Supply Chain and Inventory Control

Preparation of Drug lists - High Risk drugs

A high-risk medicine is one that may cause serious health problems if not taken the right way, or taken with another drug or food item that it may interact with.

High risk medications are drugs that have a heightened risk of causing significant patient harm when they are used in error.

High risk medicines include drugs:

- With a low therapeutic index
- That present a high risk when administered by the wrong route or when other system errors occur

High risk medicines may vary between hospitals and health care settings depending on the types of medicines used and patients treated. However, evidence suggests a group of medicines which can universally be considered high risk.

List of high risk drugs

- Adrenergic drugs
- Anaesthetics
- Antiarrhythmics
- Anticoagulants
- Cardioplegic solutions
- Chemotherapy
- Dextrose ≥ 2%
- Dialysis solution
- Electrolytes (concentrated)
- Epidural/ Intrathecal agents
- Epoprostenol
- Ionotropic agents
- Insulin/ hypoglycemics
- Liposomal products
- Narcotics
- Neuromascular blocking agent
- Nitroprusside
- Oxytocin
- Parenteral nutrition
- Promethazine
- Radiocontrast agents
- Sedatives
- Sterile water for injection

Emergency drugs

Emergency drugs/life saving drugs require immediate administration within minutes post or during a medical emergency or medicines which have the potential to sustain life or prevent further complications.

List of emergency drugs

- Aminophylline
- Amphetamine sulphate
- Amylnitrite inhalations
- Atropine sulphate
- Caffeine sodium benzoate
- Calcium gluconate
- Chlorpheneramine
- Digoxin
- Diphenyl hydantoin sodium
- Heparin
- Hydrocortisol
- Magnesium sulphate injection
- Mannitol injection
- Nalorphine
- Neostigmine
- Phenobarbital
- Picrotoxin injection
- Procainamide
- Protamine injection
- Saline water injection
- Water for injection

Schedule H1 drugs

Why was Schedule H1 Introduced?

The schedule H1 drugs were mainly allocated to restrict the selling of antibiotics through over the counter (OTC) sales, after it was noted that any number of these drugs could be bought from pharmacies across India without any limitations.

Irrational prescribing of antibiotics and other drugs by doctors and chemists lacking a registered pharmacist has contributed to the increasing antibiotics resistance and tolerance of psychotropics. In response to these serious issues, antibiotic forums, scientific meetings and symposiums were conducted by medical fraternity and various educational institutions.

As a result, the Government of India issued a gazette notification, GSR 588 (E) dated on 30. 08. 2013 regarding schedule H1 Drugs which shows the importance of this schedule.

The schedule H1 drug includes 3rd & 4th generation antibiotics, anti-tuberculosis drugs and certain habit-forming drugs like psychotropic drugs.

To dispense these drugs two main criteria have to be followed strictly

1) The drug supplied under the schedule H1 specification should be recorded in a separate register at the time of supply, mentioning the name and address of the prescriber, name of the patient, and the name of the drug along with the quantity supplied. This register has to be maintained confidentially up to three years and should be open for inspection.

2) The schedule H1 drugs should be labelled with the symbol Rx in red, clearly displayed on the left top corner of the drug label. The label should also bear the following words in a box with a red border.

The schedule H1 drug list, however, shows no limitation of using the drugs as topicals or for external use such as in ophthalmic, ear or nose preparations.

Schedule H1 Drug-Warning:

- It is dangerous to take this preparation except in accordance with the medical advice.
- Not to be sold by retail without the prescription of a Registered Medical Practitioner.

List of Schedule H1 Drugs

- Alprazolam
- Balofloxacin
- Buprenorphine
- Capreomycin
- Cefdinir
- Cefditoren
- Cefepime
- Cefetamet
- Cefixime
- Cefoperazone
- Cefotaxime
- Cefpirome
- Cefpodoxime
- Ceftazidime
- Ceftibuten
- Ceftizoxime
- Ceftriaxone
- Chlordiazepoxide
- Clofazimine
- Codeine
- Cycloserine
- Diazepam
- Diphenoxylate
- Doripenem
- Ertapenem
- Ethambutol HCl
- Ethionamide
- Faropenem

- Gemifloxacin
- Imipenem
- Isoniazid
- Levofloxacin
- Meropenem
- Midazolam
- Moxifloxacin
- Nitrazepam
- Pentazocine
- Prulifloxacin
- Pyrazinamide
- Rifabutin
- Rifampicin
- Sodium Para-aminosalicylate
- Sparfloxacin
- Thiacetazone
- Tramadol
- Zolpidem

NDPS drugs

The full form of NDPS is narcotic drugs and psychotropic substances. Narcotics are the substances used to treat moderate to severe pain. Narcotics are like opiates such as morphine and codeine, but are not made from opium. They bind to opioid receptors in the central nervous system. Narcotics are now called opioids.

Psychotropic substances: A drug or other substance that affects how the brain works and causes changes in mood, awareness, thoughts, feelings, or behaviour. Examples of psychotropic substances include alcohol, caffeine, nicotine, marijuana, and certain pain medicines. Many illegal drugs, such as heroin, LSD, cocaine, and amphetamines are also psychotropic substances. These are also called psychoactive substance.

List of NDPS drugs

- Codeine
- Dextropropoxyphene
- Dihydrocodeine
- Fentanyl
- Hydrocodone
- Hydromorphone
- Ketobemidone
- Morphine
- Oxycodone
- Pethidine
- Tilidine
- Trimeperidine

Reserved antibiotics

This group includes antibiotics that should be treated as 'last-resort' options, or tailored to highly specific patients and settings, and when other alternatives would be inadequate or have already failed (e.g., serious life-threatening infections due to multi-drug resistant bacteria).

The reserve group includes drugs that should be accessible but reserved for treatment of confirmed or suspected infections caused by multidrug-resistant organisms. They are considered "last-resort" drugs to be used when all alternatives have failed.

- Aztreonam
- Carumonam
- Cefiderocol
- Ceftaroline
- Ceftazidime + avibactam
- Ceftolozane + tozobactam
- Colistin (injection)
- Colistin (oral)
- Dalbavancin
- Daptomycin
- Eravacycline
- Faropenem
- Fosfomycin (injection)
- Iclaprim
- Minocycline (injection)
- Oritavancin
- Polymixcin B
- Tigecycline

Procedures of Drug Purchase

Purchase: “It’s an act of obtaining an article by making payment in terms of money or its equivalent, to buy for a price”.

Inventory: “It’s an itemised list of goods with their estimated worth.”

The Hospital Pharmacy Store (HPS) is the key facility in supply chain and distribution for pharmaceutical, medical and surgical inventories. HPS’s function as a distribution warehouse for all inventories required for patient care services. Pharmacy procuress drugs, medicines and essential goods used by clinical staff. The procedure to be adopted for purchase is decided by the PTC or by executive committee. The purchasing of drugs is done under the supervision of purchase officer and pharmacist. The source for purchasing is usually selected from licensed party with a good history.

Role of purchasing officer in drug purchasing

Role of purchasing officer for drug procurement vary from small to large hospitals. In small hospitals purchasing functions may be a part time and may be handled by administrator and he may have person like storekeeper. In large hospitals where purchasing functions is full

time work the following duties should be performed by purchasing officer who should carry out the following activities

- Issuing purchase orders
- Maintaining purchase records
- Follow up on the orders which are delayed
- Obtaining quotations from specified sources

Role of pharmacist in drug purchasing

In India many hospitals drug purchase is still in hands of junior medical officer. Now there are some changes in policy which are engaging pharmacist in purchasing of drug. Pharmaceuticals for hospital use may be purchased in one of the following ways:

- By direct purchase from the manufacturer and/or whole seller
- By inviting tender from manufacturer or wholesalers
- For emergency purchases, from a local retail drug store
- By a contract purchase arrangements with manufacturer

The basic purpose of purchases is to ensure continuous flow of raw materials of right quality, right quantity, and right price and from right sources. Another objective of purchasing is the avoidance of duplication and wastage with respect to various items purchased. Centralized purchase by medical stores procures the drugs on behalf of all the departments and helps in getting quality drugs at cheaper rates. Some important terms explained below.

1. Right Quality-Right quality means the quality which is available according to the particulars mentioned in terms of grades, brands or trade name, physio-chemical characteristics, etc. The quality must describe even the national standards to the extent it is possible.

2. Right Quantity-Right quantity is an important parameter of purchasing for continuous supply of raw materials. "Economic order Quantity" or any other technique may be followed in order to avoid shortage.

3. Right Price-The term right price means consistent matching with the quality of drug. Generally tender system is followed in hospitals and the lowest bidder is chosen for supplying the order.

4. Right Source-The supplier should be dependable and capable of supplying as per requirements from time to time. The selection of supplier requires consideration of various factors.

5. Right Time-Purchased department should have lead time information for all products. Lead time is the total time period between the placing of order and receipt of material while doing purchases. The purchase committee should consider emergency situations like floods, strikes, accidents, etc

Procedure for Purchasing Drugs

The general steps involved in purchase of drugs for hospital pharmacy includes following steps:

- Purchase Request Form
- Quotation Invitation
- Purchase Order Form
- Return of Goods

Purchase Request Form: The pharmacist or a person authorized by him should complete a purchase request form. This form provides the purchase department with the data concerning description specifications, packing, and price quantity needed and also information about the inventory balance and anticipated monthly use.

Quotation Invitation: On receipt of "request for purchase", invites competitive rates (quotations) from different suppliers. To prevent delay in supply, an annual rate contract can also be undertaken.

Purchase Order Form: The purchase officer scrutinizes quotations received, checks the quality expected to be supplied in consultation with pharmacists and prepares a purchase order. The purchase order may take the form of any different type- it may consist of two pages or a many page or a many page "snap out" form. However, a multi-copy snap out form is suitable as it provides a copy for the supplier, accounts department, purchasing number file, department which has sent the purchase requisition, two receiving reports and a copy which indicates the history of the purchase.

Return of Goods: If for any reason, any portion of the articles received are to be returned to the supplier a "Returned Goods Memorandum" must be prepared because it is by its means

that the hospital can be assured of receiving credit for the goods. This form is of the snap out type and provides four copies first to account department, second to the purchasing officer, third to the store room, fourth to the pharmacy and the supplier.

Tender for purchase of drugs

"Tendering is a formal procedure to purchase medications using competitive bidding for a particular contract".

The ultimate goal of pharmaceutical procurement is to purchase high-quality products with reliable supplier service and the lowest-possible prices. One method used to contain spending is tendering, a formal procedure using competitive bidding for a particular contract. Tendering is used when equivalents for a specific medicine are available, and is defined by the World Health Organization (WHO) Collaborating Centre for Pharmaceutical Pricing and Reimbursement Policies as:

"Any formal and competitive procurement procedure through which offers are requested, received and evaluated for the procurement of goods, works or services, and as a consequence of which an award is made to the tenderer whose tender/offer is the most advantageous".

Tendering is a major purchasing strategy worldwide for inpatient treatments, but is only used by a few countries for outpatient pharmaceuticals. The tendering process for pharmaceuticals typically comprises:

- Determining the tender format and scope
- Defining the requirements for the medication (including quantities)
- Selecting the suppliers to participate in bidding
- Preparing and sending the documents
- Receiving and opening bids; collating bids for adjudication
- Adjudicating the tender
- Issuing contracts to the winning bidder(s)
- Monitoring performance and product quality
- Enforcing contract terms (as needed)

Tendering should be conducted with the goal of purchasing high-quality, consistent, and effective products; therefore, the decision on which supplier(s) is awarded the contract should

not be based solely on price. Tendering has several positive impacts on pricing. The tendering process is designed to select the most cost-efficient supplier(s) of a particular product. Therefore, tendering may achieve important savings when the purchasing power of the procurement office is high and there are several potential suppliers for similar products. Short-term savings in pharmaceutical costs due to the use of tendering have been reported. Despite the positive short-term effects on pricing, long-term negative consequences have also been associated with the use of tendering. For example, the achievement of low pricing through tendering can force some manufacturers out of a given market and lead to erosion of competition, which could subsequently lead to higher prices. Other long-term negative economic impacts that have been associated with tendering include decreased pharmaceutical investments, resulting in loss of employment and income from taxes, as well as reductions in value-added features, such as improved packaging and programs to support patient compliance. Furthermore, tendering procedures can lead to slower development of innovations (to differentiate products) and competition within the generic medicine market.

Inventory control

Drug store management is based on principles of inventory control. Mismanagement 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 control

(i) ABC analysis

ABC analysis is an inventory categorization technique. It is a basic tool with a selective approach for concentration upon the items. As ABC analysis the items are divided into three categories—

"A items" with very tight control and accurate records,

"B items" with less tightly controlled and good records, and

"C items" with the simplest controls possible and minimal records.

The ABC analysis provides a mechanism for identifying items that will have a significant impact on overall inventory cost, while also providing a mechanism for identifying different categories of stock that will require different management and controls.
The ABC analysis suggests that inventories of an organization are not of equal value. Thus, the inventory is grouped into three categories (A, B, and C) in order of their estimated importance.

'A' items are very important for an organization. Because of the high value of these 'A' items, frequent value analysis is required. In addition to that, an organization needs to choose an appropriate order pattern (e.g. 'just-in-time') to avoid excess capacity. 'B' items are important, but of course less important than 'A' items and more important than 'C' items. Therefore, 'B' items are intergroup items. 'C' items are marginally important.

There are no fixed thresholds for each class, and different proportions can be applied based on objectives and criteria. ABC Analysis is similar to the Pareto principle in that the 'A' items will typically account for a large proportion of the overall value, but a small percentage of the number of items.

Examples of ABC class are

'A' items – 20% of the items accounts for 70% of the annual consumption value of the items

'B' items – 30% of the items accounts for 25% of the annual consumption value of the items

'C' items – 50% of the items accounts for 5% of the annual consumption value of the items

Another recommended breakdown of ABC classes:

"A" approximately 10% of items or 66.6% of value

"B" approximately 20% of items or 23.3% of value

"C" approximately 70% of items or 10.1% of value

(ii) VED analysis

It is an inventory management technique that classifies inventory based on its functional importance. It categorizes stock under three heads based on its importance and necessity for an organization for production or any of its other activities. VED analysis stands for Vital, Essential, and Desirable.

V- Vital Category: as the name suggests, the category "Vital" includes inventory, which is necessary for production or any other process in an organization. The shortage of items under this category can severely hamper or disrupt the proper functioning of operations. Hence, continuous checking, evaluation, and replenishment happen for such stocks. If any of such inventories are unavailable, the entire production chain may stop. Also, a missing essential component may be of need at the time of a breakdown. Therefore, order for such inventory should be before-hand. Proper checks should be put in place by the management to ensure the continuous availability of items under the "vital" category.

E- Essential category: the essential category includes inventory, which is next to being vital. These, too, are very important for any organization because they may lead to a stoppage of production or hamper some other process. But the loss due to their unavailability may be temporary, or it might be possible to repair the stock item or part. The management should ensure optimum availability and maintenance of inventory under the "Essential" category too. The unavailability of inventory under this category should not cause any stoppage or delays.
D- Desirable Category: the desirable category of inventory is the least important among the three, and their unavailability may result in minor stoppages in production or other processes. Moreover, the easy replenishment of such shortages is possible in a short duration of time.

(iii)EOQ

Economic order quantity (EOQ) is the ideal order quantity a company should purchase to minimize inventory costs such as holding costs, shortage costs, and order costs. The formula assumes that demand, ordering, and holding costs all remain constant.

Formula of Economic Order Quantity (EOQ)

$$Q = \sqrt{2DS}/H$$

Q = EOQ Units

D = Demands in units (generally on annual basis)

S = Order cost (per purchase order)

H = Holding cost (per unit, per year)

The goal of the EOQ formula is to determine the optimal number of product units to order. If achieved, a company can efficiently reduce its costs for buying, delivery, and storing units. The EOQ formula can be modified to determine different production levels or order intervals, and corporations with large supply chains and high variable costs use an algorithm in their computer software to determine EOQ.

EOQ is an important cash flow tool. The formula can support a company control the amount of cash tied up in the inventory balance. For many companies, inventory is its largest asset other than its human resources, and these businesses must carry sufficient inventory to meet the needs of customers. If EOQ can help minimize the level of inventory, the cash savings can be used for some other business purpose or investment.

The EOQ formula determines a company's inventory reorder point. When inventory falls to a certain level, the EOQ formula, if applied to business processes, triggers the need to place an order for more units. By determining a reorder point, the business avoids running out of inventory and can continue to fill customer orders. If the company runs out of inventory, there is a shortage cost, which is the revenue, lost because the company has insufficient inventory to fill an order. An inventory shortage may also mean the company loses the customer or the client will order less in the future.

(iv) Lead time

The lead time is the sum of the supply delay and the reordering delay. The lead time is the applicable duration to calculate the lead demand, the safety stock or the reorder point through a direct forecast. The longer the lead time, the higher the total inventory level or the larger is the safety stock, resulting in excess of investment in inventories.

(V) Buffer stock

Buffer stock is used in emergency to meet the unforeseen demands. It refers to minimum quantity of a particular item which must be kept in the stores of all time. Buffer stocks can be calculated using the following formula:

Buffer stocks = (Maximum consumption rate / day average- consumption rate / day) X lead time

Buffer stocks needs following factors to be taken into consideration like;

(i) Lead time

(ii) Nature of item and rate of consumption

(iii) Availability of substitutes

(iv)Re-order level

(v) Stock out cost

Reorder quantity level

The reorder level is the level of the stock of a particular item, held by the firm, when an order is needed to be placed for avoiding the risk of being out of stock. It is based on the average time taken by the supplier for replenishment, maximum usage of the item during the replenishment time, and safety stock requirement.

It is also known as reorder point. Reorder level is the stock level of a particular item of inventory, at which there is a need to place an order for the fresh supply or replenishment of the item. It gives an indication regarding when to place a new order for the fresh supply of an inventory item. The internal factors involved in reorder level are maximum usage during the lead time, safety level, and replenishment period. Whereas the external factor involved in reorder level is lead time taken by the supplier. The main risk factor in reorder level is being out of stock and some other risk factors are disruption in production and foregone sales.

The following formula is used for estimation of reorder level:

Reorder level = (Average daily usage rate X Average lead time in days) + Safety level

The above formula is used when usage and lead time are known with certainty; therefore, no safety stock is provided.

When safety stock is provided then the following formula will be applicable:

Ordering point or re-order level = Maximum monthly usage × Lead time + Safety stock

Buffer Stock/ Safety Stock is the minimum quantity of supplies set apart as an insurance against variation in supplies and demand. This can be calculated by multiplying the average demand for maximum delay or the probable delay.

Delivery period/Lead time

It is important to know how long it will take to receive the supplies after placing the order and this period is referred as Delivery time or Lead Time. This could be days, weeks or months depending upon:

1. Distance and road conditions

2. Availability of delivery vehicle

3. Work load at issuing store

4. Consumption rate

Time to reorder: if the balance is less than the reorder level, reordering should be done.

Inventory turnover

The inventory turnover ratio is a measure of how many times the inventory is sold and replaced over a given period.

To calculate inventory turnover, complete the following 3 steps:

1. Identify cost of goods sold (COGS) over the accounting period
2. Find average inventory value (beginning inventory + ending inventory / 2)
3. Divide the cost of goods sold by your average inventory

Formula to calculate inventory turnover

Inventory turnover = COGS/ Average inventory value

For most retailers, an inventory turnover ratio of 2 to 4 is ideal; however, this can vary between industries. A ratio between 2 and 4 means that inventory restocking matches sale cycle.

Low inventory turnover

A rate of 1 or less means one has excess inventory. For example, if you sell 20 units over a year, and always have 20 units on-hand (a rate of 1), you invested too much in inventory since it is way more than what's needed to meet demand. It's important to maintain inventory levels by calculating how much the company sells and avoid dead stock which cogs your entire cash flow.

High inventory turnover

High inventory turnover can indicate that you are selling your product in a timely manner, which typically means that sales are good in a given period. Ecommerce retailers should strive for a high inventory turnover rate, which means they sell the inventory they have on hand quickly and repurchase fresh inventory often. This also helps save on inventory carrying costs.

While a high turnover rate is generally considered an indication of success, too high of an inventory turnover rate can actually be problematic. An influx of sales can cause you to constantly have to replenish inventory, and if you can't keep up with demand, you may experience stock outs.

Techniques to solve inventory turnover problems

- Offer promotions to deplete inventory by increasing sales. Beyond clearing inventory, discounts can be an effective way to drive customer loyalty, boost word-of-mouth marketing, and help your business grow.
- Buy less stock, more often. By purchasing inventory to meet a month's demand, rather than the whole year, you take on less risk and invest less capital in products that may not necessarily sell. This can be especially prudent when stocking a new product for which you don't have prior sales data.
- Negotiate discounts with your manufacturer or supplier. If you've built a strong rapport with your supplier, you may be able to negotiate a lower price for recurring orders.

- Encourage pre-orders. Pre-orders can be a beneficial tool for businesses looking to gauge demand, generate excitement, and raise funds.

Inventory Management of Central Drug Store

Organisation of Drug Store

Stores are defined as a sub-organisation in any hospitals where materials obtained are held in abeyance till inspected, approved and stocked. A store should have a standard specification of materials and since the store procured the drugs on behalf of the department for regular flow of material, the condition of storage should be proper.

Objectives of Drug Stores

1. To stock all drugs and accessories required in the hospital.

2. To procure drugs from different sources.

3. To supply drugs to the consuming departments.

4. To store drugs required in research work.

5. To preserve records of receipt and issue of drugs.

6. To maintain records of receipt and issue of drugs.

7. To carry out all operations regarding drugs economically to save revenue.

The basic concept in supply organization is that we should be able to locate the supply in the store easily which means supplies are shelved in a predetermined manner. The principle for organizing supplies of drugs and medicines are:

a) Drugs to be stored in original containers

b) Similar drugs (Oral/injectable, internal/external use) to be kept on same shelf

c) Supplies to be arranged in alphabetical order/groups

d) Items with short shelf life to be kept in front

e) Ensure expiry dates are visible clearly

f) Shelf storing principle to be followed

i. Top Shelves: dry medicines

ii. Middle shelves: liquid/injectables/ointments

iii. Bottom shelves: surgical items, laboratory supplies, condoms

g) Within each drug group, arrange supplies in a alphabetical orders

h) Store items in groups (easy to count)

i) Store medicines and supplies with expiry dates by labelling “first expiry first out”

j) Clear all expired/damaged supplies

k) Identify overstocked items

While storing the supplies, ensure

a) Supplies are kept at least 10 cms above the floor.

b) Supplies are kept at least 30 cms away from wall.

c) Supplies are kept at a height not more than 2.5 mts.

d) Manufacturer’s directions are followed.

e) Liquids are placed on the lower shelves.

f) Appropriate temperature is to be maintained.

g) High value products are kept at security zones.

h) Expiry date is visible from front

It is essential to follow the product manufacturer’s storage instructions to the extent possible. If this is not possible, the product must be kept in the most suitable conditions available and used as quickly as possible. The product manufacture should be consulted before violating recommended storage conditions to determine how long the product will remain safe and effective under the actual storage conditions. If no specific storage instructions are given, “normal storage conditions” apply. Normal storage conditions for drugs have been defined as “storage in dry, well ventilated premises at temperatures of +15°C to 25°C, or depending

upon climatic conditions, up to +30°C. Each storage zone should have at least one thermometer, and temperatures should be recorded daily at the hottest time of day.

Orderly arrangement of essential medicines

Medical stores must have a system for classifying or organizing medicines, and must ensure that all employees know the system being used.

Some common systems for arranging medicines include

a) Alphabetical order by generic name: When using this system, the labelling must be changed when the Essential Medicines List is revised or updated.

b) Therapeutic or pharmacologic category: Most useful in small storerooms or dispensaries where the storekeeper is very knowledgeable about pharmacology.

c) Dosage form: Medicines come in different forms, such as tablets, syrups, injectables, and external use products such as ointments and creams. In this system, medicines are categorized according to their dosage form. Within the area for each form, a fixed, fluid, or semi-fluid system is used to store items. Any of the other methods of categorizing can be used to organize the items more precisely.

d) System level: Items for different levels of the health care system are kept together. This works well in stores at a higher level when storage of kits is required.

e) Frequency of use: Frequently used products that move quickly or often through the store should be placed in the front of the room or closest to the staging area. This system should be used in combination with another system.

f) Random bin: Identifies a specific storage space or cell with a code that corresponds to its aisle, shelf, and position on the shelf. This system requires computer automation.

g) Commodity coding: Each item has its own article and location code. This system has the greatest flexibility, but it is also the most abstract. Stores staff does not need any technical knowledge of the products to manage this system because the codes contain the information needed for storing products properly, such as temperature requirements, level of security, and flammability. This system works well in computerized inventory control systems.

h) Separate storage of items of resale potential (high value items, narcotics, psychotropic drugs) and flammable liquids (acetone, alcohol, anaesthetic ether and store in security zones).

i) Stock rotation

a. Follow First to Expire First to be Out (FEFO) procedure.

b. Place products that will expire first in front.

j) Write expiry date on product card.

k) For items which do not have an expiry date, the principal to be followed is FIFO-First in First Out. l) Put newly received items at the back of existing stock

m) Always remove expired and poor quality stock from the store

n) Identify overstocked items and items that are not in use and distribute them to other facilities

o) Keep a record of all items removed so that balances can be tallied later.

Cold storage of Drugs & Vaccines

Indian Pharmacopoeia describes conditions for storage of some official substances which are likely to deteriorate, if not stored properly. It is important to follow the manufacturer's recommended storage conditions for all products. The terms used under definite meaning of the pharmacopeia are: **1. Store frozen:** Some products, such as certain vaccines, need to be transported within a cold chain and stored at -20°C. Frozen storage is normally for longer-term storage at higher-level facilities.

2. Do not freeze or do not store over 8°C: To be kept in refrigerator (from +2°C to +8°C but not in the freezer chamber).

3. Keep Cold: Storage at any temperature NOT exceeding 8°C and usually between 2°C and 8°C but must not be frozen. These are usually kept in the first and second part of the refrigerator (never the freezer). This temperature is appropriate for storing vaccines for a short period of time. A refrigerator is a cold place in which the temperature is maintained thermostatically between 2°C and 8°C.

4. Keep Cool: Store at 8°- 25°C. An article for storage in a cool place is directed, may, alternatively, be stored in a refrigerator (at temperature between 2°C and 8°C), unless otherwise specified in the individual monograph. Store at room temperature or do not store over 30°C: store at 15°C - 30°C.

5. Storage at ambient temperature: Store at the surrounding temperature. This term is not widely used due to significant variation in ambient temperatures. It means "room temperature" or normal storage conditions, which means storage in a dry, clean, well-ventilated area at room temperatures 15° to 25°C or up to 30°C, depending on climatic conditions.

6. Protect from moisture: To be stored in normal humidity at room temperature (Relative Humidity less than 60%).

7. Protect from light: To be stored in a light-resistant cupboard/drawer; to be provided by the manufacturer in a light- resistant container.

The potency of vaccines, sera, test kits, and many other items depends on cold storage. Vaccine, in particular, must be kept at precisely controlled temperatures from the point of manufacture to the point of administration. Also daily temperature record should be maintained properly.

FEFO, FIFO methods

FEFO (first expired, first out), is an inventory management method that allows for products with the shortest shelf-life to be distributed first. This is a simple, highly effective inventory management method that prioritizes the handling and moving of date sensitive inventory. The FEFO method requires, regardless of the date of entry or acquisition, that inventory with the earliest expiration date (or shortest shelf-life) to be handled first. The method of FEFO is most commonly practiced in the food and beverage and the pharmaceutical industries, where expiration dates and shelf-life cycles are of critical importance.

FIFO (first in, first out) method is another commonly used inventory management method. While the FIFO principle is not strictly guided by an expiration date or a specific shelf-life cycle, it ensures that product that was received first into a warehouse leaves the warehouse first. Companies that normally practice the FIFO principle usually have a policy of displaying and selling older stock before selling newly acquired stock.

Expiry drug removal and their disposal methods

Disposal – Steps and Methods

A series of steps need to be taken when disposing of unwanted pharmaceuticals:

1. Decision

The hospital, district or regional pharmacist or organizations with pharmaceutical programs decide when action needs to be initiated, because of an accumulation of unwanted pharmaceuticals which are unfit for human consumption and for veterinary treatment.

2. Approval

Approval and sanctioning of disposal of pharmaceuticals must be sought from the appropriate authority. This authority will differ from country to country and may be the department responsible for pharmaceutical management within the ministry of health, the drug regulatory authority, or the regional or local health authority (pharmaceutical officer).

3. Planning

Planning, in terms of funding, necessary expertise, human resources, professional time, space, equipment, material and available disposal options will be required. This is essential before practical steps can be taken to start disposal.

4. Forming work teams

Work should be conducted by teams consisting of supervising pharmacists and general medical workers, who are preferably pharmaceutical technicians or experienced pharmaceutical warehouse personnel. The size of each team, and the ratio of experts to workers, will be determined by the volume and composition of the stockpiles, and working conditions at the sites.

5. Health and safety of work teams

All workers should wear appropriate protective equipment including overalls and boots at all times, and gloves, masks and caps when appropriate. Masks should be worn when tablets or capsules are being crushed as part of the disposal technique and when there is a risk of powders being liberated. Particular care is required when handling anti-neoplastics.

6. Sorting

The objective of sorting is to separate the pharmaceuticals into separate categories for which different disposal methods are required. The separation should be made into those that can be safely used and returned to the pharmaceutical supply system and those that require disposal by different methods. For example, controlled drugs (e.g. narcotics), anti-neoplastic drugs and antibiotics all require special methods of disposal. Substantial investment in human resources may be required for identifying and separating pharmaceuticals.

7. Disposal

Disposal options vary considerably between situations, and the ideal solution may not be feasible. The aim of these guidelines is to propose the simplest, safest and most practical alternatives.

8. Security

Controlled substances (e.g. narcotics and psychotropics) require tight security and control. In some countries, scavenging of material from landfills is a frequent problem, and, disposed drugs may be recovered and sold by the scavengers. Measures are therefore necessary to prevent diversion during sorting, and pilfering of drugs from landfills. Immobilization is the best method of preventing pilfering from a store or landfill. If, as a last resort, pharmaceuticals must be discarded direct to a landfill then they must be covered immediately with a large quantity of municipal wastes.

Disposal Methods

1. Burial Pits:

The bottom of the pit should be 1.5 m above the groundwater level, 3-5 m deep, and lined with a substance of low permeability, such as clay. Surround the opening with a mound to keep run-off water from entering the hole, and build a fence around the area. Periodically, cover waste layers with 10-15 cm of soil.

2. Encapsulation:

Cement-lined pits or high-density plastic containers or drums are filled to 75% capacity with health care waste. The container is then filled with plastic foam, sand, cement, or clay to

immobilize the waste. The encapsulated waste is then disposed of in a landfill or left in place if the container is constructed in the ground.

3. Incineration:

Medium- and high-temperature incineration devices require a capital investment and an operations and maintenance budget. They operate on fuel, wood, or other combustible material and produce solid ashes and gases. Pollutants are emitted to varying degrees. The ash is toxic and must be buried in a protected pit. Combustible waste is reduced to incombustible waste with a decreased volume.

The high temperatures kill microorganisms:

Medium-temperature incinerators, commonly a double- chamber design or pyrolytic incinerator, operate at a medium-temperature combustion process (800°-1,000°C).

High-temperature incinerators, recommended by WHO, treat health care waste at a temperature >1,000°C. When operated by staff trained in correct use and maintenance, incineration in a device like this one- a) completely destroys needles and syringes b) kills microorganisms c) reduces the volume of waste d) generates less air pollution than low-temperature burning.

4. Low-Temperature Burning:

Burning devices not exceeding 400°C include single-chamber brick hearths, drum burners, and burning pits. They burn incompletely and do not fully destroy waste. They may not kill microorganisms. Given these shortcomings, low-temperature burning should be used only as a short-term solution.

5. Burn and Bury:

Pit burning is a low-cost but relatively ineffective means of waste disposal. A fence should surround the pit to prevent children, animals, and others from waste. The pit location should avoid walking paths (high traffic areas). The fire, usually started with a petroleum-based fuel and allowed to burn, should be supervised by designated staff and located down-wind of the facility and residential areas. The low temperature fire emits pollutants, and the ash and remaining material should be covered with 10-15 cm of dirt.

6. Other Methods:

In addition to the common methods, other methods are used in some settings, including needle removal/ needle destruction, melting syringes, steam sterilization (autoclaving and hydroclaving), and microwaving (with shredding).