because of drug errors within the community and hospital setting. Over 90 per cent of incidents reported are associated with no harm or minimal harm to the patient and the most frequently reported types of medication incidents involve:

- administering the wrong dose
- omitting or delaying medicines
- giving the wrong medicine to the wrong patient

To reduce the likelihood of drug errors occurring, the following practical steps should be adhered to:

1. Record all *near misses*. Reporting near misses can provide invaluable information for proactively reducing errors. This would enable internal processes and policies to be reviewed and identify any procedural problems and where applicable, implement new processes
2. Adopt 'no blame' culture to encourage the reporting of drug errors and near misses
3. Thorough checks are made PRIOR to administering the medication. Consider the **SIX RIGHTS** of medication:
   RIGHT patient (checking ID bands/photographs on MAR and/ or verbal verification from the patient)
   RIGHT drug/ medication
   RIGHT dose
   RIGHT time/ frequency
   RIGHT documentation
   RIGHT route

4. Avoid preparing medication in advance as this will only increase the incidence of errors being made.
5. If preparing IV medication or controlled drug doses which requires two members of staff, you should calculate the dosages separately to avoid talking each other through mistakes.
6. Always use orthodox techniques and ensure solutions are as agreed to the pharmaceutical preparation requirements. I.e. if an intravenous antibiotic is to diluted in 0.9% Sodium Chloride Solution, do not immerse in 5% Dextrose as not only will this affect the effect of the drug, it may counteract and cause adverse reactions to the patient.
7. Try to avoid decimal dosages where possible when administering medication. For example:
    i. Patient prescribed 1.2g, Benzyl penicillin IV- convert to 1200mgs.
    ii. Digoxin 0.125 mg- covert to 125mcgs
    iii. Avoid using terminal 0 as this can be overlooked and risks x 10 normal dose to be administered such 1.0g of Flucloxacillin can be read as 10mgs if the decimal point is not legible.

Known drug allergies and drug sensitivities should be highlighted in the patient's MAR/case record and the patient is provided with a red ID bracelet.

AFTER A MEDICATION ERROR

Although all NHS staff should strive to avoid making mistakes, they do happen, and they must be dealt with accordingly. It is important to remember that an isolated incident including a single medication error does not necessarily and immediately render that person incompetent. It does, however, indicate that there may be a flaw in the system, or another hitherto unidentified problem, which has contributed to creating circumstances in which the mistake could happen.

Reporting and identifying mistakes allow for appropriate measures to be taken in response to the error. Naturally, patient safety must take priority over other actions: if a medication error has occurred, the most important thing to do is to has not been harmed – if harm has occurred, it must be addressed, and steps must be taken to treat the damage if possible.
When an error occurs at any stage in the handling, ordering, prescribing, recording, storage, transportation, labelling, administration and disposal of medicines and related preparations across clinical services the following steps must be taken:

- Make sure the patient is safe and if necessary, call emergency services or the Medical Practitioner as dictated by clinical need
- Record any treatment or advice given, ensuring suggested monitoring arrangements are followed and documented
- Ensure any evidence relating to the error is retained and not tampered with (evidence will include any relevant documentation, the remaining medication administered and any packaging or administration equipment.)
- Inform line manager immediately to support communication with patients and or carers.
- Inform the General Practitioner or other Medical Practitioner with clinical responsibility.
- Complete an electronic Datix incident form on the same shift of duty. The Datix system will automatically email the designated Datix Reviewer who would usually be the Assigned Practitioner in Charge/ Service Lead for the service. The reviewer is responsible for recording on the Datix system any immediate actions taken
- All incidents coded as involving medicines will also automatically generate an email to the Trust Pharmacist and the Quality Manager
- At the weekend or out of hours, the Manager should inform the On-Call Duty Manager

- For any incident involving controlled drugs the Trust's Accountable Officer for Controlled Drugs, Director of Quality and Governance must also be informed by the Service Lead within the span of duty, out of hours the incident must be reported to the On-Call Duty Manager.
- If a medication error has occurred within a patient's home, the healthcare professional who discovered the error must also ensure that systems are in place to monitor the patient's condition appropriately over the following 24 hours. The GP should be informed at the earliest opportunity and an action plan drafted that defines what service will be responsible for monitoring the patient and keeping other key healthcare professionals updated. An electronic Datix incident form should also be completed

Honesty with patients and transparency regarding any errors are some of the key principles that guide the NHS. Therefore, if a medication error is detected and it has affected a patient, an appropriately trained healthcare professional should:

- Inform the patient that an error has occurred
- Provide information regarding the likely risk and outcome of the incident
- Reassure the patient that the error is being investigated in order to prevent it from happening again

REPORTING CONCERNS

Healthcare staff have a professional duty to always put the interests of patients first, and to raise concerns if they think the patients may be at risk. The importance of reporting medication errors as soon as they occur or become apparent has been outlined above; it is vital to alert other members of staff if a mistake has been made by you or another member of staff. Equally, healthcare professionals should always report their concerns if they identify a potential risk to the safety of patients or staff – in the case of medication handling, examples of such a risk could include a flawed aspect of a computerised system, improper storage of medication, or a local procedure which allows for errors to go unnoticed.

In every healthcare establishment there ought to be a robust system in place, enabling staff to register their concern about any relevant issue. If, as a healthcare professional, you ever find yourself in need of reporting a potential risk to the quality of care received by the patients, you have the right to:

- Expect to be made to feel confident and supported by relevant staff
- Expect that the relevant members of the Leadership team have a system in place for dealing with staff concerns
- Expect that if the concern is substantiated, the organisation will take steps towards resolving the issue

In most cases, you should discuss your concerns with your line manager. If this is not an option for any reason, your employer should have a whistleblowing procedure in place which will provide contact information for relevant people within the organisation. Additionally, NHS Improvement can be contacted directly with any possible concerns, either by phone or in writing (including email).

It is important to voice your concerns appropriately as and when they arise. Any malpractice, wrongdoing, or service that falls below standard may not be obvious to other members of staff or to service users. According to the NHS Improvement 'Freedom to Speak Up' policy, you should raise a concern even when you are not sure as to its validity and/or when you do not have proof. If you are mistaken, there will be no negative consequences for you or others, provided that your concern was genuine. Regardless of the outcome of the investigation of your concern, there will be no negative impact on your career.

As part of the CQC Essential standards care homes are required to have arrangements for reporting adverse events, adverse drug reactions, incidents, errors and near misses. These should encourage local and, where applicable, national reporting, learning and promoting an open and fair culture of safety".

- If a resident is unwell as a result of the medication error or incident, medical assistance should be sought straight away.
- All notifiable incidents should be reported to the CQC.
- However, a care home should not ignore other errors, incidents or near misses but should encourage a culture that allows their staff to report incidents without the fear of an unjustifiable level of recrimination. The more evidence that is reported the more information is available about what could possibly go wrong.
- A medication policy should include how to deal with medication errors, incidents and near misses.
- Staff should be clear as to the definition of a medication error, incident and 'near miss'. Examples of medication errors are given above.
- All medication errors, incidents and near misses should be reported to the duty manager to inform them what has happened and also what action has been taken to rectify the immediate situation and what has been done to prevent it happening again.
- The resident and their relatives should be notified of any medication errors or incidents.
- A home should have a clear reporting system, including the requirement for a written report describing what has happened, was done to rectify the immediate situation and what has been done to prevent it happening again.
- There should be a regular schedule for investigating and reviewing medication errors, incidents and near misses by a designated member of staff.
- The results of these regular investigations should be recorded including any actions taken such as offering training to individuals or reviewing existing procedures.
- Regular meetings should be held with all staff involved with medicines to review the outcomes and investigations of errors/incidents/near misses share learnings and prevent reoccurrence of similar errors, incidents or near misses.
- A care home should also log any incidents that occur as a result of errors made as part of the prescribing or dispensing process, for example, by GPs or community pharmacists. Such errors should be discussed with the GP or community pharmacist.
- To help reduce administration errors, the Care Home Use of Medicines Study (CHUMS) recommends a robust system for constant review of accuracy of medicine administration records. This could be in form of a regular audit or review. It could focus on, for example, reasons for omitted doses, coding of refusals, and administration of prn (when required) medicines.

DRUG CALCULATIONS AND PREFIXES

PREFIX: A prefix is used where an amount of a base unit is too small or too large. Most common examples include:

PREFIX	VALUE
MILLI	1000th
MICRO	1,000,000th
NANO	1000th of a MICRO UNIT

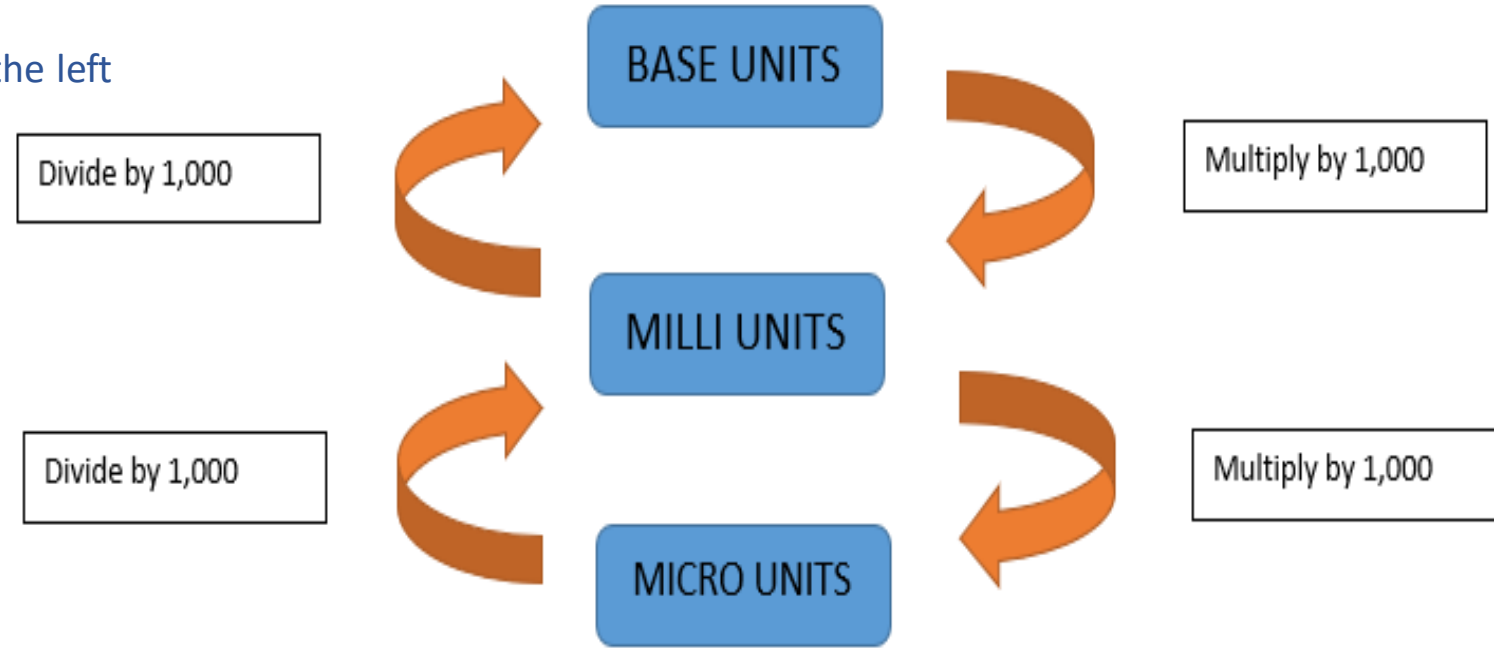
Common abbreviations used in drug calculations

ABBREVIATION USED	UNIT
kg	Kilogram
g	Gram
l	Litre
Mmol	Millimol
mg	Milligram
mcg	Microgram
mol	Mol
% w/v	Percentage weight/volume

Poor arithmetical skills are one of the most common factors in drug error and the final section of this online module will provide guidance, most frequent formulas to use when calculating and administering the correct dose of medication to patients. Below are the rules when converting units to ensure the correct prescribed dose is administered:

To MULTIPLY by 1,000. Move decimal point 3 places to the right.
For example:
Convert 1.25g to milligrams: 1.25 multiplied by 1,000= 1250mgs.
Convert 0.25 mgs to micrograms: 0.25mgs multiplied by 1,000= 250mcgs

To DIVIDE by 1,000. Move decimal point 3 places to the left
For example:
Convert 4500mgs to g: 4500 divided by 1,000= 4.5g
Convert 50mcgs to mg: 50 divided by 1000= 0.05mg



Oral Medication:

As previously discussed in the module, medications can be administered via different route including injections, intravenous infusion, oral, topical, rectal, Nasogastric, PEG and vaginally. Most student nurses, domiciliary HCA and newly qualified trained staff will normally only administer oral and topical pharmaceuticals. This section will explain the procedure of calculating and ensuring the correct dose of oral medications.

Oral medication can be in the form of tablets, capsules or liquid. Some drugs can be broken should a smaller dose be required however ALWAYS check the manufacturer's instructions as there are certain types of drugs that cannot be broken as can affect the potency or cause adverse effects.

FORMULA:

$$\boldsymbol{Volume\ Required} = \frac{Strength\ required}{Stock\ strength}\ x\ (Volume\ of\ stock\ solution)$$

Example 1: Patient has been prescribed 0.25mgs of digoxin, orally. The digoxin is available in 125 micrograms. How many tablets should the patient receive?

To calculate, first change both strengths to the same units: 0.25 mgs equates to 250 micrograms (mcg) (0.25 x 1000= 250)

$$Volume\ Required = \frac{Strength\ required}{Stock\ strength}\ x\ (Volume\ of\ stock\ solution)$$

$$Volume\ Required = \frac{250\ micrograms}{125\ micrograms}\ x\ (1\ tablet)$$

$$= \frac{2}{1}\ x\ (1\ tablet)$$

= 2 tablets

Example 2: *Patients has been prescribed 450 mgs aspirin; stock available is 300 mgs. How many tablets should the patient receive?*

$$Volume\ Required = \frac{Strength\ required}{Stock\ strength}\ x\ (Volume\ of\ stock\ solution)$$

$$Volume\ Required = \frac{450\ mgs}{300\ mgs}\ x\ (1\ tablet)$$

$$= \frac{45}{30}\ x\ (1\ tablet)$$

= 1 and a half tablets (1½tablets)

For some medications, tablets are available in different strengths. The tablets may be of different colours to reduce the risk of errors when dispensing.

Example 3: *Provide the best combination of 1mg, 2mg, 5mg and 10mg tablets of warfarin for each of the following dosages:*
i. 7mgs ii. 8mgs iii. 4mgs iv.6mgs

The number of tablets should be as few as possible and only whole tablets may be used:

Answers:

i. 5mg + 2mg (2 tablets)
ii. 5mg + 2mg + 1 mg (3 tablets)
iii. 2mg + 2mg (2 tablets)
iv. 5mg + 1mg (2 tablets)

STRENGTH OF SOLUTION ACCORDING TO VOLUME

Example: *A syrup contains penicillin 125mg/5ml. How many milligrams of Penicillin are in the following?*
i. 10ml; ii. 15ml; iii. 25ml of the syrup?

i. Each 5ml contains 125mg penicillin
   10ml ÷ 5ml= 2
   2 x 125mgs= 250mg penicillin

i. Each 5ml contains 125mg penicillin
   15ml ÷ 5ml= 3
   3 x 125mg= 375mgs penicillin

i. Each 5ml contains 125mgs penicillin
   25ml ÷ 5ml= 5
   5 x 125mg= 625mgs penicillin.

Calculating Dosages of Oral medications:

Example 1: *A patient is prescribed Fluoxetine 40 mgs. Stock suspension contains 20mgs/5ml. Calculate the volume to be given.*

$$Volume\ Required = \frac{Strength\ required}{Stock\ strength}\ x\ (Volume\ of\ stock\ solution)$$

$$Volume\ Required = \frac{40mg}{20mg}\ x\ (5ml)$$

$$= \frac{2}{1}\ x\ (5ml)$$

= 10mls

Dosages of Medications for Injection:

When calculating dosages for injection, accuracy is paramount as an overdose can be fatal, and too little may result in little or no benefit to your patients.

Always ensure that you check the graduations on the syringe i.e. a 1ml syringe will normally be graduated in hundredths of a millimetre, 5ml syringes are 0.2ml graduation and 60ml have 1ml graduation etc.

REMEMBER:

The number of decimal places when calculating dosages should relate to the graduations of the syringe being used. Where you a using a syringe with a capacity greater than 1ml, you should give answers correct to one decimal place (tenths of a ml). Where you are using 1ml syringes, give answers to two decimal places (hundredth of a ml.)

It is advised that you should learn to estimate an answer before beginning to calculate the correct answer.

Example 1: *An injection of morphine 9mg is prescribed. Each stock ampoule contains morphine 15 mg/ml. The volume to be drawn up is;*

a) 6ml?
b) 0.6ml?
c) 0.06 ml?

The correct answer is b) 0.6 ml.

$$Volume\ Required = \frac{Strength\ required}{Stock\ strength}\ x\ (Volume\ of\ stock\ solution)$$

$$Volume\ Required = \frac{9mg}{15mg}\ x\ (1ml)$$

$$= \frac{3}{5}\ x\ (1ml)$$

= 0.6mls

Example 2: *An injection of digoxin 250mcg is prescribed. Each stock ampoule contains digoxin 500mcg/2ml. The volume to be drawn up is:*

a) 0.5ml
b) 1ml?
c) 1.5 ml?

The correct answer is b) 1 ml.

$$Volume\ Required = \frac{Strength\ required}{Stock\ strength}\ x\ (Volume\ of\ stock\ solution)$$

$$Volume\ Required = \frac{250mcg}{500mcg}\ x\ (2ml)$$

$$= \frac{1}{2}\ x\ (2ml)$$

= 1ml