Chapter-1 | Hospital Pharmacy

Topic in this Notes:

- Definition, scope, national and international scenario
- Organisational structure
- Professional responsibilities, Qualification and experience requirements, job specifications, work load requirements and inter professional relationships
- Good Pharmacy Practice (GPP) in hospital
- Hospital Pharmacy Standards (FIP Basel Statements, AHSP)
- Introduction to NABH Accreditation and Role of Pharmacists

Hospital:

It is a Place where Treatment & diagnosis of disease by expert doctor.

Or

Hospital is a organization is governing body which make the use of specialized scientific equipment and functioning through team of trend.

Hospital word has been derived from Latin word "Hospes" as we know which means a host, guest or Hotel.

Some also believe that the origin of the hospital from the word „HOSPITUM" a rest house for travelers or night shelter showing „hospitality" to the guests.

Function of Hospital

- Take care of sick & injured patient.
- Promote good service to patient getting relief from disease and pain.
- Restoring & Keeping up good health of community.
- To run programmer people education.
- Primary function is to take care of inpatient and outpatient.

Hospital pharmacy

Hospital pharmacy is the healthcare service which comprises the art practice and profession of choosing preparing storing compounding and dispensing medicine and medical device advising healthcare professionals and patients on their safe effective and efficient and use.

Or

Hospital pharmacy is a specialized field of pharmacy that is integrated into the care of a medical center. These include centers such as a hospital, outpatient clinic, drug-dependency facility, poison control center, drug information center of residential care facility.

The profession involves choosing, preparing, storing, compounding and dispensing medications for patients in a medical environment. Another important area is the provision of advice to both patients and other health professionals about the safe and effective use of medicines.

Function of Hospital pharmacy:-

- To precipitate in the patient care system by dispensing medicine.
- It inspects the received items and maintains an inventory for the same.
- It keeps a record of all the narcotic drugs and alcohol received and issued.
- Packaging of medicine drug and labeling containers.
- Profit center of the Hospital
- It discusses about the drug related information with the medical staff, residents nurses, health care team and the patients.
- It participate in minimizing the incidence of illness, and improves the general health of the population.

Objectives of Hospital pharmacy services.

- It maintain the professional working environment of the hospital pharmacy in order to attain the objectives of the hospital.
- To provide the right medicine to right patients and right time in right quantity with minimum cost.
- To participate in and apply the rules of the pharmacy and therapeutic committee.
- To interact, co-operate and coordinate among departments of the hospital.
- It act a counciling center to the patient.
- It act as an information center about drug.

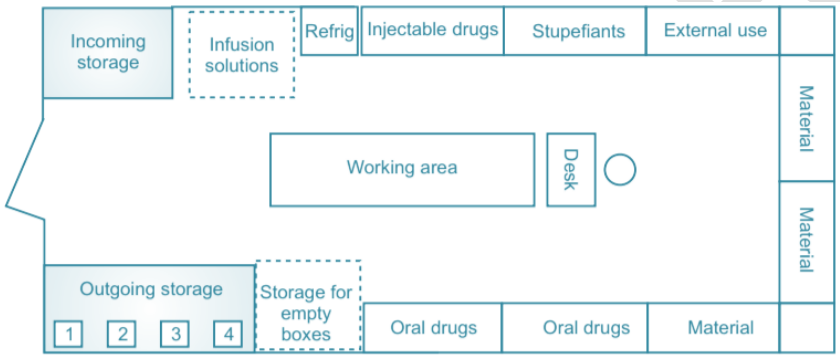
Scope, national and international scenario

Organisational structure of Hospital Pharmacy

- **Location of Hospital pharmacy:-**
  - The pharmacy should be situated at the ground floor or the first floor to ease its accessibility and to provide adequate service to the various departments and nursing stations.
  - If the hospital has an out-patient department the pharmacy or its branch should be near it.

- The layout of floor pharmacies should be such that continuous flow of men and materials is maintained.

- **Layout of Hospital pharmacy:-**
- The design and construction of the hospital pharmacy should be done considering its functionality.
- Its location and size should support personnel and inventory movement, work process and activities.
- Built in storage and fixed equipment for storing documents, bulk supplies, portable medical gas cylinders, etc.



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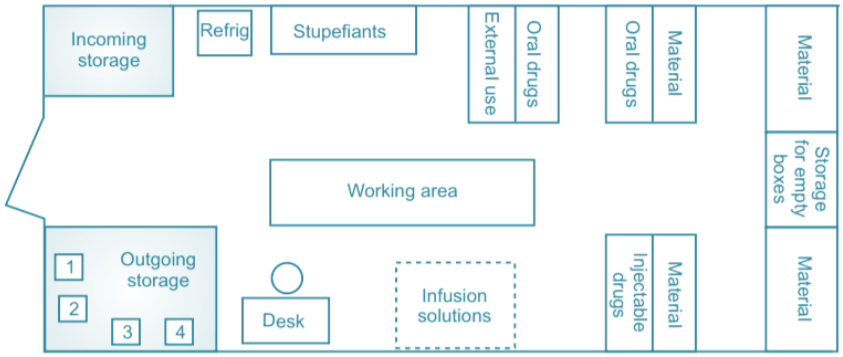


Professional responsibilities, Qualification and experience requirements, job specifications, work load requirements and inter professional relationships

Professional responsibilities

- The key responsibilities of a hospital pharmacist include:

Medicine Management

- A key role in a hospital pharmacist's job is determining which form of medication best suits each patient. Each decision must be made in a timely and efficient manner and requires significant input from doctors, nurses and other healthcare professionals.
- Hospital pharmacists will often monitor the effects of the medications they prescribe and counsel their patients on the effects of the drugs.
- Another aspect of this role is to recommend administration routes and dosages, all of which are dependent on an individual's needs.

A source of information

- A hospital pharmacist is often a great source of advice for patients. They can also be called upon to recommend safe combinations of medicines or solutions to specific patient problems.
- Hospital pharmacists can offer information on potential side effects and check that medicines are compatible with existing medication. They will often also monitor the effects of treatments to ensure that they are proving effective, safe and appropriate to the user.

Monitoring drug charts

- As hospital pharmacists are required to work closely with other members of staff, such as physicians, nurses and dieticians, information must be passed on in a way that is clear to understand. While this might seem simple, performing hand-overs between shifts has the potential to make this aspect of the role a little more complicated.
- Luckily, drug charts provide a vital source of information and act as an efficient method of communication between hospital pharmacists and other members of medical staff. Hospital pharmacists must monitor these charts and ensure that the correct medication is being provided to each patient.
- Such information may include which form of medication a patient requires, with options including tablets, injections, ointments or inhalers. How the medication should be administered must also be communicated.

Discharging patients

- Discharging patients is another important role. It is the duty of a hospital pharmacist to keep track of which patients are being discharged and inspect the discharge summary. This requires the pharmacist to inspect the patient's drug chart to ensure that the medication prescribed matches that contained in the discharge summary. It is then the responsibility of the pharmacist to dispense the correct medication.
- Many hospital pharmacists are also qualified to prescribe medication, however, this does not apply to all those in the profession.

Keeping up to date

- As with any healthcare job, hospital pharmacists are expected to remain up to date with all aspects of medicine. This includes their usage and any new developments that may occur.
- To do this, hospital pharmacists must use electronic databases and read research papers.
- These provide invaluable data that enables pharmacists to learn more about new drugs before recommending that they are purchased by the hospital.

- Utilising these resources regularly will allow hospital pharmacists to remain an excellent source of pharmaceutical advice.

Beyond the ward

- Of course, hospital pharmacist duties can extend beyond the ward too.
- Hospital pharmacists are responsible for monitoring the supply of all medicines used in the hospital and are in charge of purchasing, manufacturing, dispensing and quality testing their medication stock along with help from pharmacy assistants and pharmacy technicians.
- The role can extend to manufacturing medicines when ready-made preparations are unavailable.

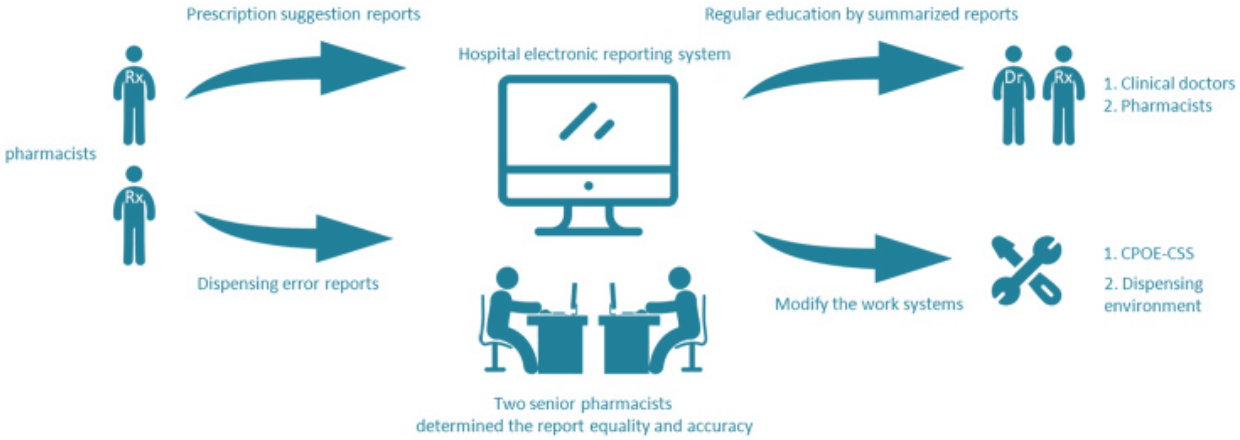
Qualification and experience requirements

- The head of hospital pharmacy department should be at least M.Pharm in Pharmacology Clinical pharmacists, should have a degree such a master in clinical pharmacology Quality control incharge should be M.Pharm in Pharmaceutical chemistry and assist should be B.Pharma or D.Pharma.
- Hospital pharmacists can improve their skills through regular rotations. Rotations see hospital pharmacists operate in a different department within their hospital for a set amount of time, essentially like a shift pattern. Such departments can include clinical wards and medicine information. Working these rotations allows a hospital pharmacist the chance to develop and gain a much more well-rounded skill set.

Job specifications:

- Sales and Marketing
- Research and Development
- Quality Assurance/ Control Manager
- Production
- Drug Inspector
- Hospital Pharmacist
- Analytical Chemist
- Customs Officer
- Drug Therapist
- Quality Control Manager
- Medical store

Work load requirements and inter professional relationships



Good Pharmacy Practice (GPP) in hospital

Good Pharmacy Practice (GPP) is at the very heart of the profession of Pharmacy indeed it is the very essence of the profession. Moreover, it expresses our covenant with the patient not only to 'do no harm' but also to facilitate good therapeutic outcomes with medicines.

GPP is the practice of pharmacy that responds to the needs of the people who use the pharmacists' services to provide optimal, evidence-based care. To support this practice it is essential that there be an established national framework of quality standards and guidelines.

Hospital Pharmacy Standards (FIP Basel Statements, AHSP)

The Global Conference on the Future of Hospital Pharmacy was hosted by the International Pharmaceutical Federation (FIP) Hospital Pharmacy Section as part of the 68th Annual Congress of the International Pharmaceutical Federation (FIP) on 30th and 31st August 2008. A total of 348 hospital pharmacists representing 98 nations met in Basel and successfully developed the attached consensus statements reflecting the profession's preferred vision of practice in the hospital setting.

Prior to the conference, facilitators commissioned by the FIP Hospital Pharmacy Section prepared literature reviews on each of six topics, covering all areas of the medicine use process in hospitals, including the procurement of medicines, preparation and distribution, prescribing, administration of medicines, and the monitoring of patient outcomes. In addition, issues related to human resources and training were addressed. Medication safety was an important consideration in all consensus statement development.

AHSP means Approved Health & Safety Plan

- AHSP may be the Director General of Quality Assurance (DGQA) or an authority in the Service Headquarters for service specific items.
- AHSP is the authority responsible for collecting, collating, developing, amending, updating, holding and supplying sealed particulars of the defence items in accordance with the laid down procedure.
- These Benefits programs include the Ambulance & Hospital Semi-Private (AHSP), Dental, Vision, Prescription Drugs, Extended Health, Travel Health, Long-Term Disability (LTD) plans and Health Spending Account and nurses will be "grandparented" to those plans for the duration of their employment.
- The testing of advance sample and bulk sample during PDI will be carried at the designated AHSP labs.When testing facilities are not available, the facilities of Govt labs/NABL/Accredited labs will be utilized.

Introduction to NABH Accreditation and Role of Pharmacists

(NABH) National Accreditation Board for Hospitals

National Accreditation Board for Hospitals & Healthcare Providers (NABH) is a constituent board of Quality Council of India (QCI), set up to establish and operate accreditation programme for healthcare organizations.

The board while being supported by all stakeholders including industry, consumers, government, have full functional autonomy in its operation.

- Patients are treated with respect, dignity and courtesy at all times.
- Patients are involved in care planning and decision making.
- Patients are treated by qualified and trained staff.
- Feedback from patients is sought and complaints (if any) are addressed.
- Transparency in billing and availability of tariff list.
- Continuous monitoring of its services for improvement.
- Commitment to prevent adverse events that may occur.

Role of Pharmacists in Hospital Pharmacy

1. Review Prescriptions
2. Dispense Prescription / Non-Prescription Medicines
3. Provide Patient Counseling / Education
4. Hospital and Community Pharmacy Management
5. Expertise on Medications
6. Proficiency on drugs / pharmaceuticals
7. Entrepreneurship and Leadership
8. Deliver Primary and Preventive Healthcare
9. Professional, Ethical and Legal Practice
10. Continuing Professional Development

Chapter-2 | HOSPITAL AND CLINICAL PHARMACY

Different Committees in the Hospital

- **Pharmacy and Therapeutics Committee - Objectives, Composition and functions**
- **Hospital Formulary -Definition, procedure for development and use of hospital formulary**
- **Infection Control Committee – Role of Pharmacist in preventing Antimicrobial Resistance**

Pharmacy and Therapeutics Committee

- Pharmacy and Therapeutics (P&T) is a committee at a hospital or a health insurance plan that decides which drugs will appear on that entity's drug formulary.
- The committee usually consists of healthcare providers involved in prescribing, dispensing, and administering medications, as well as administrators who evaluate medication use.

Objectives

- Ensure compliance with appropriate standards and state and federal regulations.
- The primary responsibilities of the P & T Committee are to ensure high-quality drug therapy for hospital patients, provide liaison between the medical staff and the department of pharmacy services

Composition:

1. The medical superintendent- Chairman
2. Chief of pharmacy services- Secretary
3. One representative each from
   - Department of internal medicine
   - Department of surgery
   - Department of clinical pharmacology
   - Department of microbiology
   - Department of nursing
   - Department of nutrition

Function:

- Maintain the Drug Formularies to promote safety, effectiveness, and affordability according to the Formulary Principles.
- Oversight consists of the Commercial Drug Formularies, the Medicare Formulary, and the State Programs Formulary (Minnesota Health Care Programs)
- Maintain pharmacy-related medical policies that promote the safety, effectiveness, and affordability of medications used in clinic settings.
- Maintain Formulary Principles that guide the management of the Drug Formularies.
- Review new drugs, drug classes, new clinical indications, therapeutic advantages, new chemical entities, and new safety information.
- Review the Drug Formularies and therapeutic classes at least annually.
- Analyse scientific, clinical and economic information.

Hospital Formulary -Definition, procedure for development and use of hospital formulary

Hospital Formulary:

- The hospital formulary is a continuously revised compilation of pharmaceutical dosage agent and their forms etc. which reflects the current clinical judgment of the medical staff.
- The hospital formulary system is a method whereby the medical staff of a hospital with the help of pharmacy and therapeutic committee selects and evaluate medical agents and their dosage form which are considered to be most useful in the patient care.
- It provides information for
    - Procuring,
    - Prescribing,
    - Dispensing
    - And administration of drugs under brand names where the drug have both names.

Procedure for development

- Identify the most common diseases being treated in the hospital by consulting all medical departments. For each disease, an appropriate first choice of treatment should be identified using standard treatment guidelines.
- An expert committee can be brought together to identify the appropriate treatment for each of the common health problems.
- The alternative method is reviewing the WHO model list of essential medicines may also be used as a starting point.

- The capability of the hospital and its staff to handle specific drugs should not be forgotten during the selection process.
- A draft of the list must be prepared and must be given to each department to comment on the list.
- The Drugs and Therapeutics Committee must deliberate on their comments and provide feedback.
- All information should be discussed with evidence based reviews where possible.
- After the preparation of final list, monographs for each drug should be prepared and it should contain unbiased information.

Use of hospital formulary:

- The statements made in this paper are not intended as an argument in favor of the use of a private drug-formulary in all hospitals.
- The possibility of restricting prescribing in certain hospitals to the use of drug products listed in a formulary of this type would not be profitable or proper here.
- It was organized can be promoted by bringing to this forum our ideas regarding the value of hospital formularies and any proven ideas which have been found to increase the value of these publications to physicians and patients in the particular hospitals which we happen to represent.

Infection Control Committee:

- The Infection Control Committee is generally comprised of members from a variety of disciplines within the healthcare facility.
- Representation may include: physicians, nursing staff, infection control practitioners, quality assurance personnel, risk management personnel as well as representatives from microbiology, surgery, central sterilization, environmental services, etc.
- Every healthcare facility uses inter disciplinary task forces such as the Safety Committee and the Infection Control Committee to minimize patient and employee risk
- Although its existence may not be widely recognized by patients, the Infection Control Committee plays an integral part in the care of every patient.

Role of Pharmacist in preventing Antimicrobial Resistance:

- ‘Pharmacists’ responsibilities for antimicrobial stewardship and infection prevention and control include promoting the optimal use of antimicrobial agents, reducing the transmission of infections, and educating health professionals, patients, and the public.
- The Impact of Pharmacists on Antimicrobial Stewardship Teams in a Community Setting.
- Pharmacists Improve Patient Outcomes after Emergency Department Discharge
- Pharmacists Play a Key Role in Educational Interventions.
- Pharmacist Led Antimicrobial Therapy Significantly Decreases Duration of IV Treatment.

Chapter-3 | Unit-1 | Hospital and Clinical Pharmacy

Topic in these Notes

Supply Chain and Inventory Control

Unit-1

- Preparation of Drug lists - High Risk drugs, Emergency drugs, Schedule H1 drugs, NDPS drugs, reserved antibiotics
- Procedures of Drug Purchases – Drug selection, short term, long term and tender/e-tender process, quotations, etc.

Unit-2

- Inventory control techniques: Economic Order Quantity, Reorder Quantity Level, Inventory Turnover etc.
- Inventory Management of Central Drug Store – Storage conditions, Methods of storage, Distribution, Maintaining Cold Chain, Devices used for cold storage (Refrigerator, ILR, Walk-in-Cold rooms) FEFO, FIFO methods.

Unit-3

- Expiry drug removal and their disposal methods e.g., Narcotics
- Documentation - purchase and inventory.

Preparation of Drug lists - High Risk drugs, Emergency drugs, Schedule H1 drugs, NDPS drugs, reserved antibiotics.

Preparation of Drug lists

In most hospitals the reconstitution and preparation of complex drugs takes place in centralized units typically in a controlled environment with experienced staff.

When preparing intravenous drugs there are key elements that need to be taken into account:

- Accurate d se and concentration
- Sterility
- Stability
- Occupational exposure

High risk drugs:

- High risk drugs are medicines that can cause significant harm to the patient; they may cause serious side-effects especially when administered incorrectly or when a dose is calculated incorrectly.
- High risk drugs may also have a narrow therapeutic range; which means there is little difference between sub-therapeutic, therapeutic and toxic doses.

List of High risk drugs:

Drugs	Monitoring	Symptoms	Actions Required	Interactions
CARBAMAZEPINE	• Full blood count, • renal function, • liver function	• Leucopenia • Blurred vision, • Diplopia • Skin Disorders • Hepatic disorders • Antiepileptic • Hypersensitivity Syndrome	• Advise patient to report immediately to a doctor if any warning signs occur • Ensure the patient receives the same brand of medicine at each time of collecting a prescription and that the patient is aware of which brand they are maintained on • Ensure patient is aware of the law regarding seizures and driving • Inform the patient of potential interactions and the need to check with a pharmacist or doctor before taking any new medication (including OTC, prescribed or herbal medicines)	• Increased plasma concentration with acetazolamide, cimetidine, clarithromycin, erythromycin, fuoxetine, isoniazid. • Anticonvulsant effect antagonised by mefoquine, antipsychotics.
CICLOSPORIN	• Full blood count, • Liver function, • Serum electrolytes	• Neurotoxicity • Liver toxicity • Hypertension • Headache • Gingival hyperplasia	• Hypertension is a common side-effect of ciclosporin therapy. Advise patient to have their blood pressure monitored regularly	• Increased plasma concentration with clarithromycin, diltiazem, erythromycin, fuconazole, grapefruit juice, itraconazole,

	• Blood pressure		• Warn patients that they must not receive immunisation with live vaccines • Brand-specifc prescribing is recommended (if changing brand monitor closely for changes in ciclosporin level, serum creatinine and blood pressure) • Advise patient to avoid excessive exposure to UV light, including sunlight and to use a wide spectrum sunscreen (may reduce risk of secondary skin malignancies). Patients with atopic dermatitis and psoriasis should avoid use of UVB or PUVA • Advise patient to avoid a high potassium diet and grapefruit juice. • The oral solution formulations can be taken with orange or apple juices to improve taste	ketoconazole, miconazole, metoclopramide, verapamil, colchicine (with which concomitant use also increases risk of nephrotoxicity and myotoxicity) and tacrolimus (avoid) • Decreased plasma concentration with carbamazepine, orlistat, phenobarbital, phenytoin, rifampicin • Increased risk of hyperkalaemia when ciclosporin given with ACE inhibitors or angiotensin-II receptor antagonists, aldosterone antagonists • Increased risk of nephrotoxicity when ciclosporin given with NSAIDs and increased plasma concentration of diclofenac. • Increased risk of myopathy when ciclosporin given with atorvastatin, fuvastatin, pravastatin, rosuvastatin, simvastatin (avoid concomitant use)
CORTICOSTEROIDS	Blood pressure, blood lipids, serum potassium, body weight and height (in children and adolescents), bone mineral density, blood glucose, eye exam (for intraocular pressure, cataracts), signs	• Cough • Wheeze • Tight chest • Nausea • Vomiting • Weight loss • Fatigue • Headache • Muscular weakness	• Give the patient a steroid treatment card if long-term treatment is required. Explain that they must not stop treatment abruptly after prolonged treatment (> 3 weeks) • Check the patient is taking oral steroids in the morning as a single dose • Ensure that patients rinse their mouth or clean their teeth after	• Metabolism of corticosteroids accelerated by carbamazepine, phenobarbital, phenytoin and rifamycins. • High dose corticosteroid can impair immune response to vaccines; avoid concomitant use with live vaccines. • Hypokalaemia can be severe when given with other drugs that lower serum potassium e.g. loop

	of adrenal suppression		using inhaled corticosteroids • If the patient has not had chicken pox and measles in the past, advise them to avoid anyone with these infections	and thiazide diuretics. • Effects if antihypertensive and oral hypoglycemic drugs are antagonized by glucocorticoids.
GENTAMICIN AND AMIKACIN	• Renal function (nephrotoxicity), auditory and vestibular function (ototoxicity which is irreversible), serum-aminoglycoside concentration must be determined in the elderly, those with renal impairment, if high doses given, obesity and in cystic fbrosis	Hearing impairment or hearing disturbance	• Advise patient to report immediately to a doctor if any of the warning signs • Ensure patient is hydrated and drinking adequate amounts of fuid to prevent dehydration before starting treatment	• Increased risk of nephrotoxicity when aminoglycosides such as gentamicin are given with ciclosporin, tacrolimus, vancomycin • Increased risk of ototoxicity when aminoglycosides given with loop diuretics, vancomycin.
NSAIDs	• Progressive unintentional weight loss or diffculty swallowing • Pregnancy and breastfeeding • Swollen ankles or feet • Unexplained, persistent recent-onset dyspepsia • Worsening of asthma	• All patients of any age prescribed NSAIDs for osteoarthritis or rheumatoid arthritis or patients over 45 years who are prescribed NSAIDs for lower back pain should be co-prescribed gastroprotection (e.g. a proton pump inhibitor) • Recommend that oral NSAID is	----------	• Possible increased risk of convulsions when given with quinolones • Possible enhanced anticoagulant effect of coumarins and phenindione • Possible enhanced effects of sulfonylureas. • NSAIDs antagonise hypotensive effect of beta-blockers, calcium-channel blockers, ACEIinhibitors, angiotensin-II receptor antagonists, alpha-blockers, nitrates

		taken with or just after food • Inform patient of potential interactions, the need to check with a pharmacist or doctor before taking any new medication (especially OTC NSAIDs)		
PHENYTOIN	• Serum concentration , ECG and blood pressure with intravenous use, liver function, full blood count, serum folate, vitamin D. Phenytoin is highly protein bound; patients with impaired liver function, elderly or those who are gravely ill may show early signs of toxicity	• Fever • Sore throat, • Mouth ulcers • Leucopenia, • Aplastic anaemia, • Megaloblastic anaemia • Suicidal thoughts • Low vitamin d levels e.g. Rickets, osteomalacia	• Use caution when dispensing: Brand-specifc prescribing recommended as preparations containing phenytoin sodium (100mg) are equivalent to those containing phenytoin base (92mg). • The dose is the same for all phenytoin products when initiating therapy, but if switching between formulations, the difference in phenytoin content may be clinically signifcant	• Increased plasma concentrations with amiodarone, chloramphenicol, miconazole, topiramate, trimethoprim (also increased antifolate effect), metronidazole, clarithromycin, telithromycin (avoid during and 2 weeks after phenytoin) • Reduced plasma concentrations with rifamycins.

Emergency drugs:

- Emergency drugs are those drugs which may be required to meet the immediate therapeutic needs of patients and which are not available from any other authorized source in sufficient time to prevent risk or harm to patients.
- Emergency drugs must be available for use by authorized personnel at strategic locations throughout the hospital.
- Emergency drugs including, but not limited to: pharmacologic antagonists appropriate to the drugs used, vasopressors, corticosteroids, bronchodilators, antihistamines, antihypertensives and anticonvulsants.

List of Emergency drugs:

Drug	Indication	Dose	Quantity
Oxygen	Almost any emergency	100% inhalation	1 "E" cylinder with adjustable regulator (0-15L)
Epinephrine	Anaphylaxis Asthma unresponsive to albuterol/salbutamol	1: 1000 (1mg/ml), auto injector 0.3 mg/ml (EpiPen), 0.15 mg/ml (EpiPen Jr)	1:1000 mg/ml ampule, 1 EpiPen, 1 EpiPen Jr auto injectors
Nitroglycerin	Angina pain	0.4 mg sublingual every 3-5 minutes	1 metered spray bottle (0.4 mg)
Diphenhydramine	Allergic reactions	1 mg/kg IM/IV; max 50 mg *dosage by age)*	50 mg/ml vials and 1 box 25 mg tablets
Albuterol/salbutamol	Asthmatic bronchospasm	2 puffs; repeat as needed	Metered dose inhaler 2.5 mg/3ml nebulized solution
Aspirin	Myocardial infarction	81 mg chewable tablet	Chewable tablet, bottle baby aspirin

			(81 mg)
Glucose	Hypoglycemia (patient unconscious)	37.5 mg; repeat as needed	1 tube (37.5 mg)
Atropine	Clinically significant bradycardia	0.5 mg IV or IM	1 ampule (1 mg/10 ml)
Hydrocortisone	Adrenal insufficiency Recurrent anaphylaxis	100 mg IV or IM (mixed with 3-5ml sterile water)	1 vial (100 mg)
Morphine or nitrous oxide	Angina pain unresponsive to nitroglycerin	Titrate 2 mg IV, 5 mg IM ~ 35% N2O inhalation	Titrate 2 mg IV, 5 mg IM ~ 35% N2O inhalation
Naloxone	Reversal of opioid overdose	0.1 mg/kg up to 2mg IV or IM	4 mg/10 ml multi-dose vial
Lorazepam or Midazolam	Status epilepticus	4 mg IM or IV 5 mg IM or IV	50 mg/10 ml multi-dose vial
Flumazenil	Benzodiazepine overdose	0.01 mg/kg at 1-minute intervals up to 1 mg IV or IM	0.5 mg / 5 ml multi-dose vial

Schedule H1 drugs:

- Schedule H1 has been introduced through to check the indiscriminate use of antibiotics, anti-TB and some other drugs in the country.
- The schedule contains certain 3rd and 4th generation antibiotics, certain habit forming drugs and anti-TB drugs.

SR. No.	Schedule H1 drugs	SR. No.	Schedule H1 drugs
1.	Alprazolam	**24.**	Doripenem
2.	Balofloxacin	**25.**	Diazepam.
3.	Buprenorphine	**26.**	Ertapenem
4.	Capreomycin	**27.**	Ethambutol Hydrochloride
5.	Cefdinir	**28.**	Zolpidem
6.	Cefditoren	**29.**	Ethionarnide
7.	Cefepime	**30.**	Feropenem
8.	Cefixime	**31.**	Imipenem
9.	Cefetamet	**32.**	Isoniazid
10.	Cefopeiazone	**33.**	Levofloxacin
11.	Cefotaxime	**34.**	Meropenem
12.	Cefpodoxime	**35.**	Midazolam
13.	Cefpirome	**36.**	Moxifloxacin
14.	Ceftazidime	**37.**	Nitrazepam
15.	Chlordiazepoxide	**38.**	Pentazocine
16.	Clofazimine	**39.**	Prulifloxacin
17.	Codeine	**40.**	Pyrazinamide
18.	Ceftibuten	**41.**	Rifabutin
19.	Ceftizoxime.	**42.**	Rifampicin
20.	Gemifloxacin	**43.**	Sodium Para-aminosalicylate
21.	Ceftriaxone	**44.**	Sparfloxacin
22.	Cycloserine	**45.**	Thiacetazone
23.	Diphenoxylate	**46.**	Tramadol

Note.- Preparations containing the above drug substances and their salts excluding those intended for topical or enernal use (except ophthatmic and ear or nose preparations) containing above substances are also covered by this Schedule.

NDPS drugs (Narcotic Drugs and Psychotropic Substances)

The central acts like Opium Act 1857, the opium Act, 1878 & the Dangerous Drugs Act, 1930 were erected a long time age.

- With the changing circumstances and the developments in the field illicit drugs traffic and drugs abuse at national and International level many drawbacks have come to notice in the said Acts.
- The government of India has repealed these old Acts passed the:
- These Acts established in 14 November 1985.
- It also provides the licensing system for both central & state government.

Cannabis:

1. Charas: Separated resin in crude or purified form obtained from the cannabis plant and raisin called ***"Hashish oil"***.
1. Ganja: The flowering or fruiting tops of the cannabis plants.
2. Caca Derivative: Includes crude cocaine which is a methyl ester of benzoyl-ecogonine and its salts.
3. Opium: Means the coagulated juice of the opium poppy and its mixture with or without neutral material.

Effects of drugs

When abused, drugs produce a variety of effects depending upon the drug:

- **Stimulants** increase the activity of the abuser and make him more lively and active. Some stimulants such as amphetamines were used in wars to make the soldiers more active.
- **Sedatives** make the person feel sleepy and reduce his activity. Opium and opiates are good examples of sedatives.
- **Hallucinogens** create hallucinations in the abuser. LSD is one of the well known hallucinogens.
- **Tranquilisers** calm the nerves of the addict without making him feel sleepy.

S.N.	Drug Lists of NDPS drugs
1.	Amphetamine
2.	Buprenorphine
3.	Charas/Hashish
4.	Cocaine
5.	Codeine
6.	Diazepam
7.	Ganja
8.	Heroin
9.	MDMA
10.	Methamphetamine
11.	Methaqualone
12.	Morphine
13	Poppy straw

Reserved Antibiotics

The reserved antibiotics are those antibiotics which are reserved for the treatment of suspected or diagnosed infection caused by multi -resistant organism , and they are used when all other antibiotics have failed .

1. Aztreonam	**2. Oritavancin**
3. Carumonam	4. Polymyxin B (Injection)
5. Colistin (Oral)	6. Tedizolid
7. Ceftaroline	8. Daptomycin
9. Cefiderocol	10. Faropenem
11. Ceftobiprole	12. Iclaprim
13. Ceftazidime + Avibactam	14. lefamulin
15. Ceftolozane + Tazobactam	16. Meropenem + Vaborbactam
17. Colistin (Injection)	18. Omadacycline
19. Dalbavancin	20. Plazomicin
21. Dalfopristin + Quinupristin	22. Polymyxin B (Oral)
23. Eravacycline	24. Telavancin
25. Fosfomycin (Injection)	
26. Imipenem + Cilastatin + Relebactam	
27. linezolid	
28. Minocycline (Injection)	

Procedures of Drug Purchases – Drug selection, short term, long term and tender/e-tender process, quotations, etc.

Procedures of Drug Purchases

- **Drug Purchase** means to obtain or get different types of medicines from external network.
- Pharmacies purchase drugs from wholesalers, and occasionally directly from manufacturers. After purchasing these drugs, pharmacies must safely store and dispense these drugs to patients.

Procedure for purchase

1) Purchase request form / Purchase requisition:

a) The pharmacist prepares the drug list to be buy and fills purchase request form .
b) This form provides information regarding required drugs , their quality and quantity .
c) This form will be sent to administration for approval , after approval it will sent to purchasing officer.

2) Quotation Invitation:

- Now the Purchasing officer send this form to different suppliers and ask their quotations

3) Purchase form:

- The purchasing officer checks all the quotations and select suppliers on the price, quality etc. and place the purchase orders.

4) Receipt of good products:

- When the ordered products delivered to the purchasing department, their quality, quantity and prices are checked. If the any products miss the desired quality, quantity, or price they should retuned to supplier.

5) Payment:

- After satisfactory completion all these process, the purchasing officer pay the amount to the suppliers.

Tender /e-tender

- It is a process in which a person or organization, who need goods / services etc. invites the other parties to submit a proposal to provide to provide their goods or services.

E-tender:

If this process is done by electronic machinery without using paper then it called E-tender.

Chapter-3 | Unit-2 | Hospital and Clinical Pharmacy

Topic in these Notes

Supply Chain and Inventory Control

Unit-1

- Preparation of Drug lists - High Risk drugs, Emergency drugs, Schedule H1 drugs, NDPS drugs, reserved antibiotics
- Procedures of Drug Purchases – Drug selection, short term, long term and tender/e-tender process, quotations, etc.

Unit-2

- Inventory control techniques: Economic Order Quantity, Reorder Quantity Level, Inventory Turnover etc.
- Inventory Management of Central Drug Store – Storage conditions, Methods of storage, Distribution, Maintaining Cold Chain, Devices used for cold storage (Refrigerator, ILR, Walk-in-Cold rooms) FEFO, FIFO methods.

Unit-3

- Expiry drug removal and their disposal methods e.g., Narcotics
- Documentation - purchase and inventory.

Inventory Control techniques:-

The procedure of handling inventory of medicines, drugs so as to fulfill the demand of the customers at comparatively lower prices and with less amount of investment is called Inventory control.

Objectives of Inventory Control:-

1) It assures adequate supply of medical goods to customers and minimums the changes of shortages in a drug Store.
2) It helps in maintaining proper records in the drugs Store.
3) It helps in short-term and long-term planning for the production of medical product.
4) It also optimizes the amount of capital tied up in inventory of a drug store.
5) Inventory control helps in bringing efficiency in purchasing, storing, accounting for medical products.

Importance of Inventory Control:-

1) Better Service to Customers
2) Continuity of Production Operations
3) Reduces the risk of loss
4) Protects variation in Output
5) Proper Utilisation of working capital
6) Check on loss of material

Modern Techniques of Inventory Control

ABC Analysis:- The system of evaluating the drugs that are present in the storage on their cost price is called as ABC Analysis.

They are classified into three groups

1) Category A
2) Category B
3) Category C

Category *A* of the ABC Analysis Carries maximum amount of the total stock of drugs.

- The drug store wants to take benefits from these drugs in terms of money then they need to manage these drugs properly.

- The calculation of annual expenditure is done by multiplying the annual consumption from its unit cost in ABC analysis. The cumulative cost of drugs was calculated by organising the Annual Drug Expenditure (ADE) in the descending order according to the value of money.
- They need to manage those drugs properly . To reduce the cost of acquiring, storing and issuing of drugs right supervision is required.

Category B comparatively less supervision is required and the orders are required to be placed semi-annually.

Category C are drugs bought in large quantity and therefore its control is leveraged.

Advantage of ABC Analysis

1. Label of Control
2. Careful Accounting
3. Safety Stocks
4. Quantity discount Factor
5. Layout of stores.

Disadvantage of ABC Analysis

1. In big industries there are large number of drugs so the recording and calculations become very difficult.
2. Increase stock of drugs of category C may lead to deterioration and obsolescence.
3. Modification in some items falling in category B drugs could be very important.

VED Analysis :-

- This analysis depends on the crucial values and the shortage cost of drugs.

VED Are classified in three groups.

1. Vital (V) :- The vital category contains drugs that are necessary for the life of the patient and needs to be present all the time in the hospital. These Drugs it will hamper the daily working of the drug store.

2. Essential (E) :- The essential category contains medicine which are comparatively less crucial and kept in the hospital under this group. The categorisation of these drugs is done according to the urgency of the stock.

3. Desirable (D) :- The Desirable category contains medicine which are not crucial and are kept in the hospital under this category.

The shortage of these drugs dose not cause any harm to the life of the patient.

Lead Time:-

- The average time period between the placing of order of medicines and receipt of medicines is called Lead Time.
- It is considered when the other of the medicines is to be made.
- It helps in identifying the amount of medicines to be ordered in time so that there is no scarcity of medicines in the hospital.

Inventory Carrying Cost:-

- Carrying cost refers to the cost which is incurred due to storing of drugs in an inventory.
- It is also popular by the name of holding cost.
- The elements of carrying cost include the following.
- The opportunity cost of capital invested in the stock.
- The obsolescence cost includes scrapping and possible rework.
- The determination cost and costs incurred in preventing deteriorations.

Safety Stocks or Buffer Stock:-

- Safety stock, also referred to as buffer stock, is the excess inventory that a company carries to make sure they don't run out of stock on something.
- You can think of this like just in case inventory. It's extra merchandise stored just in case they run out of the items on the shelves.

Minimum and Maximum stock levels:-

- Minimum and maximum stock levels are stock limits for the customer location product that the customer agrees upon with the supplier. The projected stock must not fall below the minimum stock level. For more information, see Calculation of Projected Stock.
- The maximum stock level is the maximum quantity of stock that is to be on hand at the customer. You can use different methods to determine these stock parameters.

Economic order quantity:-

- Ordering costs and carrying cost of drugs are taken into consideration while determining economics order quantity of a Drug store.
- Ordering costs is basically the cost associated with receiving an inventory while carrying costs includes handling warehousing and allied cost.

Scarp and surplus disposal

The residue attained in the manufacturing process is called scrap. These are the items whose value can be recovered but in a very less amount without being processed further.

Example- granules that are found in the manufacturing of tablet packing cases and containers that is not to be returned

Re-Order Level (ROL)

- Re-Order Level (ROL) implies the material level at which purchase requisition is generated for a fresh supply of material.
- When the stock on hand, approaches the reorder point, the storekeeper takes action to replenish the exhausted stock. So, the difference between reorder level and minimum level will be adequate to meet the production requirement till the fresh supply is received.
- Re-Order Quantity (ROQ) represents the size of the order, which is going to be placed by the entity with the selected supplier when the stock level touches reorder level.

Definition:

- If the firm has an idea about the lead time, EOQ, and consumption pattern, Reorder level can be determined easily.

Formula for Re-Order Level

In general, Re-Order Level is calculated using the following formula:

- **Re-order Level = Maximum Consumption × Maximum Reorder Period**

Further, if the maximum consumption is not known, Re-Order Level can also be calculated using an alternative formula:

- **Re-order Level = Minimum Stock Level + (Average Rate of Consumption × Average Reorder Period)**

If the company maintains safety stock it can be calculated as:

- **Re-Order Level = Safety Stock + (Average Consumption per day × Average Lead Time)**

Reorder Quantity Level:

- The reorder stock level is the level of inventory at which a new purchase order should be placed.
- The reorder level of stock is the fixed stock level that lies between the maximum and minimum stock levels. At the reorder stock level, an order for the replenishment of stock should be placed.
- The reorder level of stock is generally higher than the minimum level to cover any emergencies that may arise as a result of abnormal usage of materials or unexpected delay in obtaining fresh supplies.

Formula for Reorder Level of Stock

The reorder level of stock is calculated using the following formula:

- Reorder level of stock = Maximum consumption per day/per week etc. x Maximum delivery time

Another formula that can be used is:

- Reorder level of stock = Minimum stock + Average consumption during normal delivery time.

Choosing which formula to use depends on the information you are given in a problem.

When calculating the reorder level of stock, it is worth noting that it is revised periodically by considering the factors that are likely to change supply and demand for goods.

Inventory Turnover

- The inventory turnover ratio measures how fast the company replaces a current batch of inventories and transforms them into sales. A higher ratio indicates that the company's product is in high demand and sells quickly, resulting in lower inventory management costs and more earnings.
- The inventory turnover is a measure of the number of times inventory is sold or used in a time period such as a year.
- It is calculated to see if a business has an excessive inventory in comparison to its sales level.
- The equation for inventory turnover equals the cost of goods sold divided by the average inventory. Inventory turnover is also known as inventory turns, merchandise turnover, stockturn, stock turns, turns, and stock turnover.

Inventory Turnover Ratio Formula

$$\textbf{Inventory Turnover Ratio} = \frac{\textbf{Cost of Goods Sold}}{\textbf{Average Inventory}}$$

Inventory Management of Central Drug Store – Storage conditions, Methods of storage, Distribution, Maintaining Cold Chain, Devices used for cold storage (Refrigerator, ILR, Walk-in-Cold rooms) FEFO, FIFO methods

Inventory Management of Central Drug Store:

Drug store management is based on principles of inventory control. Mis-management of stores and non-applicability of Scientific and Modern techniques has been identified as the root cause of material storage in majority of hospitals.

Objective of Inventory Control

(i) To supply drug in time.
(ii) To reduce investment in inventories and made effective use of capital investment.
(iii) Efforts are made to procure goods at minimum price without bargaining the quality.
(iv) To avoid stock out and shortage.
(v) Wastage are avoided

Techniques of Inventory Management:

Intuitive Method: This is the most common method in practice today and surely the least effective. Items are recorded in the want book when the number of units in stock reaches one to three, and the amount ordered is the best estimate of the person in charge of inventory.

Storage conditions

Cold storage: 2-8^{o}C

Cool temp: 8-25 ^{0}C

Room temp RT-temp. Temperature prevailing in working area.

Warm: 30-40^{o}C

Excessive Heat: Above 40^{o}C

Methods of storage

Bulk packaging

- The majority of medications in outpatient pharmacies are received in bulk stock bottles. These bottles include labeling that is required by the FDA: brand and generic drug names, dosage form, quantity, national drug code (NDC) number, lot number, expiration date, name of the manufacturer, and storage requirements.

Unit dose packaging

- In hospitals or inpatient pharmacies, medications are often packaged individually for ease of use by the nursing staff and to decrease contamination of unused medication by sick patients.
- Unit dose packaging must be labeled properly and must include the generic name and strength of the medication, dosage form, the name of the manufacturer, expiration date, and lot number.
- Medications sent from the wholesaler in unit dose packaging generally have the required information on the packaging already, but the pharmacy technician should be aware of these requirements.

Repackaging medications

- The machines can range from simple manual machines that separate the medication into each blister package, all the way to automatic machines that can fill each package as well as create labels with all required information for each unit dose.

General drug storage

The manufacturer's recommendations should be followed when storing prescription medications.

Many medications are able to be stored at room temperature, between 59-86 degrees F. Drugs should not be stored above or below this temperature range unless authorized by the manufacturer.

The storage area should be clean and free of clutter, moisture, and dust, and be properly ventilated to allow for adequate airflow around the products.

Distribution of Drugs to Wards-

- Drugs should be supplied in the original packing of manufacturers. However if it is not possible to do so, then that should be supplied in clean containers so that the integrity and original properties can be preserved.
- Name and quantity of the drug should be properly labelled.
- It is always advisable that suitable precautions should be taken to dispose off "Original empty containers" in order to avoid their misuse.
- The containers should be destroyed in the presence of a responsible person with a written statement signed by him.
- Chief pharmacist should visit wards to check whether the drugs are properly stored under special storage conditions like cold storage, cool temperature and at room temperature.

Drug Distribution System

1) **Distribution of drugs to indoor patients** (Patients in wards, operation theatres, X-ray, and other specified departments)
2) **Distribution of drugs to outdoor patients** (Patients not admitted and not occupying bed)

Out-patient Services:-

- This type of patients is not admitted in hospital and is given general or emergency treatment which could be diagnosis, therapeutic, or preventive.
- An out-patient department keeps a check on patients who not to be admitted and require only diagnostic and therapeutic services.

There are three types of out-patients:-

1) General out-patient: such a patient is given treatment for a general condition or emergency condition but not referred case.

E.g. Diahorrea, Hypertension, Diabetes, Fever etc.

2) Referred Out-patient: In this type patient is referred to out-patient department by the attending medical/dental practitioner for specific treatment, and the patients for further treatment returns to the practitioner.

3) Emergency out-patient: In this type patient is given emergency or accident care for conditions (Determined clinically or considered by the patient or his representative) demanding instant medical attention.

In-patient services:-

The patient which is admitted in hospital receiving general or specific treatment is called In-patient.

Types of services provided to In-patients.

1) Individual prescription order system
2) Complete floor stock system
3) Combination of individual drug order and floor stock system
4) Unit dose dispensing system
5) Bed size pharmacy

Maintaining Cold chain

It means to provide 2-8 ° C temperature to any product like vaccines, during manufacturing, storing , transporting ,and distribution , to maintain their potency .

Devices Used for Cold Storage:

1) Refrigerator
2) Thermometer which indicate the temperature level.
3) Cold boxes for storage and transportation.
4) Ice packs

IRLs (ice lined refrigerator)

- Ice lined refrigerator is a type of refrigerator which has an extra function where cold ice water , or ice packs are filled . they maintain the inside temperature at a safe level in case of electricity fails .

Walk In Cold Rooms (WIC)

- Walk- in cold room is a cold storage condition on a large scale and it provide a constant an comfortable temperature throughout the space .

FIFO and FEFO

FIFO: Means First In, First Out It is a method in which the product came first in the warehouse in taken out first, to avoid expiration.

FEFO: It means First Expire, First Out. In this method the products whose expiry is closest are out first, to avoid expiration.

Chapter-3 | Unit-3 | Hospital and Clinical Pharmacy

Topic in these Notes

Supply Chain and Inventory Control

Unit-1

- Preparation of Drug lists - High Risk drugs, Emergency drugs, Schedule H1 drugs, NDPS drugs, reserved antibiotics
- Procedures of Drug Purchases – Drug selection, short term, long term and tender/e-tender process, quotations, etc.

Unit-2

- Inventory control techniques: Economic Order Quantity, Reorder Quantity Level, Inventory Turnover etc.
- Inventory Management of Central Drug Store – Storage conditions, Methods of storage, Distribution, Maintaining Cold Chain, Devices used for cold storage (Refrigerator, ILR, Walk-in-Cold rooms) FEFO, FIFO methods.

Unit-3

- **Expiry drug removal and their disposal methods e.g., Narcotics**
- **Documentation - purchase and inventory.**

Expiry

- There is a time period and condition in which a drug is good for use, and ending this time period or missing the specific condition (temperature, darkness) in which a drug is good, called Expiry .
- Expired drugs imply financial losses because they should no longer be distributed and must be discarded.

Removal and Handling of expired Drugs

- It is a process of store management to remove the expired drugs from store and to handle properly so that they should not be given to use.

Disposal of Expiry Drugs

- Disposal of expiry drugs means destroying the expired drugs so they cannot use.
- Disposal methods recommended by the International Authorities

Following actions can be taken for handling expired drugs

1. Return to donor or manufacturer
2. Waste immobilization: encapsulation.
3. Landfill
4. Waste immobilization: encapsulation
5. Waste immobilization: inertization.
6. Sewer
7. Burning in open containers
8. Chemical decomposition

1) Returning to the Manufacturing: The Manufacturer has good disposal method at its disposal.

2) Landfill: This is the oldest and best way for disposal of solid waste, In this method the waste materials are placed into land.

- The municipal waste should be used to cover this site.

3) Waste immobilization (Encapsulation): In this method, the pharmaceuticals are packed in a plastic or steel drum , solid and semi solid materials are filled 75 % of drum, then mixture of lime, cement and water in 15: 15: 5 ratio is filled, then mouth of drum sealed and placed in landfill and cover with municipal solid waste.

4) Sewer: Syrups and IV fluids are diluted with water and flushed into sewer, in small quantity, over a time period.

5) Incineration: In this methods the waste material are given high temperature heat to be destroyed.

6) Chemical Disposal: In this chemicals are used to destroy the expired drugs.

Disposal Of Narcotics

- Narcotics drugs should be disposed in supervision of a pharmacist or the police, and public should not be allowed to prevent abuse .

Documentation of purchase and Inventory

- Documentation means to write every purchase, inventory retuned products .

Inventory Control

- Inventory Control is designed to support the requisition processing, inventory management, purchasing, and physical inventory reconciliation functions of inventory management through a set of highly interactive capabilities.
- **The design of Inventory Control is based on the following….**
  - To facilitate timely requisition processing
  - To automatically record and service backorders
  - To help minimize inventory investments consistent with service objectives by basing purchasing decisions on usage history
  - To provide automated tools to assist servicing, purchasing, and management of the inventory
  - To improve financial control of the inventory by chargebacks to the user organizations
  - To improve financial control of the inventory by periodic reconciliation of the inventory balances with the physical counts.

Documents for Inventory Control:

Inventory Control includes the following documents

- Stock Requisition (SR)
- Pick and Issue (PI)
- Issue Confirmation (CI)
- Over the Counter (OC)
- Stock Return (SN)
- Inventory Adjustment (IA)
- Physical Inventory Purchase Input (IP)
- Stock Transfer Issue (TI)

Stock Requisition (SR)

- Reserves quantities of stock items from an on-hand supply for later delivery.
- This reduces the available quantity.
- If items are not immediately available, they may be backordered and later filled by having the Backorder Servicing program run.

Pick and Issue (PI)

- Schedules previously reserved items to be picked up for delivery and releases them from a reserved status. This function is performed by creating a Pick Ticket Report (IN80).
- From this report, the warehouse can determine the stock item, the quantity, and the bin number of the items that are to be picked up.
- It also creates the corresponding Issue Confirmation (CI) document.

Stock Issue Confirmation (CI)

- Confirms to the system that previously reserved and released items have been issued from the warehouse to the buyer.
- The on-hand quantity of the warehouse for this item is reduced by the amount issued.

Over the Counter (OC)

- Issues requested items directly from the on-hand quantity. As the items are issued immediately upon request, in effect, "over-the-counter," backordering is not allowed.
- Once an "Over the Counter" transaction is successfully completed, an Over the Counter Issued Report will be produced, identifying the requestor and the stock items issued.

Stock Return (SN)

- Allows the original buyer to return previously issued items. At the option of the issuing warehouse, a return charge may be imposed.

Inventory Adjustment (IA)

- Allows warehouse management to adjust quantities or unit values of on-hand items due to a change in on-hand quantities or unit costs.
- These adjustments alter inventory and cost of goods expense balances.

Physical Inventory Purchase Input (IP)

- Allows warehouse management to adjust quantities of on-hand items due to a change in on-hand quantities at a specified unit costs.
- These adjustments alter inventory and cost of goods expense balances.

Stock Transfer Issue (TI)

- Initiates the transfer of items from one warehouse to another.

Stock Transfer Receipt (TR)

- Recognizes the receipt of transfer items by the receiving warehouse. On-hand quantities of receiving/issuing warehouses are adjusted.

Chapter-4

Drug distribution

- **Drug distribution (in- patients and out - patients) – Definition, advantages and disadvantages of individual prescription order method, Floor Stock Method, Unit Dose Drug Distribution Method, Drug Basket Method.**
- **Distribution of drugs to ICCU/ICU/NICU/Emergency wards.**
- **Automated drug dispensing systems and devices**
- **Distribution of Narcotic and Psychotropic substances and their storage**

Drug distribution:

Drug distribution is defined as, "Physical transfer of drugs from storage area in the hospital to the patient's bedside". This involves two types of drug distribution.

They are: -

1. In-patient distribution
2. Out-patient distribution

Inpatient distribution:

- The drug distribution to the in-patient department can be carried out from the Out-patient dispensing area.
- The pharmacists involved in dispensing the drugs for Out-patient can dispense drugs for in patients too.
- The pharmacist employed for drug distribution to the In-patient wards should be well skilled and qualified staff.

This can be done through a number of different methods, including:

1. Unit-dose dispensing: This involves providing each patient with individually packaged doses of medication, which are labeled with the patient's name and the medication's name and dosage. This helps to prevent medication errors and ensures that patients receive the correct medication at the correct time.

2. Ward stock: This involves storing medication on the patient's ward, rather than in a central pharmacy. Nurses or other healthcare professionals can then access the medication as needed.

3. Automated dispensing cabinets: These are computerized cabinets that store medication and dispense it automatically when authorized healthcare professionals enter their credentials.

Out-patient drug distribution:

Out-patient drug distribution involves providing medication to patients who are not currently admitted to a healthcare facility.

This can include patients who are receiving treatment at a clinic, doctor's office, or other outpatient facility, as well as patients who are managing their own medication at home. Out-patient drug distribution methods can include:

1. Retail pharmacies: Patients can obtain their medication from a retail pharmacy, either in-person or through mail order.
2. Specialty pharmacies: These pharmacies specialize in providing medication for patients with complex medical conditions, such as cancer or HIV.
3. Mail-order pharmacies: Patients can order their medication online or over the phone and have it delivered to their home.

Advantages of individual prescription order method

The individual prescription order method is a drug distribution method that involves providing each patient with individually packaged doses of medication, which are labeled with the patient's name and the medication's name and dosage. Here are some advantages of this method:

1. Reduces medication errors: With individual prescription order method, the chances of medication errors are significantly reduced since the medication is packaged and labeled specifically for the individual patient. This helps to ensure that patients receive the correct medication at the correct time, which can improve patient safety and outcomes.
2. Convenient for patients: Individual prescription order method is convenient for patients as they do not have to worry about remembering to take multiple pills at different times throughout the day. The medication is packaged in a way that is easy to take and can be taken on-the-go.
3. Helps with medication adherence: This method can improve medication adherence as patients are more likely to take their medication as prescribed when it is packaged and labeled specifically for them. This can help to improve health outcomes and reduce hospitalizations and readmissions.

4. Reduces waste: With individual prescription order method, there is less medication waste since the medication is dispensed in the exact amount needed for each patient. This can help to reduce the overall cost of medication and minimize the impact on the environment.

Disadvantages of individual prescription order method

1. Cost: This method can be more expensive than other methods of drug distribution, such as ward stock or unit-dose dispensing. The packaging and labeling process for each individual dose can be time-consuming and costly.

2. Time-consuming: The process of packaging and labeling each individual dose can be time-consuming for healthcare professionals. This can take away from other important tasks, such as patient care and medication management.

3. Limited flexibility: Individual prescription order method may not be suitable for all medications or patient populations. Some medications, such as those that require refrigeration, may not be suitable for this method. Additionally, patients who require frequent dosage adjustments may find this method limiting.

4. Storage requirements: With individual prescription order method, there is a need for additional storage space to accommodate the packaged medication. This can be a challenge in healthcare facilities where space is at a premium.

5. Environmental impact: The packaging and labeling materials used in individual prescription order method can have an impact on the environment. This method may generate more waste than other methods of drug distribution.

Floor Stock Method:

- The floor stock method is a method of inventory management that involves keeping a certain quantity of inventory items on hand at all times to meet customer demand. This method is commonly used in retail stores, particularly those that sell fast-moving consumer goods.
- Under the floor stock method, the retailer keeps a certain quantity of each product on the store shelves or sales floor. When a customer purchases an item, the retailer notes the sale and removes the item from inventory.
- As inventory levels approach a predetermined minimum threshold, the retailer orders more of the product to replenish the floor stock.

Unit Dose Drug Distribution Method:

Unit dose drug distribution is a method of dispensing medications in individual, pre-measured doses, typically packaged in single-use containers, such as blister packs or pouches. This system aims to ensure the safe and accurate delivery of medication to patients and reduce the risk of medication errors.

In a unit dose system, medications are prepared by a pharmacist or pharmacy technician and packaged in a way that each dose is clearly labeled with the patient's name, medication name, dosage strength, and administration instructions. This system can be used in hospitals, long-term care facilities, and outpatient settings.

Some advantages of the unit dose drug distribution method include:

- Accuracy: Each dose is individually measured and labeled, reducing the risk of medication errors, including wrong doses, wrong medications, and incorrect administration routes.
- Convenience: The system can be designed to allow for easy administration of medications, particularly in busy settings where time is of the essence.
- Cost-effectiveness: By reducing medication errors and minimizing waste, the system can result in cost savings for both patients and healthcare organizations.
- Improved patient safety: The unit dose system can help to reduce the risk of adverse drug events, which can be particularly dangerous for vulnerable populations, such as the elderly or those with complex medical conditions.

Disadvantage:

- Increased packaging waste: The use of individual packaging for each dose can result in more packaging waste than other drug distribution methods, which can be a concern for environmental sustainability.
- Equipment and personnel requirements: Preparing and dispensing medications using the unit dose system requires specialized equipment and trained personnel, which can increase costs and staffing requirements for healthcare organizations.
- Limited flexibility: The unit dose system may not be suitable for all medications, particularly those that require specialized handling or storage conditions, which can limit its flexibility in some settings.
- Potential for medication errors: Although the unit dose system aims to reduce the risk of medication errors, there is still the potential for mistakes to occur during the preparation or administration of medications, particularly if proper protocols and quality control measures are not in place.

Drug Basket Method:

- The drug basket method is a type of clinical trial design in which a group of patients receives a combination of different drugs, also known as a "drug basket," for the treatment of a specific disease.
- **The goal of this method is to evaluate the safety and effectiveness of the combination of drugs in treating the disease, as well as to identify any potential drug interactions or side effects.**
- In this method, patients are selected based on their specific disease and are given a combination of drugs that are believed to have potential therapeutic benefits. The drugs in the basket may be chosen based on their known or hypothesized mechanisms of action, or they may be selected based on their effectiveness in treating similar diseases.
- The drug basket method is typically used in the early stages of clinical trials, when little is known about the efficacy of the combination of drugs being tested. The results of these trials can be used to guide the development of more targeted therapies and to inform future clinical trials.

Advantage:

1. Efficiency: The drug basket method allows for the simultaneous testing of multiple drugs in combination, which can be more efficient than testing each drug individually. This can speed up the drug development process and reduce costs.
2. Enhanced efficacy: Combination therapies have been shown to be more effective in treating some diseases than single drugs alone. By testing multiple drugs in combination, the drug basket method can potentially identify more effective treatments.
3. Targeting multiple pathways: The drug basket method can test drugs that target different pathways or mechanisms of action, which can be important in diseases with complex or multifactorial causes.
4. Personalization: The drug basket method can be used to identify which drugs or drug combinations work best for specific patient populations, which can help tailor treatments to individual patients.
5. Versatility: The drug basket method can be used to test a wide range of drugs and drug combinations, making it a versatile approach to drug development and clinical research.

Disadvantage:

1. Complexity: The drug basket method can be more complex than testing single drugs, as it requires careful selection and dosing of multiple drugs in combination. This complexity can increase the risk of drug interactions and side effects, as well as make it more difficult to interpret study results.
2. Limited knowledge: The drug basket method is typically used in the early stages of drug development, when little is known about the efficacy and safety of the drugs being tested in combination. This can make it challenging to select the optimal drugs and dosages to include in the basket.

3. Cost: Testing multiple drugs in combination can be more expensive than testing single drugs, as it requires more resources and coordination.
4. Interpretation of results: The interpretation of study results can be more complex with the drug basket method, as it may be difficult to determine which drugs or drug combinations are responsible for any observed effects.
5. Ethics: The use of combination therapies in clinical trials can raise ethical concerns, as patients may be exposed to more potential risks and uncertainties.

Distribution of drugs to ICCU/ICU/NICU/Emergency wards.

Distribution of drugs to ICCU:

ICCU: The intensive Coronary care unit (ICCU) is a unit dedicated to the treatment of heart condition such as coronary heart disease, heart attack, cardiac arrest and heart failure Critical care.

ICU: Intensive care unit, life support are provided in an intensive care Unit for Critically ill Patients.

NICU: Neonatal Intensive care Unit , also known as an intensive care nursery, is a unit specializing in care of ill or Premature new born infants.

The first 28 days of life are referred to as neonatal.

Emergency Ward:

- Also known as an accident and emergency department, emergency room or causality department.
- It is a medical treatment facility specializing emergency medicine, the acute care of patient present without prior appointment, either by own means or ambulance.

Intensive Coronary Care Unit:

- Coronary care unit arose in the 1960s as it became obvious that constant supervision by highly trained personnel , cardiopulmonary resuscitation, and medical intervention may minimize death from cardiovascular disease Complication.
- Patient who are critically unwell are admitted to the ICCU.
- The availability of telemetry or continuous cardiographic monitoring of the heart rhythm, is a key element of coronary treatment.
- Patient with myocardial infarction or unstable angina are commonly admitted to the coronary care Unit.
- Myocardial infarction is the most common morbidity discovered.

- The majority of the medications prescribed were from the WHO'S essential drug list.
- Tablet aspirin is the most commonly prescribed medicine.
- Promethazine, Heparin, hydrocortisone, buprenorphine , streptokinase ,metaprolol, pentazocine and frusemide are among the most commonly utilized injections.
- Antibiotics are used less frequently.

Intensive Care Unit (ICU)

The following is a list of the eight most commonly utilized medications in emergency situations:

- Adenosine
- Amiodarone
- Atropine
- Epinephrine
- Lidocaine
- Procainamide
- Sotalol
- Vasopressin

Neonatal Intensive care Unit (NICU)

- Organ immaturity, congenital disease, or birth related problems are the most common reasons that neonates brought to the NICU.
- They monitor medication dosage and levels.
- They keep the team informed about any potential adverse effects and any addition monitoring that may be required.
- Exposure to potential drug interaction (DDI) is a significant risk related with ADE occurrence in the NICU.
- Medication most commonly administered include: ampicillin, furosemide, dopamine, azithromycin, sildenafil, ibuprofen and fluconazole.

Emergency word:

- Error can occur if a physician prescribes the incorrect medication.
- If the prescription intended by the doctor is not the one communicated to the pharmacy due to an illegally written prescription or a misheard verbal order, if the pharmacy dispenses the incorrect medication or given to the incorrect person.
- One of the ways to overcome this situation was to use emergency trolleys used or missing items on the emergency trolleys as efficient as possible.

- All wards are always fulfilled with emergency medications such as adrenalin, salbutamol, atropine, furosemide, hydrocortisone, insulin, lidocaine, and medical oxygen.

Automated drug dispensing systems and devices:

Automated drug dispensing systems and devices are computerized systems that can accurately dispense medications to patients. These systems can be found in hospitals, pharmacies, and other healthcare facilities.

There are several types of automated drug dispensing systems and devices, including:

1. Robotic dispensing systems: These systems use robots to dispense medications. They can be programmed to dispense a specific dose of a medication, and can handle multiple medications at once.
2. Bar code scanning systems: These systems use bar code technology to ensure that the correct medication is dispensed to the right patient. The bar code on the patient's wristband is scanned, and then the medication is scanned to ensure that it matches the medication prescribed for the patient.
3. Automated medication cabinets: These systems are similar to vending machines and are often used in hospitals. The medications are stored in individual drawers, and the system dispenses the medication based on a prescription order.
4. Pharmacy dispensing systems: These systems are used in pharmacies to fill prescriptions. The system can accurately count and dispense pills, and can also label and package the medications.

Distribution of Narcotic and Psychotropic substances and their storage:

Narcotic Drugs and Psychotropic Substances have several medical and scientific uses. However, they can be and are also abused and trafficked. India's approach towards Narcotic Drugs and Psychotropic Substances is enshrined in Article 47 of the Constitution of India which mandates that the 'State shall endeavour to bring about prohibition of the consumption except for medicinal purposes of intoxicating drinks and of drugs which are injurious to health'

Purpose:

To provide guidelines governing adequate control for procurement, proper storage, dispensing and record keeping of Narcotic and Psychotropic Drugs in Hospital.

Scope:

All the important activities related to the procurement, storage, dispensing and record keeping of Narcotic and Psychotropic Drugs in accordance with the Delhi Narcotic Drug Rules, 1985 as well as Drugs and Cosmetics Act, 1940 and Rules framed there under.

Definition:

a) Narcotic Drugs are the addictive drugs that reduce the user's perception of pain and induce euphoria (a feeling of exaggerated and unrealistic well-being). They are substances that lead to increasing tolerance and physiological dependence. They have a potential for abuse and/or addiction.
b) Psychotropic Drugs - Any drug capable of affecting the mind, emotions, and behavior.

Storage:

The Narcotic and Psychotropic Drugs must be stored under lock and key in a separate cupboard.

- Strict compliance of statutory requirements must be adhered to as provided under the Narcotic
- Drugs Rules, 1985, Drugs & Cosmetics Act, 1940, Drugs & Cosmetics Rules, 1945 and Pharmacy Act, 1948.
- Narcotic drugs and psychotropic substances must only be dispensed by a pharmacist against a proper prescription of a doctor authorized for the purpose.
- Narcotic drugs and psychotropic substances must be procured and stored in such a manner so as to preclude their falling into the hands of unauthorized persons.
- The storage area for the narcotic drugs and psychotropic substances may be opened and accessed by specific Pharmacist in-charge and Nursing Sister in-charge of respective department.
- Cupboard or safe in which narcotic drugs and psychotropic substances are stored may be opened and accessed only when substances belonging to these categories are being placed into or taken out from the cupboard or room.
- Pharmacist in-charge must check physically at least once daily the stock of narcotic and psychotropic drugs stored. The same must be recorded in stock register and verified by the officer in-charge with signature and date.
- The prescribing practitioner shall be responsible in case the prescription does not conform to statutory regulations. Nursing station shall ensure the entry of batch number in the prescription form while administering.
- Appropriate registers shall be maintained to have information on usage. A proper record of their uses, administration and disposal shall be maintained at all the places wherever narcotic drugs are stored. The narcotic drugs register must incorporate a record of all receipt and issue involving narcotic drugs. The narcotic drugs register must be a bound register with consecutively numbered pages. A separate page must be used for each narcotic drug.
- Pharmacist shall be notified if any medicines or register is missing.

Chapter-5

Compounding in Hospitals

Compounding in Hospitals: Bulk compounding, IV admixture services and incompatibilities, Total parenteral nutrition

Compounding in Hospitals:

- Compounding in hospitals refers to the process of preparing and mixing medications in a controlled environment, such as a pharmacy.
- This can include creating new formulations of medications, adjusting the strength of medications, or combining multiple medications into a single dose.
- Pharmaceutical/hospital compounding require because of the-
  - Limited number of dosage forms.
  - Limited number of drug strengths.
  - Shortages of stability of the drug products and combination.
  - New therapeutic approaches.
  - Due to changes in environmental/patient's conditions.
- Compounding is typically done under the supervision of a licensed pharmacist and must adhere to strict guidelines to ensure the safety and effectiveness of the compounded medications.
- The goal of compounding is to provide personalized and unique medication options for patients that cannot be obtained through commercially available products.
- Due to the compounding, we make the suitable doses and formulation according to the patient/disease conditions.
- Now a days, compounding is very easy because many combinations drugs are already present in the market.

Ideal requirement for the compounding

For compounding the medicine first of all aseptic area, room temperature and necessary equipment's like-

- Compounding platform.
- Lab coat and gloves.
- Sterile equipment's like mortar and pestle.
- Sterile container and closers.
- Packing material etc.

Bulk compounding:

- Involves the preparation of large quantities of a medication for use in the hospital.
- This can include creating new formulations of medications, adjusting the strength of medications, or combining multiple medications into a single dose.
- This is usually done in a controlled environment such as a hospital pharmacy, under the supervision of a licensed pharmacist.
- The goal is to provide a consistent and cost-effective supply of medications for patients.
- **Examples of bulk compounding** include creating a batch of an ointment for wound care or preparing a large quantity of an IV solution for a specific unit of the hospital.

IV admixture services:

- Involves the preparation of medications for intravenous administration.
- This includes mixing different medications into a single solution, which is known as an IV admixture.
- IV admixtures are typically prepared by a pharmacist and administered by a nurse or other healthcare professional.
- The goal of IV admixture services is to provide patients with a convenient and efficient way to receive multiple medications at once.
- Examples of IV admixture services include preparing a solution of antibiotics and pain medication for post-surgery patients or a solution of anticoagulant and electrolytes for critical care patients.

IV fluids commonly used for IV admixtures

Injection	Concentration	pH	Therapeutic use
Dextrose	2.5%-50%	3.5-6.5	Nu trient replenisher
Dextrose/Na Cl	5%-20%	3.5-6.5	Nu trient replenisher
Lactated Ringer's solution	0.5%	6-7.5	Systemic alkalizer/electrolyte replenisher
Sodium chloride	045%,09%,2%,5%	4.5-7	Nutrient replenisher

IV fluids are commonly used for number of clinical conditions

- Correction of disturbances in electrolyte balance
- Correction of disturbances in body fluids
- Provides basic nutrition
- As a vehicle for other drug substances
- Provide total parenteral nutrition

Incompatibilities:

- Refers to situations where certain medications cannot be mixed together due to chemical reactions that could potentially harm the patient.
- Medications can be incompatible due to chemical reactions such as precipitation, oxidation, or neutralization.
- It is important to identify and avoid these incompatibilities to ensure the safety and effectiveness of the medication.
- Examples of incompatibilities include mixing an aminoglycoside antibiotic with a beta-lactam antibiotic, as it may cause inactivation of the aminoglycoside or mixing a calcium-containing solution with a phosphate-containing solution which could lead to the formation of an insoluble salt.

Total parenteral nutrition (TPN):

- A method of providing nutrients to a patient through intravenous means, rather than through the gastrointestinal tract.
- It is typically administered under the supervision of a healthcare professional and requires careful monitoring to ensure that the patient is receiving the appropriate balance of nutrients.
- Examples of patients who may receive TPN include critically ill patients, burn victims, or patients recovering from surgery.

Total parenteral nutrition (TPN) is a method of delivering nutrients directly into the bloodstream via a vein. It is used when a patient is unable to consume food or absorb nutrients through the gastrointestinal tract due to a medical condition or surgical procedure. TPN solutions are typically made up of a combination of glucose, amino acids, lipids, vitamins, and minerals.

Indications for TPN include:

- Short bowel syndrome
- Malabsorption

- Severe injuries or burns
- Cancer
- Trauma
- Intestinal surgery
- Inflammatory bowel disease

TPN is usually administered through a central venous catheter, which is inserted into a vein in the neck, chest, or arm. The catheter is then threaded through the vein to the superior vena cava, which is the large vein that carries blood back to the heart. This allows the TPN solution to bypass the gastrointestinal tract and go directly into the bloodstream.

Risks and complications of TPN include:

- Blood clots
- Infection
- Inflammation of the vein
- Liver dysfunction
- Metabolic imbalances
- Blood sugar fluctuations
- Weight gain

TPN is typically administered under the supervision of a healthcare provider, such as a dietitian or nurse. Blood tests are regularly done to monitor electrolyte, glucose, and lipid levels, to ensure that the patient is receiving the appropriate balance of nutrients.

Overall TPN is a complex procedure that requires close monitoring, and should only be administered under the supervision of trained healthcare professionals. It can be life-saving for patients with certain medical conditions, but also carries significant risks and complications.

Chapter-6

Radio Pharmaceuticals - Storage, dispensing and disposal of radiopharmaceuticals

Radio Pharmaceuticals:

- Radio pharmaceuticals, also known as radiopharmaceuticals, are drugs that contain radioactive isotopes. These isotopes emit radiation, which allows them to be used in medical imaging and therapy.
- They are used to diagnose and treat a variety of conditions, such as cancer, thyroid disorders, and blood flow problems.
- They can be administered by injection, orally or inhalation.

Storage of Radio Pharmaceuticals:

- Radio pharmaceuticals should be stored in a secure, designated area that is separated from other drugs and medical equipment. The storage area should be well-ventilated, with a low level of background radiation.
- The storage area should also have limited access, and be clearly labeled to indicate the presence of radioactive materials.
- The temperature and humidity of the storage area should be carefully controlled to ensure the stability of the radio pharmaceuticals.
- It's recommended to store them in a refrigerator or freezer, depending on the specific requirements of the drug.
- It's also important to maintain accurate records of the storage, use and disposal of radiopharmaceuticals, and to ensure that they are handled and disposed of properly to minimize the risk of exposure to radiation.
- Additionally, the storage area should be equipped with radiation detection and alarm systems, as well as emergency response protocols in case of a spill or other accident.

Dispensing and disposal of radiopharmaceuticals:

The dispensing of radiopharmaceuticals is an important step in their use in medical imaging and therapy. The following are some key points to consider when dispensing radiopharmaceuticals:

- Verify the patient's identity to ensure that the correct drug and dosage is being given to the correct patient.
- Handle and administer radiopharmaceuticals using appropriate protective equipment, such as gloves, gowns, and shields, to minimize the risk of exposure to radiation.
- Follow the manufacturer's instructions and any applicable regulations for the storage, handling, and administration of the radiopharmaceuticals.
- Monitor the patient's condition and response to the radiopharmaceuticals, and report any adverse reactions promptly.
- Dispose of any unused or expired radiopharmaceuticals in accordance with regulations and guidelines.

Overall, the proper dispensing of radiopharmaceuticals is crucial to ensure the safety of patients and healthcare workers, and to ensure accurate and effective imaging and therapy.

Disposal of radiopharmaceuticals:

Disposal of radiopharmaceuticals is an important aspect of their use in medical imaging and therapy. The following are some key points to consider when disposing of radiopharmaceuticals:

- Disposal should be done in accordance with local, state, and federal regulations, as well as guidelines from professional organizations.
- Any remaining radiopharmaceuticals should be properly disposed of in accordance with regulations. This may involve returning the unused portion to the supplier or disposing of it in a licensed radioactive waste disposal facility.
- Patient's urine, feces, and other bodily fluids that may contain traces of radiopharmaceuticals should also be handled and disposed of properly.
- Equipment that has come into contact with radiopharmaceuticals should be properly decommissioned and decontaminated before it can be used again.
- It's important to keep accurate records of the disposal of radiopharmaceuticals, including the amount and type of material disposed of, the date, and the method of disposal.
- It's also important to ensure that proper protective equipment is worn and safety procedures are followed when handling and disposing of radiopharmaceuticals to minimize the risk of exposure to radiation.

Overall, the proper disposal of radiopharmaceuticals is crucial to ensure the safety of patients and healthcare workers, and to comply with regulations and guidelines.

Chapter-7

Application of computers in Hospital Pharmacy Practice, Electronic health records, Software's used in hospital pharmacy

Application of computers in Hospital Pharmacy Practice:

Computer plays an important role in development of clinical pharmacy practice and basic pharmacy research. The use of computer in hospital administration and medical research become the need of large hospitals

- Hospital pharmacy is the health care service, which comprises the art, practice, and profession of choosing, preparing, storing, compounding, and dispensing medicines and medical devices, advising healthcare professionals and patients on their safe, effective and efficient use.
- The computer has become a very common tool in all the areas of science and technology.
- The field of pharmacy has immensely benefitted by the use of computers and will continue to do so.
- The complete field of pharmacy requires computers.

Computers have transformed the healthcare industry, including hospital pharmacy practice. Here are some ways in which computers are used in hospital pharmacy practice:

1. Medication Management: Computerized systems are used to manage medication administration, prescription orders, and inventory control. This system can track medication usage, monitor medication errors, and streamline medication distribution.

2. Clinical Decision Support: Pharmacists use computer-based tools to help make clinical decisions regarding drug therapy. These tools provide access to patient records, drug interactions, and patient-specific information.

3. Electronic Medical Records: Electronic medical records (EMRs) allow pharmacists to access patient records, including medical history, medications, allergies, and laboratory results. EMRs allow pharmacists to quickly access and review patient information, which can help to identify drug interactions and ensure appropriate medication use.

4. Barcode Technology: Barcoding technology is used to track medication usage and prevent medication errors. Barcodes can be scanned to verify the correct medication, dose, and administration route.

5. Telepharmacy: Telepharmacy involves the use of technology to remotely manage pharmacy operations. This technology can be used to remotely verify prescriptions, manage medication orders, and provide medication counseling to patients.

6. Drug Information Databases: Computer-based drug information databases provide pharmacists with access to the latest drug information, including dosage guidelines, side effects, and interactions.

Electronic health records:

Electronic health records (EHRs) are digital versions of patients' medical records that are stored and managed electronically. Here are some important notes on EHRs:

- Benefits: EHRs have several benefits, including improved patient safety, increased efficiency and accuracy in record-keeping, improved communication between healthcare providers, and better coordination of care.
- Information included: EHRs contain a patient's medical history, medications, allergies, laboratory test results, imaging studies, and other relevant medical information. This information is accessible to authorized healthcare providers, which can help to ensure that patients receive appropriate care.
- Privacy and security: EHRs must comply with strict privacy and security regulations to protect patient information. Healthcare providers must take steps to ensure that EHRs are secure and that patient information is not accessed or shared without proper authorization.
- Interoperability: Interoperability is the ability of different EHR systems to exchange information with one another. Interoperability is important because it allows healthcare providers to access and share patient information across different healthcare settings.
- Patient access: Patients have the right to access their EHRs and review their medical information. This can help patients to better understand their health conditions, medications, and treatments.
- Challenges: EHRs have also posed several challenges, including the high cost of implementation, the need for staff training and support, and potential technical issues that can lead to errors or downtime.

Software's used in hospital pharmacy:

Hospital pharmacies rely on several software programs to manage their operations efficiently. Here are some of the software programs used in hospital pharmacy:

1. Pharmacy Information Systems (PIS): Pharmacy Information Systems (PIS) are used to manage medication orders, medication dispensing, and inventory control. PIS can track medication usage, monitor medication errors, and streamline medication distribution.

2. Electronic Health Records (EHR): Electronic Health Records (EHR) are digital versions of patients' medical records that include medication history, allergies, laboratory results, and other relevant medical information. EHRs can improve medication safety by providing healthcare providers with accurate and up-to-date information about patients' medications.

3. Clinical Decision Support Systems (CDSS): Clinical Decision Support Systems (CDSS) provide healthcare providers with patient-specific information, including drug interactions, contraindications, and dosage guidelines. CDSS can help healthcare providers make informed decisions about medication therapy.

4. Barcode Medication Administration (BCMA): Barcode Medication Administration (BCMA) is used to track medication administration and prevent medication errors. BCMA uses barcode scanning technology to verify the correct medication, dose, and administration route.

5. Automated Dispensing Cabinets (ADC): Automated Dispensing Cabinets (ADC) are used to store and manage medication inventory in hospital pharmacies. ADC can help to reduce medication errors, improve medication tracking, and increase efficiency in medication dispensing.

6. Inventory Management Systems: Inventory Management Systems are used to track medication inventory levels, expiration dates, and reorder points. These systems can help to ensure that the pharmacy has the necessary medications on hand to meet patient needs.

Chapter-8

Clinical Pharmacy

Clinical Pharmacy: Definition, scope and development - in India and other countries, Technical definitions, common terminologies used in clinical settings and their significance such as Paediatrics, Geriatric, Antenatal Care, Post-natal Care, etc.

Daily activities of clinical pharmacists: Definition, goal and procedure of

- Ward round participation
- Treatment Chart Review
- Adverse drug reaction monitoring
- Drug information and poisons information
- Medication history
- Patient counselling
- Interprofessional collaboration

Pharmaceutical care: Definition, classification of drug related problems. Principles and procedure to provide pharmaceutical care Medication Therapy Management, Home Medication Review

Clinical Pharmacy:

- Clinical pharmacy is a branch of pharmacy that provides patient care by optimizing the medication therapy and promoting health, wellness, and disease prevention by means of pharmaceutical care.
- Clinical pharmacy is a health science discipline in which pharmacists provide patient care that optimizes medication therapy and promotes health, and disease prevention.
- Pharmaceutical care comprises of responsible provision of drug therapy for the purpose of achieving positive outcomes that improve a patient's quality of life.

Scope of clinical pharmacy in India:

- In hospitals the services regarding clinical pharmacy are of considerable value because the concerned clinical pharmacist serves as a guide to the physician for safe and rational use of drugs.
- He also assists to achieve economy in the hospital by planning safe drug policies, suggestive means of reduction of waste, by preventing misuse or pilferage of drugs.
- In addition to it the preparation of preventing forecasting future drug requirements of the hospital, based upon their drug utilization patterns.
- Clinical pharmacist enables rational drug use by providing correct drug information including the proper utilization of the drugs utilized as drug therapy, along with all the precautions to be taken as indicated or asked by the pharmacist or the physician.
- Clinical pharmacists practicing in the hospitals and the community pharmacies may obtain medication histories, counsel patients, review treatment regimens, monitor drug therapy, give drug information, report ADRs, conduct drug-use evaluations, and provide poison control services

Scope in Other Countries:

1. **United States:** Clinical pharmacy is a well-established practice in the United States, and clinical pharmacists are recognized as essential members of the healthcare team. Clinical pharmacists work in a variety of settings, including hospitals, clinics, and community pharmacies. They are involved in patient care and collaborate with other healthcare professionals to optimize medication therapy.

2. **Canada:** Clinical pharmacy is also well established in Canada, and clinical pharmacists play a vital role in patient care. Clinical pharmacists work in hospitals, community pharmacies, and other healthcare settings, and they are involved in medication management, drug therapy monitoring, and patient counseling.

3. **United Kingdom:** In the United Kingdom, clinical pharmacy is an emerging field, and clinical pharmacists work in hospitals and primary care settings. Clinical pharmacists are involved in medication management, drug therapy monitoring, and patient counseling.

4. **Australia:** Clinical pharmacy is a recognized specialty in Australia, and clinical pharmacists work in hospitals, clinics, and community pharmacies. Clinical pharmacists are involved in medication management, drug therapy monitoring, and patient counseling.

Clinical pharmacy in developing countries:

- The pharmacy practice models significantly vary based on implementation of clinical pharmacy and practice.
- The profession is more industry oriented rather than patient oriented and the role of clinical pharmacist is still unclear among the healthcare professionals and community.
- Looking from the perspective of African countries like Ethiopia, there seems to be an acute shortage of pharmacists.
- Only 1088 pharmacists are serving 80 million people which is equal to 0.14/10,000 people. In 2007, the number of licensed pharmacies were 463, consisting of 143 hospital pharmacies, and 320 community pharmacies.

Technical definitions:

Clinical pharmacy is a specialized field within pharmacy that focuses on the application of pharmacotherapy and the provision of patient-centered care.

Technical definitions in clinical pharmacy may include:

1. **Clinical pharmacy:** A specialized field of pharmacy that focuses on the application of pharmaceutical knowledge, skills, and abilities to optimize patient outcomes. Clinical pharmacists work collaboratively with healthcare providers to ensure the safe and effective use of medication therapy.

2. **Medication therapy management (MTM):** A comprehensive approach to optimizing medication use that involves assessing the patient's medication regimen, identifying any medication-related problems, and developing a plan to resolve them. MTM is typically provided by clinical pharmacists.

3. **Pharmacotherapy:** The use of medications to treat and manage disease. Pharmacotherapy involves selecting the appropriate medication, dosing it correctly, monitoring its effects, and adjusting therapy as needed to achieve therapeutic goals.

4. **Drug interaction:** The effect that one medication has on another medication when they are taken together. Drug interactions can be beneficial (such as when two medications work together to enhance their therapeutic effects) or harmful (such as when two medications interact to cause side effects or reduce the effectiveness of one or both drugs).

5. **Adverse drug event (ADE):** Any harm that occurs as a result of medication use, including medication errors, side effects, allergic reactions, and other adverse reactions. Clinical pharmacists play a key role in preventing and managing ADEs.

6. **Pharmacokinetics:** The study of how medications are absorbed, distributed, metabolized, and excreted by the body. Pharmacokinetics plays an important role in determining the appropriate dose and dosing regimen for a medication.

7. **Pharmacodynamics:** The study of how medications produce their therapeutic effects. Pharmacodynamics involves understanding the mechanisms of action of medications and how they interact with the body's physiological processes.

8. **Therapeutic drug monitoring (TDM):** The measurement of medication concentrations in the blood to ensure that they are within a safe and effective range. TDM is commonly used for medications that have a narrow therapeutic index (i.e., a small difference between the therapeutic and toxic doses).

9. Clinical decision support (CDS): Computerized tools and systems that provide healthcare providers with information and recommendations to support clinical decision-making. CDS is increasingly used in clinical pharmacy practice to improve medication safety and optimize patient outcomes.

10. **Formulary management:** The process of selecting, evaluating, and managing medications that are included on a healthcare organization's formulary (i.e., the list of medications that are approved for use). Formulary management is an important aspect of clinical pharmacy practice, as it helps to ensure that patients have access to safe, effective, and affordable medications.

Pediatrics:

- Pediatrics is the branch of medicine dealing with the health and medical care of infants, children, and adolescents from birth up to the age of 18.
- The word “paediatrics” means “healer of children”; they are derived from two Greek words: (pais = child) and (iatros = doctor or healer).

Common terminologies used in clinical settings and their significance such as Pediatrics

There are many terminologies used in clinical settings, including those specific to Pediatrics. Here are some of the most common terminologies used in Pediatric clinical settings and their significance:

1. **Growth charts:** These are charts that are used to track a child's growth and development over time. They are used to assess a child's weight, height, and head circumference, and to compare these measurements to those of other children of the same age and gender.

2. **Vaccines:** These are substances that are given to children to help protect them against various infectious diseases. Vaccines work by stimulating the body's immune system to produce antibodies that can fight off the disease.

3. **Developmental milestones:** These are specific skills or behaviors that most children achieve by a certain age. Examples of developmental milestones include crawling, walking, and speaking.

4. **Pediatric dosing:** This refers to the amount of medication that should be given to a child based on their age, weight, and other factors. Pediatric dosing is different from adult dosing and is designed to ensure that children receive the appropriate amount of medication for their size and age.

5. **Respiratory distress:** This is a medical emergency that occurs when a child is having difficulty breathing. It can be caused by a variety of conditions, including asthma, pneumonia, and bronchiolitis.

6. **Failure to thrive:** This is a term used to describe a child who is not growing and developing as expected. It can be caused by a variety of factors, including malnutrition, gastrointestinal problems, and developmental delays.

7. **Neonatal intensive care unit (NICU):** This is a specialized unit within a hospital that provides care for premature or critically ill newborns. The NICU is equipped with advanced medical technology and staffed by specially trained healthcare professionals.

Geriatric:

- Geriatrics is the medical specialty dedicated exclusively to providing high-quality, patient-centered care for older adults.
- Older adults have a unique set of issues and concerns which geriatric clinicians are trained to focus upon.
- Illnesses, diseases, and medications may affect older people differently than younger adults, and older patients may have overlapping health problems that require multiple medications.

Common terminologies used in clinical settings Geriatric:

- For older patients, developing a relationship with a pharmacist and using one pharmacy can help ensure consistency in care.
- A pharmacist can help prevent drug-related problems, which are a particular risk for older adults.
- For older patients, pharmacists are sometimes the most accessible health care practitioner. In addition to dispensing drugs, pharmacists provide drug information to patients and providers, monitor drug use (including adherence), and liaise between physicians or other health care practitioners and patients to ensure optimal pharmaceutical care.

- Pharmacists also provide information about interactions between drugs and other substances, including over-the-counter drugs, dietary supplements (eg, medicinal herbs), and foods.

Significance:

Pharmacists can help improve patient adherence by doing the following:

- Assessing the patient's ability to adhere to a drug regimen by noticing certain impairments (eg, poor dexterity, lack of hand strength, cognitive impairment, loss of vision)
- Teaching patients how to take certain drugs (eg, inhalers, transdermal patches, injectable drugs, eye or ear drops) or how to measure doses of liquid drugs
- Supplying drugs in ways that are accessible to patients (eg, easy-open bottles, pills without wrappers)
- Making sure that drug labels and take-home printed materials are in large type and in the patient's native language
- Teaching patients how to use drug calendar reminders, commercially available drug boxes, electronic drug-dispensing devices, and pill splitters or crushers
- Eliminating unnecessary complexity and duplication from the overall drug regimen
- Completing a medication reconciliation when patients transition to and from various care settings

Antenatal Care:

- Antenatal care is the care you get from health professionals during your pregnancy.
- It's sometimes called pregnancy care or maternity care.
- You'll be offered appointments with a midwife, or sometimes a doctor who specialises in pregnancy and birth (an obstetrician).
- This is the care you receive while you're pregnant to make sure you and your baby are as well as possible.

The midwife or doctor providing your antenatal care will:

- Check the health of you and your baby.
- Give you useful information to help you have a healthy pregnancy, including advice about healthy eating and exercise.
- Discuss your options and choices for your care during pregnancy, labour and birth.

Some common terminologies used in clinical setting antenatal care:

- **Antenatal:** Refers to the period of time during pregnancy before the birth of the baby.
- **Prenatal:** Another term for antenatal care, which refers to medical care provided to pregnant women.

- **Obstetrician:** A medical doctor who specializes in the care of pregnant women, childbirth, and the postpartum period.
- **Midwife:** A healthcare professional who provides care for pregnant women during pregnancy, childbirth, and the postpartum period.
- **Fetal development:** The process by which a fetus grows and develops during pregnancy.
- **Ultrasound:** A medical imaging technique that uses sound waves to produce images of the fetus in the womb.
- **Gestational age:** The age of the fetus calculated from the first day of the woman's last menstrual period.
- **Fundal height:** The measurement of the distance from the top of the uterus to the pubic bone, which helps estimate fetal growth.
- **Fetal heart rate:** The number of times the fetal heart beats per minute, which is monitored during antenatal care visits.
- **Amniocentesis:** A medical procedure in which a sample of amniotic fluid is taken from the uterus to test for genetic disorders or other abnormalities.

Significance of antenatal care:

- Pregnant women can also access micronutrient supplementation, treatment for hypertension to prevent eclampsia, as well as immunization against tetanus.
- Antenatal care can also provide HIV testing and medications to prevent mother-to-child transmission of HIV.

Postnatal care:

- Providing care to a woman during the 6-week time period beginning immediately after childbirth.
- Postnatal care should be a continuation of the care the woman has received through her pregnancy, labour and birth and take into account the woman's individual needs and preferences.

Common terminologies used in clinical setting postnatal care:

- **Postnatal:** Refers to the period of time after the birth of the baby, also known as the postpartum period.
- **Postpartum depression:** A type of depression that can occur after childbirth, characterized by feelings of sadness, anxiety, and fatigue.

- **Lactation consultant:** A healthcare professional who specializes in providing support and guidance to new mothers regarding breastfeeding.
- **Neonatal:** Refers to the period of time after birth up to 28 days of age.
- **Neonatal jaundice:** A condition in which a newborn's skin and eyes appear yellow due to a buildup of bilirubin in the blood.

Significance of postnatal care:

- Women and newborns require support and careful monitoring after birth.
- Most maternal and infant deaths occur in the first six weeks after delivery, yet this remains the most neglected phase in the provision of quality maternal and newborn care.

Daily activities of clinical pharmacists: Definition, goal and procedure of

- **Ward round participation**
- **Treatment Chart Review**
- **Adverse drug reaction monitoring**
- **Drug information and poisons information**
- **Medication history**
- **Patient counselling**
- **Interprofessional collaboration**

Ward round participation:

Definition:

- A ward round is a visit by a medical professional to hospital in-patients at their bedside to review and follow-up on the progress in their health, either alone or with a team of health professionals and medical students.
- Patients can learn about and participate in healthcare delivery during ward rounds.
- Additionally, it offers a chance for the medical personnel involved in patient care to learn together.
- Every day, at least one ward round is often held to assess how each patient's outcome is progressing.
- It enables pharmacists to prospectively contribute to patient care through the dissemination of drug information and encouragement of sensible drug use.

Goal:

- The main goal of ward round participation is to assess and manage the patient's medical condition and progress.
- It involves a team of healthcare professionals, including doctors, nurses, and other allied health workers, reviewing the patient's medical status, evaluating treatment options, and making decisions about the patient's care plan.

Objectives:

- To better comprehend the patient's clinical status, progression, and next scheduledstudies.
- To give pertinent data on a range of drug therapy topics, including pharmacology, pharmacokinetics, drug availability, pricing, drug interaction, and adverse drug reactions

Influence drug therapy selection, drug administration, monitoring, and follow-up to improve therapeutic management.

- Examine any strange medicine orders or dosages
- Find out more about the patient's co morbidities, medication compliance, or use of alternative medicines that may be important for their care.
- Medication interactions and adverse drug reactions are detected, managed, and prevented

Procedure:

- The procedure for ward rounds usually involves the healthcare team visiting the patient at their bedside, reviewing their medical history, examining their vital signs and physical condition, and discussing the patient's progress and treatment options.
- The healthcare team may also discuss any concerns or issues that have arisen during the patient's hospital stay.
- Ward round participation is an important opportunity for healthcare professionals to communicate with each other and ensure that the patient receives the best possible care.
- It also provides an opportunity for patients and their families to ask questions and be involved in decisions about their care.
- The participation of all members of the healthcare team is essential to ensure that patients receive coordinated and effective care.

Treatment Chart Review:

- Treatment Chart Review is a process where a pharmacist reviews the patient's drug treatment during his hospital admission and involves evaluation of the therapeutic efficacy of each drug and the progress of the conditions being treated.
- It addresses issues such as adverse drug reactions, drug-drug interactions, and medication errors, lack of efficacy, suboptimal patient adherence, poor quality of life, economic consequences and patient experience as well as understanding of the condition.
- Recommendations from a pharmacist to a clinician and framing a good rapport between them are essential for rendering better clinical services to the patients.

Goal:

- The goal of treatment chart review is to minimize the risk of medication errors that might occur at the level of prescribing or drug administration.

Procedure

The following points should be considered when performing Treatment Chart Review

- Evaluate whether all of the patient's medications are appropriately indicated, the most effective, the safest possible and affordable and if the patient is able and willing to take the medication as intended to rule out some medication problems.
- With other members of the health care team, assess the appropriateness of the current medications on the basis of health conditions, indications, and the therapeutic goals of each medication. Check whether the medicine order is comprehensive and unambiguous, that appropriate terminology is used, and that medicine names are not abbreviated.
- Make sure, if necessary medications are ordered and the patient has access to it, whether administration times are appropriate, e.g. with respect to food, other medicines,and procedures.
- Discuss patient-specific recommendations with the physician.
- Perform calculations form dosage adjustments, aid in the reconstitution for parenteral preparations,and follow-up on the stability after reconstitution
- Evaluate medication-taking behaviors and adherence to each medication.
- Detect actual and potential DTPs (drug related problems), record and document any identified DTPs on the Inpatient Medication Profile Form and report the identified adverse drug event (ADE) to the “yellow form” (Adverse Drug Event Reporting).
- Based on the agreed goals of therapy, prepare pharmaceutical care plan (PCP) based on patient progression that addresses the medicine therapy needs and prioritized DTPs, according to the patient’s disease condition, age, co-morbidity, renal and liver functions, pregnancy status,etc in collaboration with other health care professionals to optimize the patient’s health outcomes. The PCP should include follow up, monitoring, and evaluation components.
- Provide key medication care information to the nurses taking care of the patient, and encourage the nurses to report any ADEs identified.
- Review whether infusion solution is used with regard to concentrations, compatibilities, rate, and clinical targets, e.g. blood sugar levels, and blood pressure.
- Evaluate the patient's outcome, determine the patient's progress toward the achievement of the goals of therapy, determine whether any safety or adherence issues are present, and assess whether any new DTPs have developed.
- Follow up of the patient must be done on day to day basis.
- Check that the order is cancelled in all sections of the medication administration record when medicine therapy is intended to cease.
- The Treatment Chart Review Form is enclosed for your reference.

TREATMENT CHART REVIEW FORM

PATIENT NAME: **AGE:** **GENDER:**

DOA: **WARD:** **IP No:**

REASON FOR ADMISSION:

DIAGNOSIS:

PAST MEDICAL/MEDICATION HISTORY:

DAY	DRUG (DOSE, FREQUENCY, FORM)	DRUG GIVEN (YES/NO)	TIME OF ADMIN.	POSSIBLE SIDE EFFECTS	EXPECTED OUTCOMES	REMARKS

Preceptor Comments: **Student Name:**

Preceptor Signature: **Class:**

Adverse drug reaction monitoring:

- World Health Organization (WHO) defines that adverse drug reactions (ADRs) are noxious and unwanted effects produced by the drug, when it is applied for the ailment of disease or diagnosis (Shukla etal.2012).
- The most common examples of drugs that produce ADRs include paracetamol and nimesulide (hepatotoxic effects) (Rehan et al.2002).
- It is a well-known fact that no drug is completely free from side effects

Classification of Adverse drug reaction monitoring:

- Type A (Augmented)
- Type B (Bizarre)
- Type C (Chemical)
- Type D (Delayed)
- Type E (Exit/End of treatment)
- Type F (Familial)
- Type G (Genotoxicity)
- Type H (Hypersensitivity)
- Type U (Un classified)

Procedure:

Methods for Identifying ADRs

1. Case Record Review
2. Drug Chart Review
3. Laboratory Data
4. Computerized ADR Reporting System
5. Attendance at Ward Rounds
6. Interviewing Patients

Drug information and poisons information:

- Drug information means providing clinically relevant information on any aspect of drug use relating to individual patients, or general information on how best to use drugs for populations.
- Drug information service can be applied to any activity where information about drug use is transferred, and includes patient related aspects of pharmaceutical care.
- A Drug information center is an area where pharmacists(or other health care professionals) specialise in providing information to health professionals or public. ™

- The drug information centre provides authenticate, unbiased information to healthcare professionals, provide tailor-made counselling and health information to patients/consumer as well as monitor and document adverse drug reactions.
- The first drug information centre was opened in 1962 at the university of Kentucky medical centre and was intended to be utilised as a source of selected, comprehensive drug information.
- A drug information centre can also contribute to pharmacovigilance(adverse drug reaction reporting), drug use reviews, health education programmes and clinical research.

Poison information:

- Poison information is a specialised area of drug information which includes information about the toxic effects of chemicals and pesticides, hazardous material spills, household products, overdose, of therapeutic medicines including mushrooms, animal toxins from bites of snakes, spiders and other venomous creature and stings

Procedure:

The procedures for drug information and poison information may differ slightly depending on the specific organization or institution providing these services, but here are the general steps:

Drug Information:

1. Request: A healthcare provider or patient may request drug information from a drug information service.
2. Gathering information: The drug information specialist will gather information about the drug in question, such as its pharmacology, indications, contraindications, adverse effects, dosing, and administration.
3. Evaluation: The specialist will evaluate the available information and provide recommendations or answer any questions.
4. Communication: The specialist will communicate the drug information to the healthcare provider or patient in a clear and understandable way.

Poison Information:

1. Initial assessment: The poison information specialist will ask a series of questions to assess the situation, including the name of the substance, the amount ingested, and the person's age, weight, and symptoms.
2. Information gathering: The specialist will gather information about the toxicology of the substance, including its effects on the body, treatment options, and potential complications.

3. Treatment recommendations: Based on the information gathered, the specialist will provide recommendations for treatment, such as inducing vomiting, administering activated charcoal, or referring the patient to a healthcare facility.

4. Follow-up: The specialist may follow up with the patient or healthcare provider to ensure that the recommended treatment was effective and to answer any further questions or concerns.

Medication history:

- Medication history is a detailed, accurate, and complete information of all the prescribed and non-prescribed medications that a patient had taken or currently taking in a hospital, ambulatory, or OP care.
- It identifies patient's needs and helps to improve the efficiency of medication by rendering medication errors and concerns of illness and treatment.

Goal:

- To gather information to be utilized to case discussion.
- Compare medication profiles with the medication administration record and investigate discrepancies.
- Verify medication histories taken by other staff and provide additional information where appropriate.
- Document allergies and adverse reactions.
- Screen for drug interactions assess patient medication compliance.
- Assess the rationale for drugs prescribed.
- Assess for evidence of drug abuse.
- Appraise drug administration techniques.

Procedure:

The procedure for taking a medication history involves several steps, including:

1. **Introduction:** Introduce yourself to the patient and explain the purpose of the medication history. Ask for the patient's name, age, and any other relevant information.

2. **Current Medications:** Ask the patient to provide a list of all medications they are currently taking, including prescription drugs, over-the-counter medications, herbal supplements, and vitamins.

3. **Dosage and Frequency:** For each medication, ask the patient to provide the dosage and frequency at which they are taking it. This will help you understand whether the patient is taking the medication as prescribed.

4. **Reason for Taking:** Ask the patient why they are taking each medication. This will help you understand the medical condition for which the medication has been prescribed.

5. **Adverse Effects:** Ask the patient if they have experienced any adverse effects from any of the medications they are taking.

6. **Medication History:** Ask the patient if they have a history of allergies or adverse reactions to any medications in the past. This will help you identify any potential drug allergies or interactions.

7. **Medical History:** Ask the patient about any medical conditions they have been diagnosed with in the past or currently. This information will help you understand why certain medications have been prescribed.

Patient counselling

- Patient counseling is defined to the process of providing information, advice and assistance to help patients use their medications.
- Counseling patients regarding their medications is an important responsibility for pharmacists and an excellent learning opportunity for students.
- Pharmacists are often the only health care providers focusing patient education on medication: how to take it, what to expect, and side effects and drug interactions.
- Many pharmacists have been trained to use a counseling method developed by the Indian Health Service (IHS).

Just Scan This QR for about Patient counselling

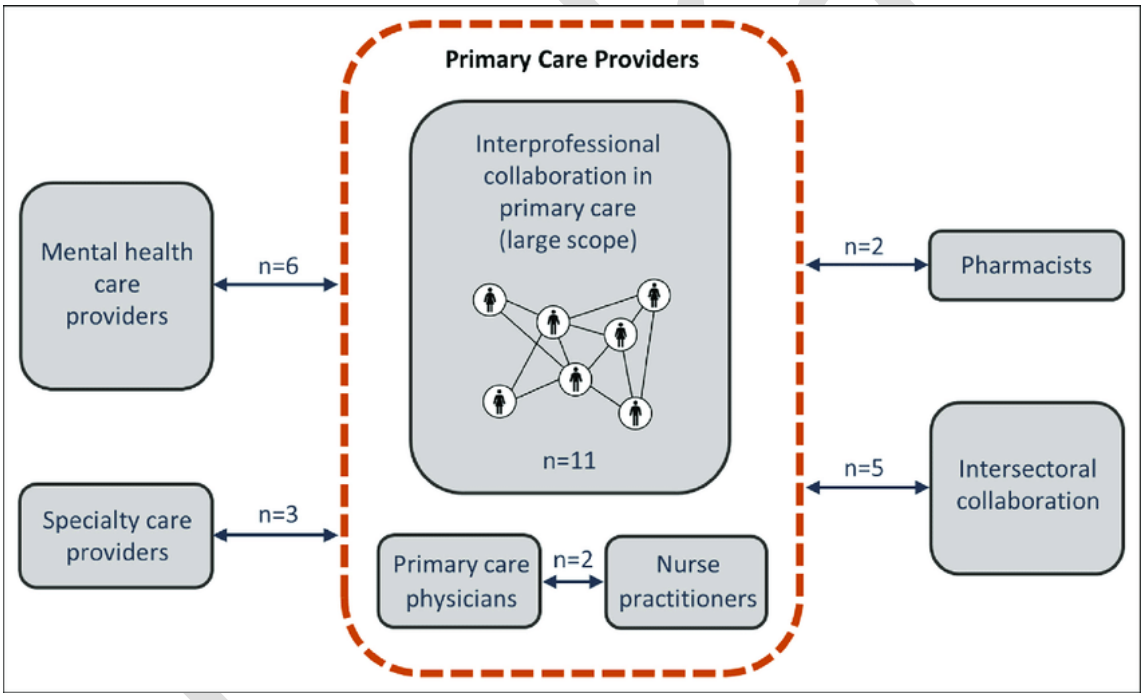
Interprofessional collaboration:

- Interprofessional collaboration occurs when 2 or more professions work together to achieve common goals and is often used as a means for solving a variety of problems and complex issues.
- The benefits of collaboration allow participants to achieve together more than they can individually, serve larger groups of people, and grow on individual and organizational levels.

Goal:

- The goal of interprofessional collaboration is to improve patient care and outcomes by bringing together healthcare professionals from different disciplines to work together as a team.
- By leveraging the knowledge and expertise of each team member, interprofessional collaboration aims to deliver comprehensive and coordinated care that addresses the physical, emotional, and social needs of the patient.

Procedure:



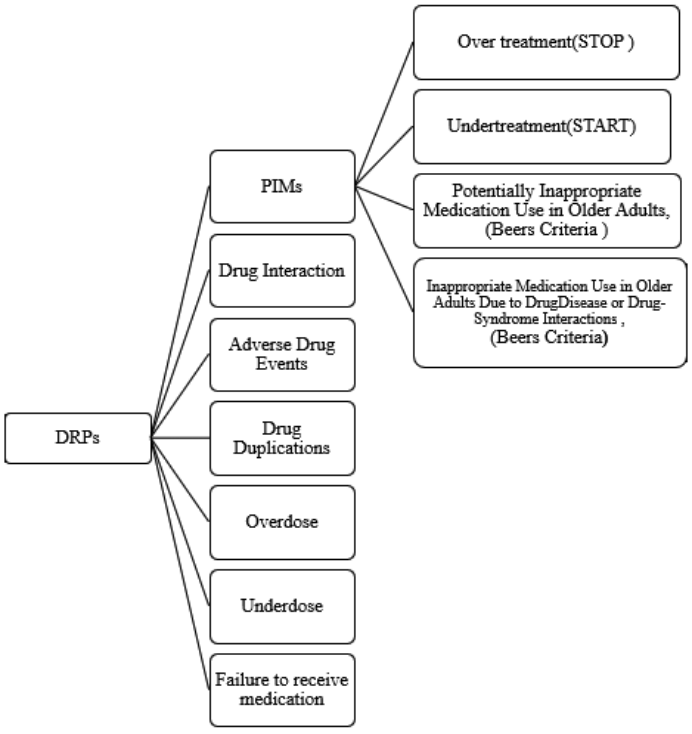
Pharmaceutical care: Definition, classification of drug related problems. Principles and procedure to provide pharmaceutical care, Medication Therapy Management, Home Medication Review

Pharmaceutical care:

Definition:

- Pharmaceutical care is the direct, responsible provision of medication-related care for the purpose of achieving definite outcomes that improve a patient's quality of life.
- It is a collaborative process that involves the pharmacist, the patient, and other healthcare professionals, with the goal of optimizing medication use and ensuring the safe and effective use of medications.
- Pharmaceutical care encompasses a range of activities, including medication therapy management, patient counseling, drug utilization review, and monitoring for adverse drug reactions.
- The pharmacist, as a medication expert, plays a key role in ensuring that patients receive the most appropriate medication therapy for their individual needs and health conditions.

Classification of drug related problems:



Principles and procedure to provide pharmaceutical care:

Pharmaceutical care is the responsible provision of drug therapy for the purpose of achieving definite outcomes that improve a patient's quality of life. Here are some principles and procedures to provide pharmaceutical care:

1. **Assessment:** The first step in providing pharmaceutical care is to assess the patient's medical history, current medications, allergies, and other relevant information. This will help the pharmacist to identify potential drug therapy problems.
2. **Goal setting:** Once the assessment is complete, the pharmacist sets goals for therapy in consultation with the patient. Goals may include improving symptoms, preventing adverse drug events, or reducing medication costs.
3. **Plan development:** The pharmacist develops a plan to achieve the therapy goals, taking into account the patient's needs, preferences, and medical history. The plan should be individualized and evidence-based.
4. **Implementation:** The pharmacist works with the patient and other healthcare providers to implement the plan. This may involve dispensing medications, counseling the patient on proper use, and monitoring for drug interactions and side effects.
5. **Evaluation:** The pharmacist evaluates the patient's progress towards the therapy goals and adjusts the plan as needed. The pharmacist also monitors for adverse drug events and communicates with other healthcare providers as necessary.

Medication Therapy Management:

Medication Therapy Management (MTM) is a comprehensive approach to patient care that optimizes medication use for improved patient outcomes. MTM involves a range of services that pharmacists can provide to patients to help them better understand their medication therapy and improve their adherence to treatment.

Requirements for Medication Therapy Management (MTM) Programs: Under 423.153(d), a Part D sponsor must have established a MTM program that:

- Ensures optimum therapeutic outcomes for targeted beneficiaries through improved medication use
- Reduces the risk of adverse events
- Is developed in cooperation with licensed and practicing pharmacists and physicians

- Describes the resources and time required to implement the program if using outside personnel and establishes the fees for pharmacists or others
- May be furnished by pharmacists or other qualified providers
- May distinguish between services in ambulatory and institutional settings
- Is coordinated with any care management plan established for a targeted individual under a chronic care improvement program (CCIP)

Home Medication Review:

A Home Medicines Review (HMR) is when an accredited pharmacist checks the medicines you are taking at home.

Taking lots of different medicines can be complicated. A Home Medicines Review makes sure that your medicines are safe. A Home Medicines Review also checks that:

- you are taking your medicines correctly
- your medicines are working for you

An HMR involves your doctor and your preferred community pharmacy. It may also involve other health care team members, such as carers or nurses in community practice.

During a Home Medicines Review (HMR), the accredited pharmacist will typically check the following:

1. The patient's medication history, including any prescription medications, over-the-counter medications, supplements, and vitamins.
2. The patient's current medical history, including any health conditions, allergies, or previous adverse reactions to medications.
3. The patient's medication adherence and any potential barriers to taking medications as prescribed.
4. Any potential drug interactions or duplications in the patient's medication regimen.
5. The appropriateness of each medication for the patient's individual needs and health status.
6. Any potential side effects of medications and how to manage them.
7. The patient's understanding of how to take their medications correctly and safely.
8. The storage and disposal of medications in the patient's home.
9. The patient's use of medication aids, such as pill boxes or inhalers.
10. The patient's overall medication management plan, including any changes or adjustments that may be necessary.

Chapter-9

Clinical laboratory tests used in the evaluation of disease states - significance and interpretation of test results

Clinical laboratory tests used in the evaluation of disease states - significance and interpretation of test results

- **Hematological, Liver function, Renal function, thyroid function tests**
- **Tests associated with cardiac disorders**
- **Fluid and electrolyte balance**
- **Pulmonary Function Tests**

Haematological:

- Hematology (hema- is from the Greek word for 'blood') is the study of blood in regards to a person's health or disease. It includes blood, blood-forming organs, and the proteins involved in bleeding and clotting.

Significance and interpretation of Haematological test:

- Hematological tests can evaluate numerous conditions involving blood and its components.
- They can also be used to diagnose inflammation, anemia, infection, hemophilia, blood-clotting disorders, leukemia, and response to chemotherapy, among many other things. Let's take a look at some of these tests.

A hematology test is a blood test. Any test that requires blood or blood parts is a hematology test. These tests can offer information to a doctor about what is happening in the blood. The most common hematology tests include:

- Complete blood count (CBC) - This test counts the number of white blood cells, red blood cells, platelets, and more. This test helps to diagnose anemia, some blood cancers, inflammatory diseases, infections, and other health concerns.
- A complete blood count (CBC) measures several components and features of your blood. A CBC and its individual components are tested on whole blood. It can include measurements of the following:
- Platelet count - This test is included in a CBC, but can also be done on its own in order to monitor clotting or bleeding disorders.
- Prothrombin time or Partial Thromboplastin Time - These tests evaluate some blood disorders and monitor ongoing therapies.
- International Normalized Ratio - This test monitors anticoagulation as well as blood disorders, including anemia
- Hematology tests help to diagnose blood cancers, anemia, and disorders related to clotting, bleeding, and coagulation.

Liver Function Test:

- Liver function tests (also known as a liver panel) are blood tests that measure different enzymes, proteins, and other substances made by the liver.
- LFTs include liver enzymes, albumin and other proteins, and bilirubin. The liver enzymes are produced by cells within the liver.
- They include alkaline phosphatase (ALP), ɣ–glutamyl transpeptidase (GGT), alanine aminotransferase (ALT) and aspartate aminotransferase (AST), but the combination of liver enzyme results you receive depends on your local laboratory.
- The protein components comprise total protein, albumin and globulin [N.B. Total protein = Albumin + Globulins].
- The globulins are a mixture of globular proteins such as immunoglobulins, enzymes, carrier proteins and complement. The LFT's reflect a limited range of hepatic metabolic processes.
- Bilirubin is an indication of the detoxification/excretory function and albumin reflects the synthetic function.

Liver function tests are most often used to:

- Help diagnose liver diseases, such as hepatitis
- Monitor treatment of liver disease. These tests can show how well the treatment is working.
- Check how badly a liver has been damaged or scarred by disease, such as cirrhosis
- Monitor side effects of certain medicines

Need liver function testing if you have symptoms of liver disease. These include:

- Jaundice, a condition that causes your skin and eyes to turn yellow
- Nausea and vomiting
- Diarrhea
- Abdominal pain
- Dark-colored urine
- Light-colored stool
- Fatigue

Renal Function Test:

- Renal function tests (RFT) are a group of tests that may be performed together to evaluate kidney (renal) function.
- The tests measure levels of various substances, including several minerals, electrolytes, proteins, and glucose (sugar), in the blood to determine the current health of the kidneys.
- If the kidneys are not functioning properly, waste products can accumulate in the blood and fluid levels can increase to dangerous volumes, causing damage to the body or a potentially life-threatening situation. Numerous conditions and diseases can result in damage to the kidneys.
- The most common causes of and main risk factors for kidney disease are diabetes and hypertension.

The most practical tests to assess renal function is to get an estimate of the glomerular filtration rate (GFR) and to check for proteinuria (albuminuria).

According to the Kidney Disease Improving Global Outcomes (KDIGO), The stages of chronic kidney disease (CKD):

- Stage 1 GFR greater than 90 ml/min/1.73 m^2
- Stage 2 GFR-between 60 to 89 ml/min/1.73 m^2
- Stage 3a GFR 45 to 59 ml/min/1.73 m^2
- Stage 3b GFR 30 to 44 ml/min/1.73 m^2
- Stage 4 GFR of 15 to 29 ml/min/1.73 m^2
- Stage 5-GFR less than 15 ml/min/1.73 m^2 (end-stage renal disease)

Thyroid Function Test:

- Thyroid function tests are blood tests which help to check the function of your thyroid gland.
- They are mainly used to detect an underactive thyroid gland (hypothyroidism) and an overactive thyroid gland (hyperthyroidism).
- The two hormones, thyroxine (T4) and thyroid-stimulating hormone (TSH), work together and are usually in balance

Normal range

The following are approximate values for what is normal for TSH and thyroxine levels. These are a rough guide only and will vary from hospital to hospital.

- Normal range for thyroid-stimulating hormone: 0.4-4.0 mU/L.
- Normal range for thyroxine: 9-24 pmol/L.
- So in general if SH is low and thyroxine level is high, you may have an overactive thyroid gland.
- Conversely if TSH is high and thyroxine level is low, you may have an underactive thyroid gland.
- There are other options such as having a high TSH but a normal thyroxine and that can indicate something called subclinical hypothyroidism.

Tests associated with cardiac disorders:

Many different tests are used to diagnose heart disease. Besides blood tests and a chest X-ray, tests to diagnose heart disease can include:

1. Electrocardiogram (ECG or EKG): This test measures the electrical activity of the heart and can detect abnormal heart rhythms, damage to the heart muscle, and other problems.

2. Echocardiogram: This is an ultrasound test that uses sound waves to create images of the heart. It can be used to evaluate the size and shape of the heart, the thickness of the heart muscle, and the function of the heart valves.

3. Stress test: This test involves exercising the heart to see how it responds. It can be done on a treadmill or with medication. It can be used to detect problems with blood flow to the heart or abnormal heart rhythms.

4. Cardiac catheterization: This test involves inserting a thin, flexible tube (catheter) into a blood vessel in the arm or leg and guiding it to the heart. It can be used to diagnose blockages in the coronary arteries or to measure pressures within the heart.

5. Holter monitor: This is a portable device that records the heart's electrical activity over a period of 24-48 hours. It can be used to detect abnormal heart rhythms that may not show up on a regular ECG.

6. Cardiac MRI: This test uses a powerful magnetic field and radio waves to create detailed images of the heart. It can be used to evaluate the size and function of the heart and to detect problems such as blockages or damage to the heart muscle.

7. CT scan: This test uses X-rays to create detailed images of the heart and blood vessels. It can be used to detect blockages in the coronary arteries or to evaluate the size and function of the heart.

Fluid and electrolyte balance:

Electrolytes are minerals in your body that have an electric charge. They are in your blood, urine, tissues, and other body fluids. Electrolytes are important because they help:

- Balance the amount of water in your body
- Balance your body's acid/base (pH) level
- Move nutrients into your cells
- Move wastes out of your cells
- Make sure that your nerves, muscles, the heart, and the brain work the way they should Sodium, calcium, potassium, chloride, phosphate, and magnesium are all electrolytes. You get them from the foods you eat and the fluids you drink.

The levels of electrolytes in your body can become too low or too high. This can happen when the amount of water in your body changes.

The amount of water that you take in should equal the amount you lose. If something upsets this balance, you may have too little water (dehydration) or too much water (overhydration). Some medicines, vomiting, diarrhea, sweating, and liver or kidney problems can all upset your water balance.

Treatment helps you to manage the imbalance. It also involves identifying and treating what caused the imbalance.

Pulmonary Function Tests:

Pulmonary Function Tests (PFTs) are a group of diagnostic tests used to evaluate the function of the lungs. These tests can help diagnose a range of respiratory conditions and can help monitor the progression of lung disease.

The most common types of PFTs include:

1. Spirometry: This test measures the amount of air a person can inhale and exhale, and how quickly they can do it. It can help diagnose conditions such as asthma and chronic obstructive pulmonary disease (COPD).
2. Lung volume measurements: These tests measure the amount of air in the lungs, both when they are full and when they are empty. They can help diagnose conditions such as interstitial lung disease and sarcoidosis.
3. Diffusion capacity: This test measures how easily oxygen passes from the lungs into the bloodstream. It can help diagnose conditions such as pulmonary fibrosis and emphysema.
4. Exercise testing: This test measures how well the lungs function during physical activity. It can help diagnose conditions such as exercise-induced asthma and evaluate the effectiveness of treatments.

Chapter-10

Poisoning

Poisoning: Types of poisoning: Clinical manifestations and Antidotes Drugs and Poison Information Centre and their services – Definition, Requirements, Information resources with examples, and their advantages and disadvantages

Poisoning:

A poison is any substance that is harmful to your body. You might swallow it, inhale it, inject it, or absorb it through your skin. Any substance can be poisonous if too much is taken. Poisons can include:

- Prescription or over-the-counter medicines taken in doses that are too high
- Overdoses of illegal drugs
- Carbon monoxide from gas appliances
- Household products, such as laundry powder or furniture polish
- Pesticides
- Indoor or outdoor plants
- Metals such as lead and mercury

Types of poisoning:

There are several types of poisoning that can occur, depending on the substance involved and the way in which it enters the body. Here are some of the most common types of poisoning:

1. Ingestion Poisoning: This occurs when someone swallows a toxic substance, either accidentally or intentionally. Examples of ingested poisons include household cleaners, medications, and poisonous plants.

2. Inhalation Poisoning: This occurs when someone breathes in toxic fumes or gases, such as carbon monoxide or chlorine gas. This type of poisoning is often associated with industrial accidents, fires, and other environmental hazards.

3. Injection Poisoning: This occurs when a toxic substance is injected into the body, such as through the use of contaminated needles or syringes. Injection poisoning is commonly associated with drug abuse.

4. Absorption Poisoning: This occurs when a toxic substance is absorbed through the skin, either by direct contact or through prolonged exposure to a contaminated environment. Examples of substances that can cause absorption poisoning include pesticides, lead, and mercury.

5. Radiation Poisoning: This occurs when the body is exposed to high levels of ionizing radiation, such as in the aftermath of a nuclear accident or a nuclear weapon detonation. Radiation poisoning can cause a range of serious health effects, including radiation sickness, cancer, and organ damage.

Clinical manifestations:

- Clinical manifestations refer to the physical or observable signs and symptoms of a disease or medical condition.
- Poisoning occurs when a person is exposed to a substance that is harmful to the body, either through ingestion, inhalation, injection, or absorption through the skin.
- Clinical manifestations of poisoning can vary depending on the type and amount of the substance ingested or absorbed, as well as the age, health status, and individual sensitivity of the person affected.

In general, clinical manifestations of poisoning can be divided into four categories: local effects, systemic effects, central nervous system effects, and cardiovascular effects.

1. **Local Effects:** Local effects are limited to the area where the poison has come into contact with the body. Examples of local effects of poisoning include:

    - Skin irritation or burns from contact with corrosive substances, such as acids or alkalis.
    - Eye irritation or damage from exposure to certain chemicals or gases.
    - Mucous membrane irritation or burns from ingesting corrosive substances, such as bleach or drain cleaner.
    - Respiratory irritation or burns from inhaling noxious gases, such as carbon monoxide or chlorine.

2. **Systemic Effects:** Systemic effects refer to symptoms that affect the whole body, such as fever, headache, or fatigue. Examples of systemic effects of poisoning include:

    - Gastrointestinal symptoms, such as nausea, vomiting, diarrhea, or abdominal pain.
    - Cardiovascular symptoms, such as high or low blood pressure, rapid or irregular heartbeat, or chest pain.
    - Respiratory symptoms, such as coughing, shortness of breath, or wheezing.
    - Renal symptoms, such as decreased urine output or blood in the urine.
    - Liver symptoms, such as jaundice, abdominal pain, or liver failure.

- Hematologic symptoms, such as anemia, bleeding, or clotting disorders.
- Metabolic symptoms, such as acidosis or alkalosis.

3. **Central Nervous System Effects:** Central nervous system effects are symptoms that affect the brain and spinal cord. Examples of central nervous system effects of poisoning include:

- Confusion, disorientation, or hallucinations.
- Seizures or convulsions.
- Coma or loss of consciousness.
- Agitation, restlessness, or anxiety.
- Depression, drowsiness, or lethargy.
- Memory loss or cognitive impairment.

4. **Cardiovascular Effects:** Cardiovascular effects refer to symptoms that affect the heart and blood vessels. Examples of cardiovascular effects of poisoning include:

- Chest pain or discomfort.
- Irregular or rapid heartbeat.
- Low blood pressure or shock.
- Pulmonary edema or fluid buildup in the lungs.
- Cardiac arrest or sudden death.

Antidotes:

- A medical substance that is used to prevent a poison or a disease from having an effect
- Antidotes are agents that negate the effect of a poison or toxin.
- Antidotes mediate its effect either by preventing the absorption of the toxin, by binding and neutralizing the poison, antagonizing its end-organ effect, or by inhibition of conversion of the toxin to more toxic metabolites.
- Antidote administration may not only result in the reduction of free or active toxin level, but also in the mitigation of end-organ effects of the toxin by mechanisms that include competitive inhibition, receptor blockade or direct antagonism of the toxin.

Types of Antidotes:

Antidotes are substances that can counteract the effects of toxins or poisons. There are several types of antidotes, including:

1. Chemical antidotes: These are substances that can chemically neutralize the effects of a poison. For example, sodium bicarbonate can be used as an antidote for acidic poisons.

2. Physiological antidotes: These are substances that can counteract the effects of a poison by affecting the body's physiological processes. For example, naloxone can be used as an antidote for opioid overdose by blocking the effects of opioids on the body's nervous system.

3. Functional antidotes: These are substances that can reverse the toxic effects of a poison by restoring normal bodily functions. For example, glucose can be used as an antidote for insulin overdose by restoring normal blood sugar levels.

4. Mechanical antidotes: These are physical measures that can be taken to remove a poison from the body. For example, activated charcoal can be used to absorb toxins in the digestive system before they can be absorbed into the bloodstream.

5. Immunological antidotes: These are substances that can stimulate the body's immune system to produce antibodies that can neutralize the effects of a poison. For example, antivenom can be used as an antidote for snake venom by providing the body with specific antibodies that can neutralize the venom.

Drugs and Poison Information Centre and their services:

- Drug Information and Poison Control Center is a source of authentic accurate unbiased and reliable source of information about drugs and poisons to health case professionals and common masses.
- A Drugs and Poison Information Centre (DPIC) is a specialized facility that provides information about drugs and poisons to healthcare professionals, patients, and the general public. These centers serve as a valuable resource for education, prevention, and treatment of drug-related problems.

Objectives

- To provide independent, unbiased, authentic, accurate and objective drug information to assist health professionals in rational prescribing to optimize patient care.
- To advise general public regarding safe. effective and economic use of medicines.

Requirements:

- Requirements for a Drugs and Poison Information Centre may vary depending on the country, but generally, it should have a team of experts, including pharmacists, toxicologists, and healthcare professionals with expertise in drug-related issues.
- The center should also have access to a comprehensive database of information on drugs and poisons, as well as the ability to perform research on drug-related issues.

Information resources:

- Databases: DPICs often maintain their own databases of information on drugs and poisons. These databases may include information on the pharmacology of drugs, their toxicology, interactions, side effects, and dosing guidelines.
- Online resources: DPICs may also offer online resources, such as websites, apps, or chatbots, where people can access information about drugs and poisons.
- Phone helplines: Many DPICs offer phone helplines that people can call to speak with a healthcare professional or pharmacist about drug-related issues.

Advantages:

- Increased patient safety: DPICs can provide healthcare professionals with up-to-date information about drug-related issues, including drug interactions and adverse effects, which can help to prevent adverse drug reactions and improve patient safety.
- Improved education: DPICs can provide education and training to healthcare professionals and patients, helping to improve their understanding of drug-related issues.
- Timely information: DPICs can provide information quickly in the event of a drug or poison-related emergency.

Disadvantages:

- Cost: Setting up and maintaining a DPIC can be expensive.
- Limited availability: DPICs may not be available in all areas, which can limit access to information about drugs and poisons for some people.
- Limited scope: DPICs may not have the resources to cover all drugs and poisons, which can limit the scope of their services.

Services

- Services offered by the DIPCC at Department of Pharmacy, University of Peshawar
- Choice of Therapy.
- Medicine Dose.
- Duration of Therapy.
- Drug Identification.
- Therapeutic Alternatives.
- Drug Interactions & Their Management.
- Drug Contraindicated in Pregnancy, During Lactation.

- Dose Adjustment in Hepatic and Renal Impairment.
- Drug Updates, Withdrawals, ADRs, Antibiotic Resistance, Novel Dosage Forms and Delivery Systems.
- Information on Reconstitution, Dilution, Stabilities and Rate Calculations of Parenterals.
- Mode of Drug Administration.
- Special Drug Related Precautions/Warnings.
- Poisoning Prevention Strategies.
- Poison Management Information (Identification, Diagnostic Tests, Absorption Minimizing Techniques, Elimination Enhancement Techniques, Antidotes Availability and Administration).

Chapter-11

Pharmacovigilance

Pharmacovigilance

- **Definition, aim and scope**
- **Overview of Pharmacovigilance**

Pharmacovigilance:

- Pharmacovigilance is the science and activities relating to the detection, assessment, understanding and prevention of adverse effects or any other medicine/vaccine related problem.
- All medicines and vaccines undergo rigorous testing for safety and efficacy through clinical trials before they are authorized for use.

Or

- Pharmacovigilance is defined as 'the activities involved in the detection, assessment, understanding, and prevention of adverse effects or any other drug related problems…'
- All drugs have the capacity to cause adverse effects and no drug is completely safe.

Aim:

- The primary aim of pharmacovigilance is to detect ADRs, which are any harmful or unintended effects associated with the use of medicines. The timely detection of ADRs can help to prevent serious harm to patients.
- The aim of pharmacovigilance is to minimize the risks associated with the use of medicines. This can involve changing the way a medicine is used or making changes to the product labeling or packaging.
- Pharmacovigilance aims to promote public health by ensuring that medicines are used safely and effectively.

Scope:

- Pharmacovigilance involves activities related to understanding assessment, detection and prevention of adverse effects or any other drug-related problems Pharmacovigilance is a continuous process accepted for safety evaluation accompanied by steps to improve safe usage of medicines.
- Pharmacovigilance is a science important to reverse most of the adverse effects by modifying the dose or omitting the offending drug.

- Pharmacovigilance knowledge on safety of drugs is obtained from clinical usage practiced daily involving patients, health professionals, regulatory authorities and pharmaceutical companies.
- Pharmacovigilance in companies is characterised in monitoring safety of the drug post launch.
- The implementation and incorporation of pharmacovigilance is growing slowly and steadily in the Indian healthcare system along with increasing awareness among patients and health professionals.
- Indian companies are increasing efforts and investment in research and development to enhance the capacity of developing and marketing new drugs that meet pharmacovigilance requirement of Indian regulatory authorities.
- The purpose of pharmacovigilance in India is to recommend regulatory interventions, communicate risks to healthcare professionals and public obtained by data collected, collated and analyzed; improve patient care and safety; contribute in assessing benefit, effectiveness and risk of medicines; promote education and clinical training on safe and rational use of medicines.

Overview of Pharmacovigilance:

The overall objective as per the National Pharmacovigilance Programme will be:

- To monitor safety of the drugs and provide structured inputs for appropriate regulatory interventions
- To create awareness about ADR monitoring in India

Regional centres will be the secondary pharmacovigilance centres under the National Pharmacovigilance Programme.

To carry out the functions as envisaged in the “Protocol for the National Pharmacovigilance Programme” a Coordinator will have to be designated who will be in-charge of the pharmacovigilance activities at the designated regional centre.

By accepting to participate in the National Pharmacovigilance Programme all centres explicitly agree that all pharmacovigilance activities at their institutions shall be performed in strict consonance with the National Pharmacovigilance Programme appended here (Coordinators of the centres and heads of the institutions are advised to carefully go through the Protocol prior to joining the programme).

Chapter-12

Medication errors

Medication errors: Definition, types, consequences, and strategies to minimize medication errors, LASA drugs and Tallman lettering as per ISMP

Drug Interactions: Definition, types, clinical significance of drug interactions

Medication errors:

Definition:

- 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 the health care professional, patient, or consumer.
- Such events may be related to professional practice, health care products, procedures, and systems, including prescribing, order communication, product labeling, packaging, and nomenclature, compounding, dispensing, distribution, administration, education, monitoring, and use.

Types of Medical Errors:

Medical errors refer to preventable adverse events or outcomes that occur during medical treatment. These errors can result from human error, system failures, or a combination of both. Here are some common types of medical errors:

- Medication errors: This includes errors in prescribing, dispensing, or administering medication, such as giving the wrong medication or dosage, administering a drug to the wrong patient, or administering a drug via the wrong route.
- Diagnostic errors: These errors occur when a patient is misdiagnosed, or a correct diagnosis is delayed, resulting in incorrect or delayed treatment.

- Surgical errors: These are mistakes made during surgery, such as wrong-site surgery, leaving a foreign object inside a patient, or performing the wrong procedure.
- System failures: These errors occur when the healthcare system fails, such as inadequate staffing, faulty equipment, or poorly designed systems and processes.
- Infections: These errors occur when a patient acquires an infection during medical treatment, such as healthcare-associated infections, including those acquired during surgery.
- Falls: These errors occur when a patient falls during medical treatment, such as in a hospital, nursing home, or other healthcare facility.

Consequences:

Medical errors can have serious consequences for patients, their families, and healthcare providers. Here are some of the consequences of medical errors:

1. Patient harm or death: Medical errors can cause physical harm, emotional trauma, or even death to patients.
2. Longer hospital stays: Medical errors can result in extended hospital stays, increasing healthcare costs, and delaying the recovery process.
3. Increased healthcare costs: Medical errors can lead to additional medical interventions, prolonged hospital stays, and increased healthcare costs.
4. Loss of trust: Patients may lose trust in their healthcare providers or the healthcare system as a whole due to medical errors.
5. Legal consequences: Medical errors can result in malpractice claims, lawsuits, and legal actions against healthcare providers or institutions.
6. Psychological impact: Medical errors can cause emotional trauma, stress, anxiety, or depression for patients, their families, and healthcare providers.
7. Reputation damage: Medical errors can damage the reputation of healthcare providers or institutions, leading to loss of business or negative publicity.

Strategies to minimize medication errors:

FDA looks for ways to prevent medication errors. Before drugs are approved for marketing, FDA reviews the drug name, labeling, packaging, and product design to identify and revise information that may contribute to medication errors. For example, FDA reviews:

- Proposed proprietary (brand) names to minimize confusion among drug names. With the help of simulated prescriptions and computerized models, FDA determines the acceptability of proposed proprietary names to minimize medication errors associated with product name confusion.
- Container labels to help healthcare providers and consumers select the right drug product. If a drug is made in multiple strengths – e.g., 5 mg, 10 mg, and 25 mg, – the labels of those three containers should be easy to differentiate. The label design may use different colors or identify the strength in large bold numbers and letters.
- Prescribing and patient information to ensure the directions for prescribing, preparing, and use are clear and easy to read.

LASA drugs:

LASA" stands for "Look-Alike-Sound-Alike" drugs, which are medications that have similar names or packaging but differ in their active ingredients or dosages.

Look Alike Sound Alike (LASA) medications involve medications that are visually similar in physical appearance or packaging and names of medications that have spelling similarities and/or similar phonetics

This can lead to medication errors if healthcare providers or patients mistake one drug for another.

To prevent medication errors with LASA drugs, healthcare providers should always double-check the medication name and dosage before administering or prescribing it, and patients should always confirm with their healthcare provider or pharmacist that they have received the correct medication.

In addition, it's important to store medications in their original packaging and to keep a current list of all medications, including their names, dosages, and purposes.

Common Risk Factors

Common risk factors associated with LASA medications includes:

- Illegible handwriting
- Incomplete knowledge of drug names
- Newly available products
- Similar packaging or labelling
- Similar strengths, dosage forms, frequency of administration
- Similar clinical use

Strategies to avoid errors with Look Alike Sound Alike Medications

- Procurement

- Storage
- Prescribing
- Dispensing/ Supply
- Administration
- Monitoring
- Information
- Patient Education
- Evaluation

Tallman lettering as per ISMP:

- Drug name confusion, particularly because of look-alike/sound-alike (LASA) name attributes, can be a contributing factor to medication related adverse events.
- TALLman lettering is a method of applying upper-case lettering to sections of LASA drug names as a differentiation strategy.
- Tallman lettering is a technique used by healthcare professionals to differentiate look-alike or sound-alike medication names to prevent medication errors.
- The technique involves using mixed case letters and placing a tall letter (typically the first letter) in the name in uppercase letters to make it stand out.
- The Institute for Safe Medication Practices (ISMP) has recommended specific guidelines for the use of Tallman lettering.
- According to ISMP, the tall letters should be at least twice the height of the other letters in the name and should be printed in uppercase letters.

The letters should be placed in the middle of the word or at the beginning of the word if it is a short name.

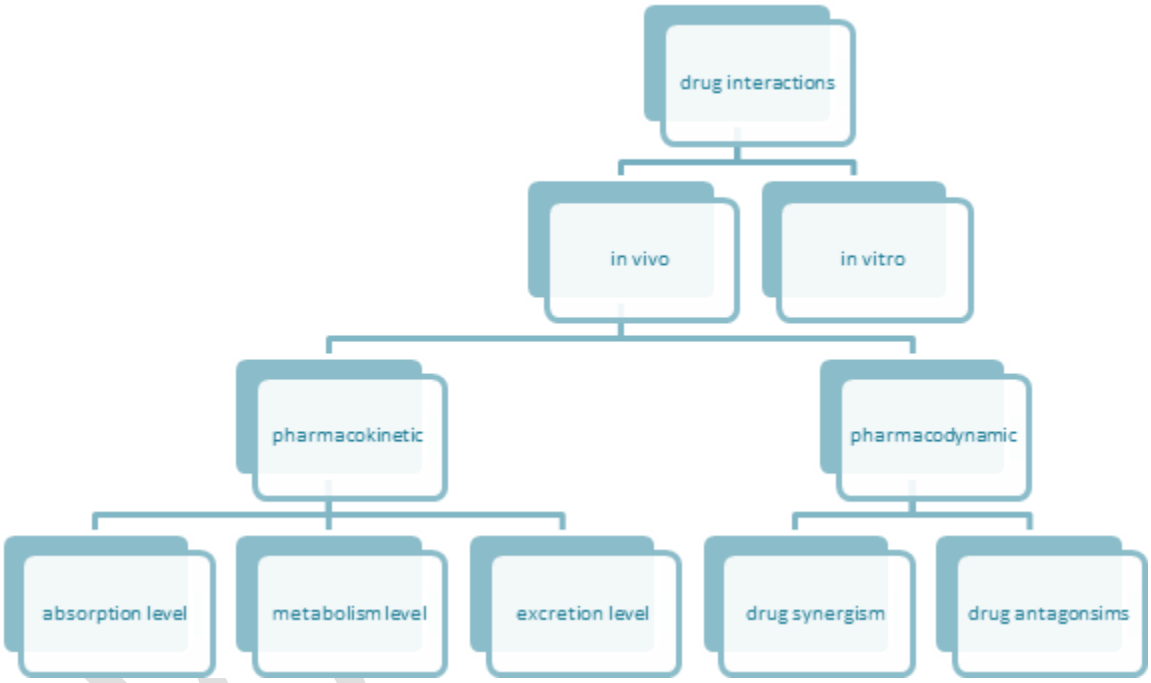
- For example, the names "vinBLAStine" and "vincrisTINE" are two chemotherapy drugs that have similar names and could easily be confused.
- To differentiate between the two names, Tallman lettering can be used to highlight the differing letters: "vinBLAStine" and "vincrisTINE.

Drug Interactions: Definition, types, clinical significance of drug interactions

Drug Interactions:

- A drug interaction is a reaction between two (or more) drugs or between a drug and a food, beverage, or supplement.
- Taking a drug while having certain medical conditions can also cause a drug interaction. For example, taking a nasal decongestant if you have high blood pressure may cause an unwanted reaction.

Types of Drugs Interaction:



Clinical significance of drug interactions:

1. Decreased effectiveness: When two drugs interact, the effectiveness of one or both medications may be reduced. This can result in a decreased therapeutic effect, which can lead to inadequate treatment of the underlying condition.
2. Increased toxicity: Drug interactions can also result in an increased risk of adverse effects or toxicity. For example, when two drugs that are metabolized by the same enzyme are taken together, they may compete for the enzyme, leading to an accumulation of one or both drugs and an increased risk of toxicity.

3. Altered pharmacokinetics: Drug interactions can also alter the pharmacokinetics (i.e., the way the drug is absorbed, distributed, metabolized, and eliminated) of one or both medications. This can result in changes in the blood levels of the drugs, which can affect their effectiveness and toxicity.

4. Potentiation: Drug interactions can also result in a potentiation of the effects of one or both drugs. For example, when two drugs that have a similar effect on the central nervous system (such as two sedatives) are taken together, they may have a greater effect than when taken alone.