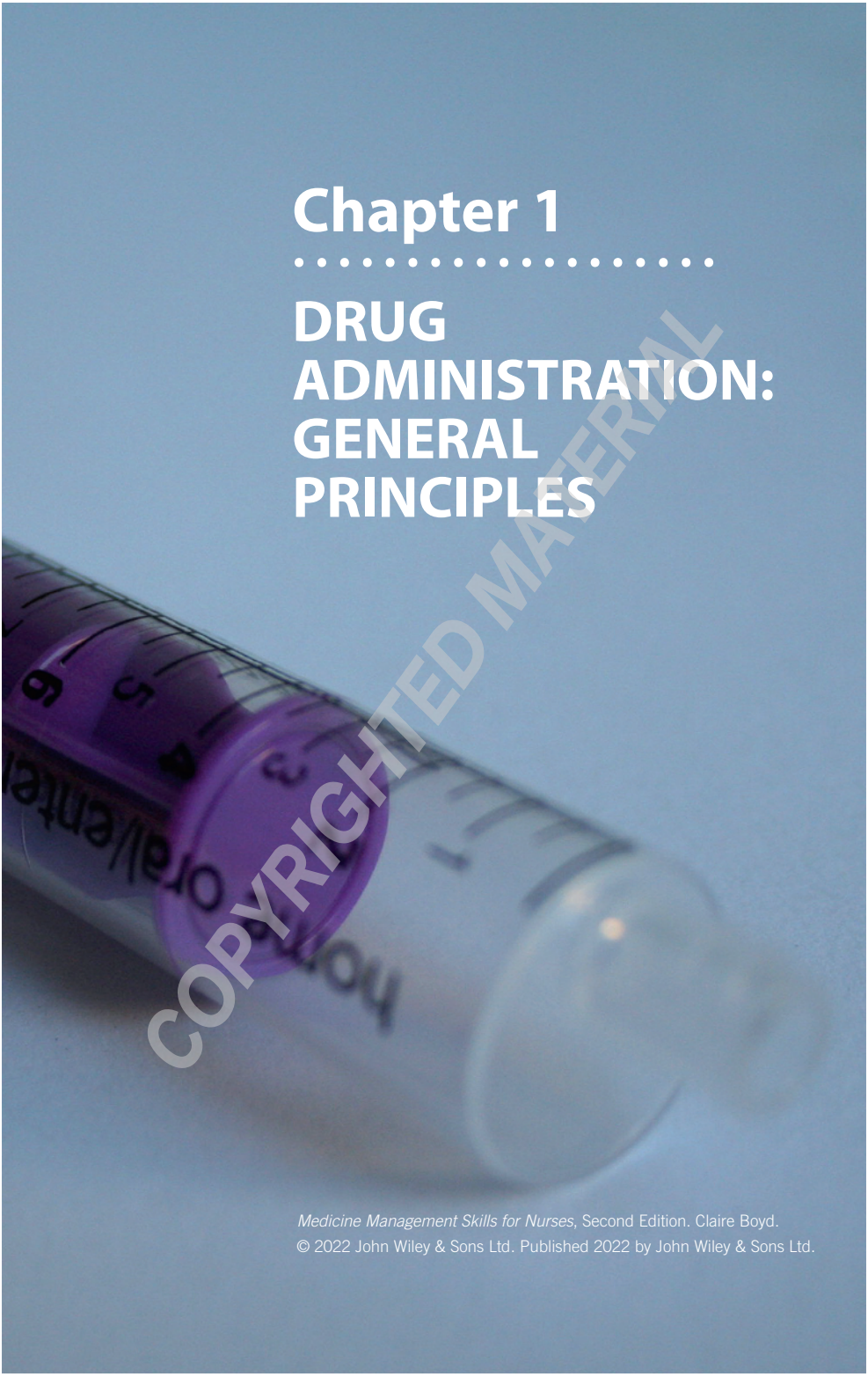
Chapter 1

DRUG ADMINISTRATION: GENERAL PRINCIPLES



Medicine Management Skills for Nurses, Second Edition. Claire Boyd.

LEARNING OUTCOMES

By the end of this chapter you will have an understanding of the general principles of drug administration, including improving medication safety factors.

Professionalism in nursing

Nurses are expected to display competent and skilful behaviour.

PROFESSIONALISM

You may well worry about making mistakes. Everyone is human after all and prone to error (known as 'Human Factors'). The key is to minimise where the faults can occur. As health carers we *always* put the patient first and apply our professionalism. As with any clinical skill we need to highlight the importance of vigilance, knowledge, and professionalism when administering drugs, as many drug errors occur when staff fail to follow correct procedures or do not recognise the limitations of their own knowledge and skill. Let's look at the cost of drug errors, both monetary and to the individual.

PROFESSIONAL JUDGEMENT

When administering medication, we need to be aware of the following:

- It is not solely a mechanistic task to be performed in strict compliance with the written prescription of a medical practitioner.
- It requires thought and the exercise of professional judgement (Lister, Hofland, and Grafton 2020).

What does this actually mean? Let's look at an example.

Question 1.1 If a patient has senna and lactulose prescribed and informs you that they have opened their bowels four times that day, do you administer their prescribed laxatives?

Also remember, it is very easy to get distracted, and lose concentration in the clinical area, so always concentrate on the job in hand.

MEDICATION ERRORS

What is a drug error? Well, the Department of Health informs us that:

> A medication error is any *preventable* event that may cause or lead to inappropriate medication use or patient harm while the medication is in the control of health professional, patient, or consumer.

Because nurses predominately administer drugs, they are often the last potential barrier between a medication error and serious harm to a patient, with drug errors frequently featuring in professional misconduct cases.

It is estimated that there are more than 230 million medication errors per year in the National Health Service (NHS). The cost to the NHS was estimated at £98.5 million for the 712 confirmed deaths from drug errors in hospital. However, if we add on the extra cost of patients made seriously ill, or potentially killed by drug errors in primary care, the estimated cost to the NHS is £1.6 billion (yes – billion!) equating to 3.8 million bed days.

So, why do drug errors occur? Well, we have been informed from the same report giving us the facts and figures above that they occur due to:

- Failure to properly monitor patients on powerful drugs,
- Poor communication between general practitioner (GP)'s and hospitals,
- Giving patients the wrong medication.

We also know that mistakes happen due to:

- Drugs that look or sound alike,
- High staff workload,
- Low staffing levels,
- Inexperienced staff.

As a means to combat some of these medication errors, the UK government pledged an investment of £75 million to implement electronic prescribing in hospitals.

Drug Errors and Adverse Reactions

The NHS has graded drug errors and adverse reactions, as follows:

1. Medication errors that do not result in patient harm, i.e. near misses (example: a dose of 500 mg amoxycillin is prepared instead of 250 mg, but corrected before reaching the patient).
2. Medication errors that result in patient harm (example: giving an antibiotic to a patient with a known allergy to that drug).
3. An adverse drug reaction that is not the result of a medication error (example: giving antibiotics to a patient with no previous history of drug reactions, but who then reacts: this is the only non-preventable type of mistake).

Question 1.2 What is a near miss? Think of an example.

Question 1.3 Apart from killing the patient, what is the worst thing you can do when you have made a drug error?

Worldwide Facts and Figures

Some facts and figures concerning drug errors worldwide:

- Worldwide: 17% of medication errors involve errors in calculations.
- Almost 50% of all intravenous injections feature a mistake, and the number of patients requiring intravenous therapy is increasing.

In medicines management, not only do we have to contend with long, hard to pronounce drug names, but we need to get our heads around all the abbreviations, including Latin ones!

LATIN ABBREVIATIONS

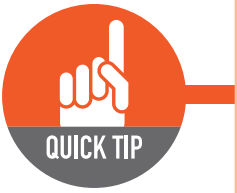
We have all seen the medic on the TV hospital soap opera shouting 'adrenaline stat!' in the emergency room but what does 'stat' actually mean? Well, it means we need to be conversant with Latin abbreviations, that's what it means.

Have a go at seeing how many of the Latin abbreviations you know in Activity 1.1.

Activity 1.1

Here is a list of Latin abbreviations used when prescribing. What do they mean?

STAT	OM	QDS
AC	ON	QQH
BD	PC	TDS
OD	PRN	TID



We tend to use specific accepted abbreviations in health care to do with medicines, such as mg, *pro re nata* (PRN), IV, etc. but not mcg as we write microgrammes in full so as not to get confused with mg. Healthcare workers are told not to use abbreviations in their written care plans, medical records, etc. as mistakes can happen. Terms may have two meanings: for instance, DOA can be taken to mean dead on arrival *or* date of admission.

MEDICAL ABBREVIATIONS

There are many medical abbreviations you will see in practice in patients' medical notes. You will also see them used throughout this book. See how many of them you can work out. Don't worry if it is all alien to you, you can find the answers at the back of this book.

Activity 1.2

AF	DKA	INR
BNF	DM	MAOI
BP	DVT	MHRA
CHD	GI	MI
COPD	GTN	NG
CR	IDDM	NHS
DH	NMC	NICE
NPSA	OTC	NIDDM
NSAID	WHO	PEG
PPI	GP	CD

DID YOU KNOW?

Doctors would often write abbreviations in patients notes – often being very derogatory to them! Thankfully this practice is not seen so much today. Here are just a few:

- LOBNH Lights on but nobody home
- TEETH Tried everything else, try homoeopathy
- PIP Pyjama Induced Paralysis
- TMB Too many birthdays

DRUG WASTAGE

It has been found that Primary Care Trusts could save almost £7 million each year if GPs prescribed more efficiently. Wastage costs the NHS approximately £200 million. I'm sure we have all met the elderly neighbour with bottles of pills dating back 10 years or more collecting dust in their bathroom cabinets. As health carers we all need to deliver better patient education, explaining why that course of antibiotics that the GP prescribed needs to be completed, even if the patient is feeling better.

Here's a question: what do you think about schemes to recycle drugs back to the pharmacist to be redistributed to other patients? What if the bottles have been opened and the drugs spilled over a dirty floor and put back in the bottle (perhaps even licked by the dog!). Would *you* like to take them? Only use sealed bottles and unopened blister packs, I hear you say, but what if these had been stored on top of a heater for the last six months and their active ingredients have now become unstable?

MEDICATION PROCESS

The medication process is made up of four parts.

- ***Prescribing***: it is often the nurse who notices that a doctor has prescribed something to which the patient is allergic, perhaps because the nurse knows the patient better.
- ***Dispensing and preparation***: a nurse should not use trade names for drugs as confusion may occur, for example Voltarol instead of diclofenac sodium. Perhaps the pharmacist has reconstituted the medication with the wrong transport medium, for example sodium chloride instead of water for injection.
- ***Administration***: you need to be very clear which route a medication should be given through and that the dose has been calculated correctly.
- ***Monitoring***: you need to check the administration and effect of a medicine on the patient. For example, a patient prescribed diclofenac sodium must be checked

to see whether they are asthmatic. Patients with hypertension or heart failure must be monitored carefully if they are given diuretics. Blood pressure, fluid input and output, and sodium and potassium, etc. must be checked.

Any one of these categories could be the weak link where a mistake can occur.

The Department of Health reports that the wrong dose, strength, or frequency of a drug accounts for over a quarter of all medication incident reports.

COMPLEMENTARY MEDICATION

What about complementary medication? As well as a nurse/nurse educator, I am also a complementary therapist and I am surprised at the number of individuals taking 'natural' remedies and not being aware of their interactions with more mainstream medications: Anticoagulants may react with ginseng, ginkgo Biloba (for improved memory and brain circulation) and should be discontinued 36 hours prior to surgery. Other complementary remedies that need to be considered in the conventional healthcare environment are:

Complementary medicine

A broad term used to describe medicines used in *conjunction* with conventional medicine.

Alternative medicine

A broad term used to describe medicines used *instead* of conventional medicine.

Homoeopathic remedies – individuals may be advised to avoid coffee, peppermint, or menthol as these substances may counteract the effect of the homoeopathic remedy.

St. Johns Wort – which is often used to treat depression, may be harmful for individuals with bipolar disease as it may induce mania.

Liquorice root – should be avoided for those with chronic heart failure and those with hypertension.

Other food/drug interactions can be seen in Chapter 2. Very often complementary therapies are referred to as 'alternative therapy' as they may not be considered part of mainstream healthcare and this is known as CAMS (Complimentary and Alternative Medicine). If in any doubt speak to a pharmacist who can give advice. Never give a drug if you are unsure. Seek advice. Table 1.1 lists many of the complementary therapies which patients may discuss with you. See how many you have heard of:

Table 1.1 CAMS.

Osteopathy	**Chiropractic**	**Acupuncture**
Herbal medicine	**Homoeopathy**	**Aromatherapy**
Alexander technique	**Massage**	**Counselling and mindfulness**
Iridology	**Stress therapy**	**Hypnotherapy**
Reflexology	**Shiatsu**	**Meditation**
Relaxation therapy	**Thermal auricular therapy**	**Traditional Chinese and Ayurvedic medicine**
Crystal therapy	**Colour therapy**	**Kinesiology**

Drug Administration Routes

When administering medications, we also need to be completely conversant with the mode of administration, or route. A very sad case involved a young boy called Wayne Jowett who died as a result of being given his medication intrathecal 'ITH' instead of intravenously (which is written as 'IV').

If you saw the route written as 'ITH' on a prescription chart, what do you think this would mean? Let's look at this and other abbreviations that you may encounter.

Activity 1.3

Here is a list of abbreviations for routes of drug administration. Can you work out what they mean?

1 ITH
2 SC
3 ID
4 IV
5 IM
6 O
7 INH
8 NEB
9 TOP

In many NHS Trusts, very few abbreviations are permitted to be used on a drug chart: subcutaneous (SC), intramuscular (IM), IV, O, nebulisation (NEB), topical (TOP), and inhalation (INH). Everything else has to be written out in full so that mistakes don't get made.

Keeping Updated

As well as being conversant with the route abbreviations, if we are administering drugs we need to keep ourselves updated about changes to drug names, as well as contraindications.

Paracetamol (derived from coal tar; also known as acetaminophen) can now be given by the intravenous route, but is obviously much more expensive than oral paracetamol and has a shorter half-life. This means that it is less effective over a longer time span and, as pain is considered to be the fifth vital sign, we need to be aware of this when keeping our patients comfortable and pain free.

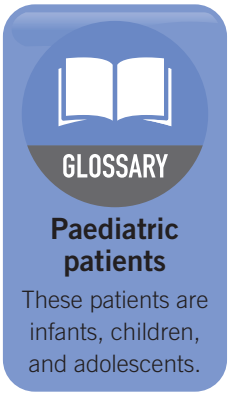
Single-Nurse Administration

In most adult hospital settings, it is one nurse who administers the medications to the patients. This is considered to be the safest option as it thought that the lone nurse will take extra care due to their sole responsibility. The exception to this is often injected drugs and controlled drugs, whereby two nurses check and sign for the drug and go to the patient's bedside together to administer the drug.

When there are any calculations or working out to do, two nurses should also check their workings out to agree on the correct answer and dose that the patient requires.

PAEDIATRIC PATIENTS

When medication errors occur, paediatric patients have a higher risk of death than adults due to the fact that most drugs are developed in concentrations for adults,



necessitating often complex weight-based calculations for paediatric doses and dilutions. Many drugs are not licensed for use in children. The gastric pH of children only reaches the same level as that of adults when they reach two to three years of age. The British National Formulary (BNF) classifies children into four groups:

- Neonates (up to one month)
- Infants (up to one year)
- One to six years of age
- 6–12 years of age

One of the special safeguards the paediatric clinical areas often have in place is that two nurses have to check and sign the prescription chart. One of these should be a Registered Paediatric Nurse.

Question 1.4 Other than paediatric patients, who may be considered as another high-risk group?

Older Adults

Ageing can influence many aspects of absorption, distribution, metabolism, and excretion (ADME) with excretion the most affected. This is because by the age of 65, the human kidney is almost a third less efficient than younger adults. This can lead to drugs not being cleared as efficiently from the kidneys, building up, and causing toxicity. Another cause for concern is the effects and side-effects of some drugs which may contribute to falls in frail adults due to postural hypotension and other factors.

Postural hypotension

A form of low blood pressure that happens when you stand up from sitting or lying down. Symptoms include dizziness, fainting (syncope), confusion, or blurred vision.

Patients being admitted to hospital from the community, on any of these 'high risk drugs' should be reviewed by a Doctor or Pharmacist and all staff should be made aware of this risk factor. Table 1.2 shows some of these drugs to be made aware of.

Table 1.2 Drugs which may contribute to falls.

Drug class	Indications	Examples of drugs
Antipsychotics	Psychosis delirium	Haloperidol, Promazine, Trifluoperazine, Quetiapine, Olanzapine, Prochlorperazine. Risperidone
Antidepressants	Mood	Amitriptyline, Trazodone, Fluoxetine, Citalopram. Paroxetine, Sertraline
Hypnotics (sedatives)	Insomnia	Zopiclone, Zolpidem
Benzodiazepines Hypnotics (sedatives)	Insomnia, agitation	Diazepam, Lorazepam, Temazepam, Nitrazepam
Anti-hypertensives	High blood pressure	Ramipril, Lisinopril, Perindopril, Valsartan, Hydralazine, Bisoprolol, Atenolol, Propranolol
Antidiabetics	Diabetes	Glibenclamide, Glipizide, Metformin, Sitagliptin
Opiates	Pain	Codeine, Tramadol, Morphine, Fentanyl, Buprenorphine, Oxycodone
Diuretics	Heart failure, fluid overload, hypertension	Bendroflumethiazide, Furosemide, Bumetanide, Amiloride
Nitrates	Cardiovascular disease	Isosorbide mononitrate, Glyceryltrinitrate (GTN) Nicorandil
Parkinson's Medication	Parkinson's disease	Co-Beneldopa, Co-Careldopa, Selegline Hydrochloride, Pramipexole
Non-steroidal anti-inflammatory drug (NSAIDS)	Pain, inflammation	Ibuprofen, Naproxen, Diclofenac

Drug class	Indications	Examples of drugs
Antimuscarinics (anticholinergics)	These are mentioned in other classes, e.g. for urinary incontinence	Procyclidine, Oxybutynin, Tolterodine, Amitriptyline
Aminoglycosides	Infection	Vancomycin, Gentamicin
Antihistamines	Allergies, itch	Chlorphenamine, Hydralazine, Cetirizine

ADMINISTERING DRUGS SAFELY

Drug Administration Competence

Many hospitals have drug administration competencies for staff to 'prove' that they are competent in the clinical skill of drug administration. Only when these competencies have been signed off can a nurse administer medications alone. Also, the student in healthcare, i.e. Registered nurse, Nursing Associate, etc. will need to be signed off in their medicines management competencies as part of their pre-reg training. Appendix 1 shows an adaption of a typical section of post-reg medicines management competencies.

Calculations Competence

Also, in order to be able to administer intravenous medications, qualified staff are required to pass a drug calculations test to prove mathematical ability, as poor mathematical skills have been indicated in medication errors with the misplacement of the decimal point leading to a tenfold error overdosing or underdosing. Many healthcare environments also set calculation tests during the interview stage.

Activity 1.4 shows a sample question of the sort that you may be expected to answer in one of these tests. Don't worry if your reaction to answering these questions is 😯 we'll go through this in Chapter 4.

Activity 1.4

Drug calculations sample question.

A drug is presented as 5 g in 500 ml A patient weighing 70 kg is prescribed 10 mg/kg/h of the drug.

1 How many milligrammes per hour of the drug does the patient need?
2 How many millilitres per hour do you set the infusion pump?

To first work out how much of the drug the patient requires according to their body weight we use the formula weight (kg) × dose, and then using the formula:

$$\text{Volume of drug to be given} = \frac{\text{what you want}}{\text{what you've got}} \times \text{volume}$$

But remember to keep the decimal units the same throughout the formula.

Reports and Safety Alerts

In order to alert health carers of the problems around drug administration, the Department of Health and National Safety Patient Agency (NPSA) issue reports and safety alerts, perhaps when mistakes have been made for shared awareness:

- Problems with missed doses,
- Promoting safer use/monitoring of patients on antico-agulant therapy (e.g. warfarin for deep-vein thrombosis [DVT]),

- Promoting safer measurement and administration of liquid medicines,
- Promoting safer use of injectable medicines,
- Safer practice with epidural injections and infusions.

Department of Health

The government department responsible for health regulation and policy in the United Kingdom.

Venous thromboembolism (VTE)

A medical condition including DVT, whereby a blood clot forms inside a vein, and pulmonary embolism (PE), whereby part of the DVT breaks off and travels to the lungs, blocking the blood flow.

Improving Medication Safety

The NPSA produced seven key actions to improve medication safety which are still relevant today (Table 1.3).

Question 1.5 Why do you think it is important that we know not just what medications the patients are allergic to, but also what foodstuffs?

Patient Self-Administration of Medication

Health carers often take over the medication care of in-patients with diabetes and mess up their blood sugars by not being able to deliver their insulin and other medications at the correct times. Patients with Parkinson's disease also have strict regimes and we may again fail to deliver their medications on time, with profound effects on their independence and wellbeing. Many hospitals now have secure boxes at the bedside for patients to store their medication and allow them to self-medicate.

Table 1.3 Seven key actions to improve medication safety.

Increase reporting	**Increase reporting and identify actions against local risks by way of an annual medication report: clinical risk.**
Implement NPSA safer medication practice recommendations	**Implement NPSA recommendations – audit safer medication practice – includes alerts on anticoagulants, injectable medications, and wrong-route errors.**
Improve staff skills and competencies	**Improve skills: preceptorship competencies will help nurses to work towards the required level of competence.**
Minimise dosing errors	**Minimise errors: information, training, and tools to make calculations easier.**
Ensure medicines are not omitted	**It also can be linked with neglect when medications are not given. The NPSA reviews medicine storage and medication supply chains.**
Ensure medicines are given to the correct patient	**Ensure correct medications with correct patient – improve packaging and labelling of medicines – support local systems that make it harder for staff to select the wrong medicine.**
Document patient's medicine allergy status	**Document: improve recording of patient's allergy status.**

Source: Department of Health (2007).

Remember that not all patients have the ability to do this; for example, patients with dementia or those too ill to administer their own medication. But please remember, patients with dementia may have windows of opportunity whereby they can self-medicate. As with all health care, this aspect of their care must be monitored frequently. Many patients in the community have their medication distributed by their pharmacist into 'dosset' boxes, boxes that have timed sections or partitioned by morning, afternoon, or evening, in order for them to take their medication.

Focus on the Task in Hand: Do Not Get Distracted

Many wards and clinical areas have notices on drug trolleys stating Do Not Disturb While Administering Drugs. This

enables the member of staff to concentrate on the task in hand. Some institutions have trialled the wearing of tabards in clinical areas for staff administering drugs, alerting others in the area not to disturb them.

Vicarious Liability

Question 1.6 What does vicarious liability mean?

We all need to comply with our Policies and Procedures, whether we work in a hospital, clinic, or the community setting.

Procedure for Administering Medication

So, when administering medications, what is the correct procedure? The person administering a drug before giving it will:

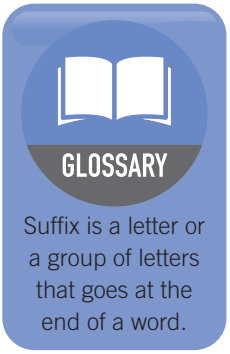
1. Check the identity of the patient,
2. Check for any recorded allergy/sensitivity,
3. Check the drug name, dose form, strength, date, and time,
4. Check the route of administration,
5. Check for any additional instructions, including safety considerations,
6. Check the drug has not already been administered,
7. Check the drug label against the prescription,
8. Check the expiry date of the drug on the label,
9. Calculate the dose if appropriate.

Prescriptions should be written in black pen, clearly, using no drug trade names, and the member of staff should not be distracted from the task in hand. Medical gases should also be prescribed (except in emergency situations).

When administering medications, we should adhere to the so-called five rights:

- Right medicine,
- Right dose,
- Right route,
- Right patient,
- Right time.

The procedure for checking the patient's name, name band, and prescription chart is referred to as the three-point check.



Commonly Used Medicine Name Suffixes

As our knowledge of medicines increase, we will begin to see patterns of drug names related to their drug class, or medicine name suffixes. We can see some of these below in Table 1.4:

Table 1.4 Medicine name suffixes.

Suffix	Medication family or class	Examples of drugs	Indications for use
• mab	Monoclonal antibodies	Trastuzumab Pertvzumab Pembrolizumab	Breast cancer Breast cancer Melanoma
• olol	b-Blockers	Propranolol Bisoprolol Timolol Maleate	Hypertension Adjunct in heart failure Angina
• sartan	Angiotensin receptor antagonists	Valsartan Telmisartan Irbesartan	Hypertension Hypertension Hypertension
• pril	Angotensin-converting Enzyme inhibitors	Lisinopril Ramipril Quinapril	Hypertension Hypertension Hypertension
• cillin	Penicillin antibiotics	Ampicillin Amoxicillin Benzylpenicillin	Susceptible infections e.g. bronchitis Susceptible infections e.g. sinusitis Mild to moderate bacterial infections e.g. pneumonia
• sone	Corticosteroids	Prednisone Dexamethasone Hydrocortisone	Rheumatoid arthritis Cerebral oedema Anaphylaxis

Finally

Before administering any drug to any patient:

- Go through the procedural steps for administering medication in your mind,
- Go through the five rights,
- Know your patient,
- Know the drug and its contraindications.

Lastly, do not cut corners. We all have time constraints, but we must always adhere to the Code of Conduct of the Nursing and Midwifery Council (2015) in order to achieve safe, effective, and professional care for our patients.

TEST YOUR KNOWLEDGE

1. What does STAT mean?
2. What does PRN mean?
3. What are the four parts of the medication process?
4. What route of administration is referred to if you see INH on a prescription chart?
5. A drug is presented as 1 g in 100 ml. A patient weighing 90 kg is prescribed 20 mg/kg/h of the drug.
   - **(a)** How many milligrammes per hour of the drug does the patient require?
   - **(b)** For how many millilitres per hour do you set the infusion pump?
6. What are the five rights in regard to drug administration?
7. How many medication errors are there estimated to be in the NHS per annum?
8. According to the BNF, children have been classified into four groups/What are they?
9. If you saw the drug suffix ‘olol’ what medication class do these drugs belong to?
10. What does ADME stand for?

KEY POINTS

- Latin abbreviations used in drug administration.
- Using your professional judgement.
- The medication process.
- The routes of drug administration.
- Examples of drug administration competencies to be signed off during placements.
- Looking at the front sheet of the prescription chart.
- Improving medication safety factors.
- The procedure for the administration of medicines.

WEB RESOURCES

BNF for Adults: www.bnf.nice.org.uk
BNF for Children: www.bnfc.nice.org.uk
Electronic Medicines Compendium: www.medicines.org.uk/emc
NMC: www.nmc.uk.org
Government publications:
www.gov.uk/government/publications/public-spending-statistics
www.legislation.gov.uk
www.england.nhs.uk/patient-safety/national-medicines-safety-programme
www.gov.uk/government/publications/medication-errors-short-life-working-group-report
www.npsa.org.uk
www.gov.uk/government/publications/the-national-patient-safety-agency-annual-report-and-account
www.england.hns.uk/patient-safety/national-medicines-safety-agency-7-key-actions-to-improve-mrdication-safety
Electronic Medicines Compendium: www.medicines.org.uk
National Patient Safety Agency: www.npsa.nhs.uk

REFERENCE

The Royal Marsden Manual of Clinical Nursing Procedure (2020) (eds.Sara Lister, *Justine Hofland, and Hayley Grafton*. 10. Wiley

NMC (2015) The Code. Professional Standards of Practice and Behaviour for Nurses, Midwives, and Nursing Associates. London. www.nmc.org.uk