iJRASET
International Journal For Research in Applied Science and Engineering Technology

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 12 **Issue:** XII **Month of publication:** December 2024

DOI: https://doi.org/10.22214/ijraset.2024.65847

www.ijraset.com

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International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.538
Volume 12 Issue XII Dec 2024- Available at www.ijraset.com

Various Control Techniques in Hospital Management

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I. INTRODUCTION TO MATERIAL MANAGEMENT AND EQUIPMENT MANAGEMENT

The function of Materials Management is the coordinated function responsible to plan, acquire, store, move and control materials to provide customer service in accordance with organizational goals. Materials management attempts with organizational goals. Materials management attempts to get the right goods, at the right price, at the right time to maintain a desired service level at minimum cost. For example, if there is requirement of chloroquinine tablets due to sudden outbreak of plasmodium vivax malaria, then it the duty of medical superintendent to procure the required drug in that crisis, in the right quantity, to overcome sudden outbreak of material epidemic. Materials costs in hospitals vary from 30 to 40 per cent of the total hospital costs. Containment of materials costs therefore has a tremendous potential in making the hospital costs bearable to patients and the potential to influence hospital profitability. If we analyse the budget of a District Health Organization or its hospitals, it will be seen that approximately 60- 70% of the expenditure is consumed on salaries and wages and the remaining about 30% is consumed on the materials. So, materials cost consumed nearly 1/3rd of the total expenditure. Most of it is consumed on purchase of drugs, vaccines, contraceptives, laboratory reagents and other consumables. The Health Administrator must ensure the regular availability of all the essential materials to avoid the stock out situation of the vital and essential items.

There are many charges levied against materials management in hospitals including the one that anticipated results have failed to materialize. The failures have mostly been due to little planning than to do with lack of desire. Some managements thought they must have a separate Materials Managements section, but they had no goals or planned programmes to properly introduce, utilize, and evaluate the function. Other failures can be traced to a desire for immediate results. Disorganized introduction of the materials management function cannot be expected to achieve the goal.

The expansion and modernization and sophistication of the health care delivery system and particularly the hospitals, demand the scientific management of the materials. Materials management is now well accepted as a quantitative technique of operations research and has been successfully employed in the industry. However, its application in the health sector leaves much to be desired. Materials management is also known as Logistics and supply management system. The word Logistic has economic connotations. It is defined as the branch of military science concerned with procurement, transportation, warehousing, maintenance and supply of troops, equipment and facilitates for bellicose (war) purposes. To give an analogy, the human body's logistics system is its circulatory system (blood), which provides oxygen and other essential nutrients to all the tissues of the body on round the clock basis. If any interruption / hindrances come in this system, it will have serious adverse effect on the entire human body. Similarly, health and family welfare institutions and hospitals have their own logistics supply system, which should provide all the essential drugs, vaccines, contraceptives, and other consumables for effective and efficient delivery of health care. If there is any interruption, it will seriously dislocate the normal functioning of these institutions, besides, adversely affecting the patient care.

As the health and family welfare programme is expanding, it is essential that the system of materials procurement, stocking and distribution to the service points should be streamlined, and the health manager should be skilled in inventory control procedures and techniques. It the DHO's responsibility for ensuring the availability of necessary drugs, supplies and equipment and their maintenance at the district level to improve the quality of the services.

The expansion and modernization and sophistication of the health care delivery system and particularly the hospitals, demand the scientific management of the materials. Materials management is now well accepted as a quantitative technique of operations research and has been successfully employed in the industry. However, its application in the health sector leaves much to be desired.

According to a survey of the Department of Electronics, Government of India in the nine States of the country, it is revealed that at least 30-40% of costly high-tech bio-medical equipment, worth hundreds of crores of rupees is lying idle in hospitals. The main reason of this wastage is identified as lack of policy in hospitals and health institutions on equipment management, maintenance, and repair.

The National Institute of Health and Family Welfare located at New Delhi have conducted two important studies in the State of Haryana and Madhya Pradesh, on the logistics and supply system of drugs, vaccines, and contraceptives in the district health system. Both these States revealed that drugs supply to the health institutions in districts follow more of the PUSH SYSTEM rather than the PULL SYSTEM.

II. OBJECTIVES OF MATERIAL MANAGEMENT AND EQUIPMENT MANAGEMENT

The Materials management function must achieve a few basic objectives. The aim is to develop a system that will always ensure right quality of stocks, properly stored, easily retrievable, and available whenever required to meet the goal of good patient care in an effective, efficient, and economical manner. The goals include the following.

1) *Optimum Materials Acquisition:* The purchase of materials must be governed by the most effective purchase, storage, handling, and usage practices.
2) *Optimum Inventory Turnover:* Inventories of all items must be maintained at the optimum level.
3) *Good Vendor Relationship:* The organization's relationship with its suppliers has a direct bearing on its ability to procure materials on the best possible terms.
4) *Materials Cost Control:* Materials purchase process must be economical. There must be a continuous cost reduction programme.
5) *Effective Issue and Distribution:* The system of issues and distribution must cater to economical holdings at the point of usage with no possibility of accumulation of large quantities of stock.
6) *Elimination of Losses and Pilferage:* Wastage and pilferage should be controlled by a system of internal audit. To summarize, the materials management function caters to planning for materials, its demand, estimates, procurement, stocking, and issue to ensure availability of Right material, for example procurement of right type of antibiotic (like procurement of Cefotaxime, known by brand name Taxim - O, for the treatment specific disease (such as Typhoid Fever).

Right quantities, for example procuring right quantity of the oral polio vaccine, according to the nod of beneficiaries, registered for the pulse polio immunization programme.

Right time, for example provision for adequate supply of Tablet Tamiflu, for controlling the outbreak of the Swine Flu epidemic.

Right price, for example from procuring hospital suture materials, like chromic catgut at negotiated prices.

Right sources, for example at procuring BCG vaccine for revised national Tuberculosis Control Programme from its manufacturing unit, which is located at Guindy, in Chennai. The WHO has recommended the "Danish 1331" strain to produce BCG Vaccine. Emphasis has been laid on regular checking of quality of vaccine at the International Reference Centre for BCG quality control at Copenhagen. The vaccine contains live attenuated bacteria of Calmette strain for the manufacturing of BCG vaccine.

Least cost. Actually, means well discounted cost as most of the renowned hospital suppliers give institutional discount, for the institutions like hospital, with discount up to 30 % on the MRP. It is very common in pharmaceutical industries to give such amount of discount because of the cutthroat competition among them especially for perennial hospital items like analgesic, dressing materials, suture materials, etc.

III. NEED FOR AND SCOPE OF MATERIALS MANAGEMENT

Materials Management is concerned with the planning, organizing, and controlling the flow of materials, from their initial purchase through internal operations to the distribution or up to the service points. For example whenever planning is done for carrying out any health activities such as organizing a blood donation camp in a given locality, first and foremost thing in the planning, is propaganda about the organization of a blood donation camp, so that everyone is aware of occurrence of that particular health event in a particular locality on the specified date and time, then manpower required for the blood donation camp is selected, materials and instrument required for organizing the blood donation camp is kept ready and when everything is organized, then actually the blood donation camp is carried out. In this context, every individual is familiar with the word 'stock' because everyone has carried it sometimes to meet his requirements. In the industry, or service sector, the word 'stock' has been replaced by the term ‘inventory'.

In health care organizations, the materials management function is responsible for the complete supply process-from purchasing to distribution for example, whenever the purchase of the drugs is centralized, then first purchased drug from retailers are stored in central drug depot, then the drugs are distributed to all local and nearby government hospitals and dispensaries. Functional areas under the materials management organization typically include purchasing, central service supply and central stores. Other departments which are also included in day-to-day management of hospital inventories are pharmacy, dietary, laundry & linen services, CSSD, housekeeping departments etc.

IV. PRINCIPLES IN MATERIALS (LOGISTICS) MANAGEMENT

Health care managers must always be aware of the seven cardinal principles or elements, which are enumerated below. These 'righteous' elements can be achieved through various management techniques marked against each principle.

#	Principles	Management Techniques
1.	Right item / material	- Value analysis - Standardization - Codification
2.	Right quantity	- Balancing of inventories - EOQ – economic order quantity (how much to buy and when to buy)
3.	Right price	- Cost analysis - Value analysis
4.	Right source	- Market research - Purchasing techniques - Selection process
5.	Right delivery time	- Procurement technique - Follow up. - PERT (programme evaluation and review technique) - OR (operation research)
6.	Right methods / systems	- Work study - System analysis - Management information systems
7.	Right people / attitude oriented towards innovation improvements	- Organizational analysis - Behavioural sciences

In addition, to the seven righteous cardinal principles of material management, other supportive elements of procurement or parameters of purchase strategies mainly aims to ensure, the continuous supply of hospital materials, items, medicines etc, so that the service is carried out without any interruptions. At the same time, it also to be seen that the items purchased is kept minimum. It includes the following additional purchase principles:

1.	Right quality	For example, the purchase of branded hospital drugs from renowned pharmaceutical company such as Ranbaxy, Glaxo - Smith, and Reddy's pharmaceutical companies. The buying hospital must make an objective evaluation of the suppliers (vendor rating) based on different criteria like financial strength, continuity in supply, uniformity in quality etc, before selecting a supplier. Further the hospital authorities must be in constant search for the cheaper substitutes and update the list of suppliers.
2.	Right place of delivery	For example, HEPA filters (high particulate efficiency filters) are to be placed in an operation theatre, just above the main operation table.
3.	Right transport	For example, patients to be shifted from one hospital to another, in a well-equipped cardiac ambulance with all arrangements to provide basic and advanced life support care, by trained manpower and machines.
4.	Right packaging	All medicines purchased for hospital supplies should bear a proper batch number, generic name of medicines, date of manufacture and date of expiry, with properly sealed waterproof aluminium foil packaging.
5.	Right handling methods	All the hospital equipment and instruments used in hospital practice usually have instruction and operating manuals, so that one is aware about how to handle the instruments in the proper manner. If things do not work in proper order, then who to contact is also mentioned in it. Many companies are giving live demonstration on how to handle the instrument in best manner in day-to-day practices. For example, if a hospital procures new operating microscope in an ophthalmic O.T., then live demos are delivered by the company sales and marketing divisions.
6.	Right materials intelligence	It depends upon, how much eager are the end user departments and how much transparent is marketing division of that hospital use items. For example, if the drug is known to produce a side effect to children, then it should carry the tags dangerous for children. Keep out of the reach of children.
7.	Right contract or legal procedures	Order to accept brand medicine should only be finalized by the medical department, for the drugs which are listed in the material management department and through proper work order contract and their while entering legal contract with the supplier, the hospital must consider the various legal enactments that affect the performance of the contracts for e.g. The Indian contract act, the sales of goods act, the I.S.I. Act, the essential commodities act etc.

V. NEED FOR MATERIALS MANAGEMENT

The four essential needs for Materials Management around which health care organizations should be focusing are:

1) To have material in hand when needed at the time of emergency, for example in a health care set up all emergency drugs (like injection avil, inj. dexona, inj. adrenaline, inj. soda-bicarbonate, etc), kits to be used in emergency patients - such as automated external defibrillator, first- aids box, tracheotomy instruments, Ambu bags, oxygen cylinders, functioning pulse-oximeters, etc should always be kept ready and in good working conditions.

2) To have right material in hand when needed. This is only possible if everything is done with proper planning, proper survey, and market analysis. For example, if any cancer institute wants to procure PET-SCAN for knowing distant metastasis in a patient diagnosed of cancer, then they must do a proper market analysis, ask for the price quotation, compare with other alternatives available in the market and then select the best possible alternatives, with no comprise on the quality and value.

3) To minimize inventory investment. So, it is very important to purchase the product (i.e. Hospital drugs, hospital equipment, hospital machinery) from a renowned proprietor, so that the recurrent cost in maintenance can be reduced. It always advisable to sign the annual maintenance contract with the company from which the machine is purchased.

4) To operate efficiently. It is very important to check that all machines deployed in hospital emergency should be in good working conditions like potable X-rays, ECG, blood suction machines, Boyle's apparatus in OT- operation theatre etc.

It envisages maintenance of inventories of materials used in hospital and health care set up. These serve many purposes, of which, the main functions are:

a) To gain economy in purchasing, particularly where discounts are given for volume or bulk purchases. For example, bulk purchase of hospital drugs and disposables syringes and needles. It is usual practice to purchase these basic hospital items directly from the manufacturer, to get maximum discount or rebate on the bulk purchase.

b) To satisfy demand of a hospital and health care service during period of replenishment, i.e., during the time-difference between placing an order or raising a requisition and receiving the goods; It is always better to maintain the buffer stock of the lifesaving and essentials medicines to tide over this lean period.

c) To carry reserve stocks to avoid stock outs situation, especially when there may be unexpected surges in demand over short periods of time for example preparedness for monsoon and the control of epidemic due to gastroenteritis, malarial fever, typhoid, dengue fever, tetanus etc in rainy season. Procurement of essential medicines, like ORS supplements, anti-diarrhea medicines, anti- malarial fever medicines, supplementation of the stocks of essentials antibiotics etc to be done in advance and to be included in emergency preparedness, so that no one is deprived of medicines due to the above-mentioned illness and hospitals are better prepared to handle an epidemic due to the above-mentioned illness.

d) To stabilize fluctuations in consumption due to seasonal and other factors; for example, in children’s hospitals, there should be proper availability of medicines to handle seasonal illnesses like diphtheria, cholera, measles, mumps, influenza, viral gastroenteritis, viral URTI, whooping cough etc. There should be proper provision for regular and ample supply of vaccines of the above-mentioned diseases.

e) To provide reasonable levels of 'client service' (patient care): This in the case of health care delivery system, is not more than mere 'cosmetics'. This can be resolved by proper deployment of the trained manpower like doctors, staff nurses, and health counsellors, health educators who can explain about the illness and about its precautionary measures like the post of a diabetic counsellor and HIV & STD disease controller health educators in many hospitals.

Otherwise, inventories remain idle resources until they can be consumed. After all, they have been purchased or procured with capital, i.e. monetary resources (I.e. hospital fund), which are always at a premium. There are costs associated not only with the price of the resource per se, but also with the procurement process (viz., cost of ordering, cost of stationary, cost of communication, cost of record keeping and salaries of staff), the storage and preservation process cost (viz., cost of space, cost of security, cost of insurance if any, cost of record keeping, salaries etc.) and even the distribution and disposal process. In case of the district health centre, it includes cost of transporting to the primary health centre.

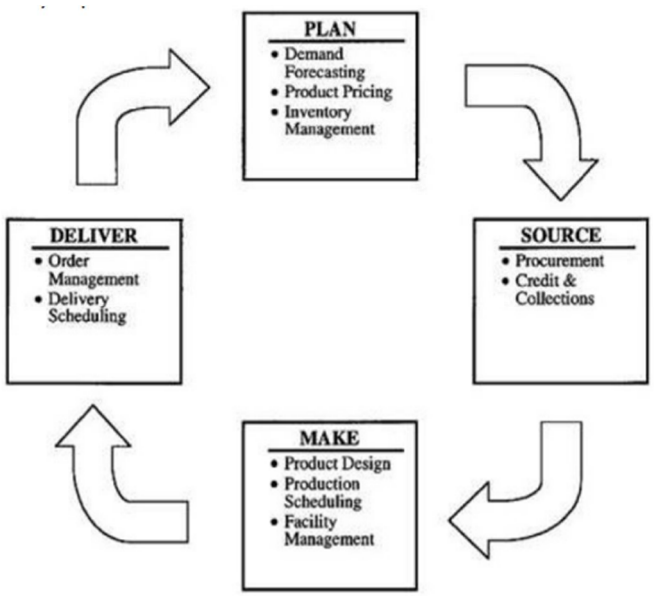
It also includes cost of disposing waste and damaged articles, transporting to sub- centres, and returning unused samples back to the headquarters etc. The headquarters of a primary health centre is the District Health Officer's office (D.H.O.) which is usually located in the district headquarters in the Zila Parishad premises.

VI. ISSUES IN INVENTORY MANAGEMENT

The basic issues relating to proper inventory management which leads to sound management of the hospital inventories are related with answering the following facts.

1) At the time of placing an order, either for purchase or procurement, what quantity should be acquired; in the parlance of materials manager 'what is the most economical quantity to order?, in a government setup usually those drug suppliers medicines are considered which quote a minimum price in their tender quotation.

2) At what point in time should an order be placed, either for purchase or procurement, in relation to existing inventory levels, or, in the language of materials managers 'How do you determine the re-order point for inventory replenishment'?



The answers to these issues relate to an understanding of the following concepts:

A. Lead Time

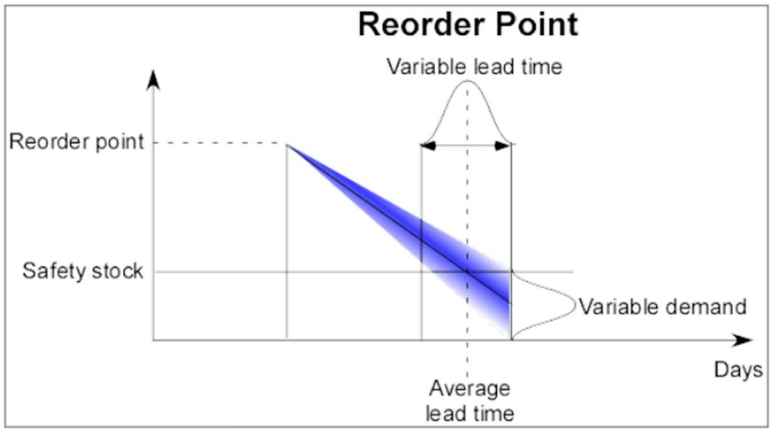
The period between placing an order and receiving the items, OR it is the time taken from the time the requisition for an item is raised, until the supplies are received, inspected, and taken into stock. This will include administrative, transportation and inspection time. Let us call it 'L'. It involves time for the completion of all or some of the following activities:

1) Raising of purchase requisition, like raising requisition for hospital drug supply.
2) Enquiries, quotations, scrutiny and approval – for example in a government set up, on particular day tenders are opened, inspected, scrutinized and the firm which quotes least price for the needed items is selected.
3) Placement of an order with supplier (s)
4) Give suppliers, ample time to keep the goods ready.
5) Transportation of items from the suppliers to the receiver i.e. hospital
6) Receipt of goods to the hospital material management
7) Inspection of received items or goods.
8) Taking the goods or items in the stocks and hospital inventories by the hospital material management.

B. Buffer or Safety Stock

The quantity of stores set apart as an insurance against the variations in demand and the procurement periods. This is the stock that must be maintained as emergency supplies for unforeseen demands. For example, it includes drugs - usually lifesaving drugs, vaccines, dressing materials, first aid boxes, etc which are to be used in the outbreak of an epidemic – like cholera epidemic or man-made or natural disasters. Let us call it 'Qo'.

C. Recorder Level



It is the stock level at which fresh orders must be placed. It usually includes reordering of the stocks or goods when the stocks in reserve or buffer stocks + the stocks to be used in the lead time gets exhausted. Let us call it 'QR'.
Reorder point = safety stock (buffer stock or reserve stock) + usage during in the lead time.

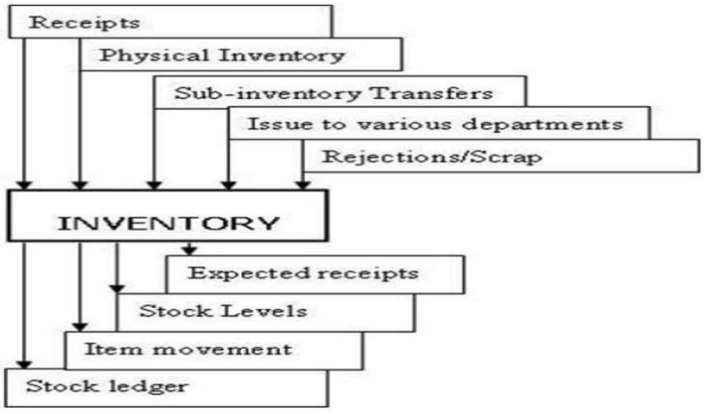
D. Stock Turnover

To ensure that there is a proper turnover of items stocked and to see that items are used up before their warranty or shelf-life or expiry date; special efforts should be made to use items on a first in first out (FIFO) basis.
In general, Qo = (Maximum Consumption rate / day - Average consumption rate/ day) x L and QR = (Average consumption rate / day) X L + Qo

E. Safety Stock

It is also called buffer or reserve stock. It is the stock maintained to prevent a stock out position situation that hampers service activities and to guard against uncertainties in consumption rates and the lead time. Thus, an extra stock is maintained which is called safety / buffer stock and it becomes beneficial when:

1) There is any excess in the process of rejection. For example, if there are large stocks of medicines in the hospital which are not moving and their expiry date is very near, for examples vaccines, sutures materials, drug eluting stents used by a cardiologist. In such situation, the hospital authorities first try to use their stocks rather than accepting the fresh stocks.



2) Rejection at the time of receipt of goods due to damage in the process of transportation, or due to poor packaging, drugs which are hygroscopic in nature and absorbs moisture and swells and becomes semi-solid in consistency or substandard in quality like drugs especially cough syrups which changes colours, or drugs whose consumption leads to fatal side effects and increased fatalities and hospital admissions.

ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.538
Volume 12 Issue XII Dec 2024- Available at www.ijraset.com

F. Economic Order Quantity

1) (EOQ) EOQ Models:

a) Static-Risk Model

This model is useful for project purchased and purchases of capital and insurance spares. Examples in this category are publication of hospital calendars, diaries, yearbooks, buying capital spares, etc., which are onetime decisions, but the quantities can be estimated in the probability values. The costs relevant for consideration are the under stocking and overstocking. It is pointless to consider the supply side costs as the purchase is not repetitive. The optimal stocking policy in this situation is to stock up to level "S" – S denoted service level – where F (S), the cumulative probability of demand up to "S" is equal to

$$\frac{Ku}{Ku + Ko}$$

b) Dynamic-Certain (EOQ) Model

The costs relevant for consideration in this model are the costs of ordering and inventory carrying. Since the demand is certain, the under stocking and overstocking costs become irrelevant for consideration.

Let the Annual Demand be M (deterministic). Let CO be the cost of ordering, CC, the unit price of an item. The total annual orderings cost when the orders are placed in quantity Q is

$$M / C_oQ$$

The average inventory carried is Q/2 and, therefore, the annual inventory carrying cost is = Q/2, SCC.

$$= \frac{M}{Q} C_o + \frac{Q}{2} +{}_sC_c$$

The costs to be minimum

$$\frac{dc}{dQ} = 0 = -\frac{M}{Q2} + \frac{1}{2} C_o + {}_sC_c$$

$$Q2 = \frac{2\,MCO}{{}_sC_c} \text{ or}$$

$$\frac{M}{Q2} C \frac{1}{2} {}_sC_c$$

or

$$Q\,(\text{optimum}) = EOQ = \sqrt{\frac{2\,MCO}{SCC}}$$

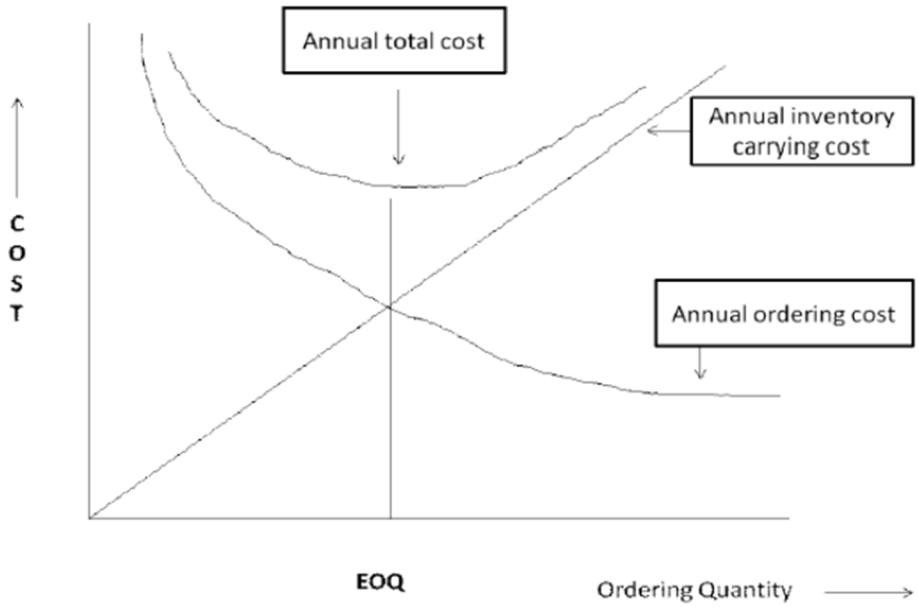
EOQ is calculated based on the following assumptions:

- Demand for the product is constant and uniform throughout the year.
- Lead-time is always constant.
- Price / unit of service are constant.
- Orderings costs are constant.
- All demands for the services will be satisfied.

The three costs considered are:

- Ordering cost.
- Inventory carrying cost.
- Total cost.

The EOQ can also be graphically shown,



- Inventory carrying cost (ICC) - Varies directly with the size of the order.
- Ordering cost (CO) - varies inversely with the size of the order.
- Total cost (TC) - It decreases first because of the fixed ordering cost and then raises because of decrease in ordering cost and increase in carrying cost.

'EOQ' represents the optimum quantity, which minimizes the total cost of inventory control. When dealing with EOQ in real situations, the following terms should be considered:

- Lead time
- Reorder point
- Safety stock

In the case of drugs and consumables which have a relatively high cost (in terms of rupee value), the dilemma may be answered by trying to balance the two major groups of costs associated with purchase or procurement of such items, viz, procurement costs or ordering costs and the holding costs or inventory carrying costs. In theory, the point at which these costs balance out is the one in which total operating costs (also called as 'working capital' are minimum. The quantity to be procured to make this total cost minimum is referred to as Economic Order Quantity. EOQ is therefore that quantity of an item to be procured or purchased at which the cost of ordering the annual requirements of an item and the cost of holding that item in stock are nearly equal, i.e., when the total of the two costs is lowest.

Therefore, this will, probably, be the quantity of an item for which the administrative cost of procuring an item equals the costs of maintaining, storing and protecting the stocks of this item.

G. Inventory Control Techniques

Inventory Control Technique represents the operational aspect of inventory management and helps to realize the objectives of inventory management and control. Several techniques of inventory control are in use, and it depends on the convenience of the firm to adopt any of the techniques.

The important aspect i.e. stressed in control techniques, is the need to cover all items of inventories and all their stages (i.e. from the stage of receipt from the supplier to the stages during their usage). Some of the commonly used techniques are:

1) Always Better Control (ABC Classification) classification
2) Vital Essential and Desirable (VED) Analysis
3) High medium and Low classification (HML)
4) Fast moving, Slow moving, Non-moving (FSN)
5) Scarce, Difficult, and easy to obtain (SDE)
6) Material Requirement Planning (MRP) classification
7) Economic order Quantity (EOQ) Classification
8) Just - in - time (JIT) Classification
9) Minimum, Maximum technique (old methods)
10) Two bin techniques (old method)

VII. HEALTHCARE INVENTORY MANAGEMENT SYSTEM

Hospitals and large healthcare organizations are responsible for keeping track of a large amount of inventory, including medical equipment and supplies, patient prescriptions, and other health and wellness products. While many have inventory management strategies in place, nearly half of the hospitals surveyed were using basic Excel sheets to manually manage their inventory. Unfortunately, supply chain costs are predicted to be the highest cost for healthcare systems this year, finally surpassing labour costs. For this reason, many providers are turning to comprehensive inventory management systems.

By implementing a strategic and streamlined supply chain process through a healthcare inventory management software, hospitals and health systems can save 17.7% or $11 million per facility annually. Therefore, many hospitals have realized the importance of inventory management and have shifted focus to finding a platform to assist in workflows should be a priority for health systems. This will help, to save money, time, and effort and more effectively manage their inventory.

Healthcare inventory management, also known as supply chain management (SCM) is a workflow responsible for keeping track of your health system's inventory, purchases, orders, payments, and more. An inventory management system is key in healthcare organizations that need to keep track of medical supplies, order and dispense prescriptions, or sell health products to patients. Within large organizations, inventory management strategies help protect your company from both monetary and product losses, by keeping an updated and accurate log of products and supplies.

VIII. BENEFITS OF AN INVENTORY MANAGEMENT SYSTEM IN HEALTHCARE

A. *Streamline Inventory Workflows*

Managing large amounts of inventory using an Excel spreadsheet is time-consuming and leaves much room for error. It's likely that supplies are being managed inefficiently, and too much time is spent taking inventory during the workday; this time could easily be reallocated to essential patient-facing care. However, implementing a comprehensive inventory management system has the potential to improve staff efficiency, reduce inventory supply costs, and overall improve the organization's bottom line.

Most importantly, virtual inventory management eliminates the need for paper workflows, including printing, mailing, filing, and faxing. All important information regarding inventory is easily accessible through a secure, cloud-based platform. This allows for increased visibility regarding the inventory available; therefore, staff has a better idea of what supplies, equipment, and medications are currently available for use. This, in turn, reduces product waste by avoiding ordering unnecessary items that are already well-stocked. It also reduces the margin of error in prescribing medications that are out of stock, avoiding leaving patients without necessary medications, a huge benefit of having an inventory management software.

B. *Contract Compliance*

When purchasing large amounts of healthcare related products, it is strategic to work with distributors and manufacturers that offer bulk purchasing contracts. These types of contracts are crucial in getting reduced prices when purchasing large amounts of essential product and medication. However, implementing this strategy requires an efficient inventory management system. If inventory is ineffectively managed, healthcare systems may either find themselves with too much or too little product, leading to a situation in which they would need to break their bulk purchasing contracts to place early or delayed orders at full price. With a proper supply chain management system in place, the risk of this happening is lowered significantly.

C. Improves Communication Between Care & Admin Teams

It is likely that in large healthcare organizations, there is an administrative team in charge of inventory management. However, this team is not likely to include healthcare providers of any level. The administrative team is therefore very knowledgeable on the current inventory availability and needs, while care teams with limited access spend unnecessary time tracking down information from those responsible for inventory management. A virtual inventory management software allows both teams access to necessary inventory updates regarding medications and healthcare supplies.

D. Instrument & Equipment Protection

Having to replace medical instruments equipment that have been lost or misplaced is extremely costly for any healthcare business. A comprehensive inventory management software lets you track exactly where equipment is and who's accountable for it, giving you the power to protect your investments that allow you to provide stellar care.

E. Digitize your Data by Going Paperless

Still wondering what the importance of inventory management in healthcare is. A healthcare inventory management system not only helps you keep inventory information more organized in a visual way, but also allows you to go paperless. Digitizing data to help the environment while improving accuracy, optimizing workflow, and providing more time for patient care is a big win-win.

IX. AIMS AND OBJECTIVES OF INVENTORY CONTROL

The Aims and objectives of Inventory Control are to:

1) Maintain availability of materials whenever and wherever required in optimal quantity.
2) Minimize the ineffective stock, which may be drugs, dressing materials, suture, etc.
3) Optimize the various costs associated with inventories, such as purchase cost, carrying cost, shortage cost etc.

The basic principle of inventory control is also to contain costs. There are four types of costs involved in the management of material suppliers as described earlier. The purchase cost of a hospital item is the direct cost of the materials, which is inclusive of taxes and freight. We can reduce this cost without compromising with the quality of the supplies. The techniques followed are bulk buying rate contract, and combined buying, negotiating purchase prices by assuring long-term business. The carrying cost consists of costs incurred on money invested, storage space, additional manpower, obsolescence, breakage, and pilferage is difficult to calculate. It can be generally about 30 per cent of the actual cost of inventory. To control this cost, we must strike a balance between the purchase cost and carrying cost by procuring the items in optimum quantity, known as the Economic Order Quantity, which is discussed earlier in this unit. The shortage cost covers the loss of hospital revenue due to the non-availability of critical items other than the extra cost, which must be paid to procure this item from an alternate source. To contain this cost, it is advisable to have two to three suppliers of good reputation for all the critical and vital items. The ordering costs both direct and indirect will go up with more frequent orders. The technique to control this cost is again by effecting economy in materials management.

X. CLASSIFICATION OF INVENTORY CONTROL

For the better management of inventory, one must classify the inventory so that control of the inventory becomes much easier and effective. The basic principle of the classification of hospital inventory is based on Pareto's Law, Pareto a German economist while studying the income pattern of a given city, found out that 20 per cent of the people have got 80 per cent of the total money and rest of the 80 per cent of the people were having 20 per cent of the money. This finding of Mr. Pareto is equally applicable to so many other spheres of life, as well as in the classification of Inventory Management.

The types of selective Inventory Control are as follows:

1.	ABC	- Based on cost criteria i.e. annual consumption cost of the items - Does not depend on unit price of the item. - Hence it is also known as always better control (ABC)
2.	VED	- Vital, Essential, Desirable - Based on importance, criticality, and shortage cost of the item in terms of availability, function, specifications, source of supply, production process, storage, etc. - Commonly used for management of consumable items.

3.	HML	- High, Medium, Low - Based on unit price - Does not depend on consumption
4.	SDE	- Scarce, Difficult, Easy to obtain. - Based on purchasing terms with respect to availability
5.	GOLF	- Government, Ordinary, Local and Foreign - Based on source of supply from which materials is procured
6.	FSN	- Fast moving, slow moving and Non-moving - Based on issues of hospital stocks from stores
7.	XYZ	- Based on the value of Inventory stored in hospital stores
8.	SOS	- Seasonal, off Seasonal

XI. FUNCTIONS OF INVENTORY CONTROL AND CRITERIA OF INVENTORY CONTROL

The main functions of the hospital inventory control are to have the optimal quantity of the items at any time and every time in all the service outlets. Inventory control will ensure that there will be no stock outs whereas at the same time there should not be any over- stocking.

The functions of the hospital Inventory Control are mainly:

1) Stocking of an adequate amount, number, and range of stores (or kind of stocks or materials) at all service outlet points.
2) Provide a maximum supply service consistent with maximum efficiency and optimum investment.
3) Provide a cushion between the forecasted and actual demand for a material; and
4) Give an optimal outlay of financial and human resources.

A. Needs / Necessity of Inventory Control

1) A good inventory / control maintains availability of materials and controls stock- out and under-stocking. The cost of not having the hospital items sometimes is costlier than the cost of having, because a hospital is meant for providing round the clock services i.e. 24 hours services to patients. This in the long run improves the image of the health centre / hospital.
2) At the same time, good inventory management also controls over-stocking vis-à-vis minimizes the ineffective stock. May be that is the reason that the business world says inventories are necessary evils as they drain out the company's profit.
3) A good inventory control will have a direct impact on the service provided by the hospital / health centres; as a result, it will enhance the patient's satisfaction and better service conditions.
4) Inventory control is also a necessary measure to control the various costs, which were discussed earlier. Larger the inventory greater are the problems with respect to investment, planning, procurement, handling, receiving, inspection, storage, distribution, accounting, deterioration, obsolescence, pilferage, damage, shelf life etc. Other than those it also controls the costs raised due to changes in line of treatments, and changes in the government policies for various health programmes from time to time.

B. Scope of Inventory Control

An efficient hospital inventory control system can:

1) Reduce costs - operational cost of running a hospital.
2) Improve service delivery - related to patient care.
3) Increase return on investment, especially in corporate hospitals which are meant for making profits.
4) Improve liquidity.
5) Improve service conditions - inpatient, out-patient & care of patient's in casualty.
6) Increase efficiency of man and machine
7) And hence improve patient’s satisfaction and good will of the hospital / health centre in the community.

C. Factors Involved in Determination of an Inventory Policy

The basic questions asked in determination of an inventory policy in a health care organization are what to order, when to order and how much to order.

1.	Requirement	-	Quantity in stock / in transit.
		-	Quantity to be procured keeping in view the consumption pattern, fluctuation in demand and utilization.
		-	Seasonal and peak requirements
2.	Lead time	-	Internal and external lead time
3.	Cost Factors	-	Ordering cost
		-	Inventory carrying cost
		-	Under / over-stock cost
		-	Saving in transportation
		-	Discount
4.	Liquidity / Financial	-	This will decide capacity to buy and capacity to position / hold inventory.
5.	Availability Credit		
6.	Obsolescence	-	Change in design of final indent
		-	Change in design of quantity of the item
		-	Advent of newer drugs and antibiotics
7.	Government Policies	-	Imported / Channelized items
		-	Change in import duty / custom duty especially before the budget
8.	Storage	-	Shelf life, inflammable, evaporation, deterioration, bulky items, air-conditioned environment to store etc.
9.	Patient Service	-	Smooth deliveries result in lower inventories
	Provider Relations	-	Increase / decrease in quantity in peal / slump season or due to change in indent / consumption rate.
10.	Marketing Conditions	-	Items easy to get yesterday may be difficult to get tomorrow and vice-versa.
11.	Other factors such as single source, multiple sou rces, proprietary items, location of source of supply, import substitution, make or buy decision etc.		

D. How to Reduce Inventory cost in a health Care Organization

1) Fixing up a maximum limit of inventory in terms of value.

2) Fixing up responsibility of controlling the inventories with one person preferably at senior level reporting to the top management, for example the medical superintendent of a hospital set up.

3) Meticulous materials planning and forecast, based on experience and feedback given by treated patients.

4) A well designed and defined inventory control system.

5) Fixing up a realistic inventory level i.e. maximum, minimum, reorder levels and the satisfy stock inventory level should be fixed item-wise / location wise, depending on the nature of drug and types of patients illness.

6) By reducing lead-time, and promoting the supply of drugs in time, so that needy & sick patients can be treated on time i.e. within the golden period.

7) Adjustment in inventory levels. Wherever called for Inventory levels should be adjusted as per the changes in requirements / consumption, change in market conditions etc, but try to avoid overstocking of life saving & essentials drugs.

8) Strict control on obsolete, slow moving and non-moving items.

9) Reducing the number of stock points.

10) Standardization and variety reduction.

11) Maintaining close co-ordination with other user departments like store, quality assurance, finance, marketing, vigilance etc. and creating an awareness and positive attitude at all levels in all the departments. To reduce the inventories. Push the idea that inventories are cash.

12) Computerize the inventory control system.

13) By improving the buyer-seller relationship, selecting the right source of supply in terms of location, quantity, and quality etc.

ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.538
Volume 12 Issue XII Dec 2024- Available at www.ijraset.com

XII. IMPORTANT TECHNIQUES OF INVENTORY CONTROL

Materials management involves thousands of individual transactions each year. To do their job effectively, a materials manager must avoid distraction of unimportant details and concentrate on significant matters. Inventory control procedures should isolate those items that require precise control from those that do not. For this purpose, items are classified based on several criteria. The commonest classification widely used is ABC analysis, VED analysis and SDE analysis.

A. ABC Analysis

ABC analysis, popularly known as "Always Better Control' or the alphabetical approach, has universal application in many areas of human endeavour. ABC analysis does not depend on the unit cost of the items but only on its annual usage and not on their importance because all items are important. Analysis commonly classify inventory into three categories 'A', 'B' and 'C' items have a high annual usage in terms of money investment. 'B' items are average, while 'C' items have a low value of usage. Every item in the inventory is ranked and listed in order of the items annual value of usage. At the top of the list, would be the high value items, followed by a longer list of medium value items, and finally a long list of low value items. The dividing line between the classes of items is arbitrary. These classes of items, thus, can be identified as:

Category	Percent of Items	Percent of Investment
A	10-15	70-80
B	20-25	15-25
C	60-70	5-15

The main aim of the ABC technique is to distinguish those items that have the most bearing on the inventory costs, so the management can concentrate efforts on those items that promise the highest possible pay offs in terms of savings. Thus, with ABC analysis more attention can be paid to a few high value items rather than many low value ones. For example: different diagnostics used in the radiology department like functional MRI, Non -contrast MRI, Cardiac MRI, in which the costliest is Cardiac MRI. Similarly, pain killer gel forms are the most used hospital items and form the bulk of commonly used hospital items.

B. VED Analysis

This analysis is based on the critical value of an item and its effect on the functioning of the health care institution.

'V' stands for Vital Items, without which an institution cannot function, or its functioning comes to a grinding halt. Such items should always be available in sufficient quantity and a sufficient safety stock should be maintained to ensure hundred per cent availability all the time. These items should be controlled by the top management (like chief medical superintendent, chief medical officer, or head of the departments.)

'E' stands for Essential Items, without which an institution can function but may affect the quality of service to some extent. These items should be controlled by middle level managers. (Senior manager, associate professor, deputy medical superintendent)

'D' stands for Desirable Items. It is desirable to have these items but without these items an institution's functioning will not suffer. These items may be controlled at a lower management level. (Officer in charge, office superintendent, Assistant manager etc)

C. SDE Analysis

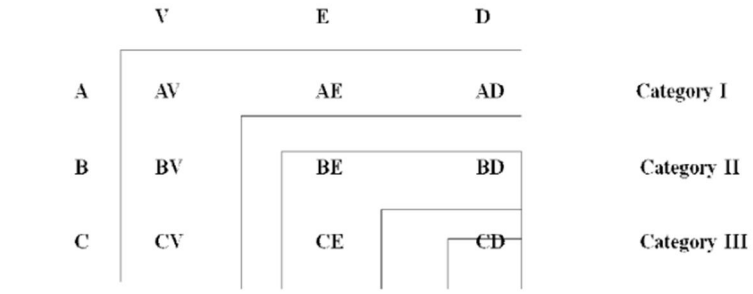
SDE Analysis is based on the availability position of hospital items in the market and the position may vary from time to time. 'S' is those items, which are scarce in the market. These are to be controlled by the top management and large safety stocks to be maintained. 'D' items are difficult to obtain but are available in the market. 'E' items are easily available in the market.

From the above, it will be seen that ABC analysis is done from the capital investment angle, VED analysis is done from the use point of view and SDE analysis is done from a procurement angle. The findings of ABC and VED analysis can be coupled, and further groupings can be done to evolve selective inventory control systems.

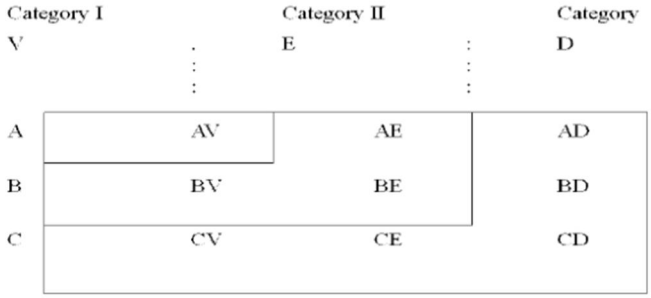
D. Models of ABC-VED Combination

There are two models of this combination, which are generally in use:

Model I



Model II



A high degree of control on inventories of each item would neither be practical considering the work involved, nor worthwhile since all items are not of equal importance. It is desirable to classify them into groups of items to control, which is commensurate with its importance. These analyses are based on the principle of 'Vital few trivial many' and a higher degree of attention is focused on vital, few which affects the results significations. The service levels of various items should consider of these classifications, and from an overall objective point of view. The suggested service levels for various items are:

		V	E	D
A	S	85%	75%	70%
	D	75%	70%	60%
	E	60%	50%	50%
B	S	95%	85%	75%
	D	80%	75%	65%
	E	70%	70%	50%
C	S	99.9%	95%	80%
	D	90%	85%	70%
	E	80%	80%	60%

XIII. THE ORDER SIZE

The problem of determining the purchase quantity becomes critical only for items that are routinely carried in stock. The Purchase quantity of hospital stocks items not only determines inventory level, but also affects the internal operation costs. The determination of an optimum order quantity is influenced by two forces pushing in opposite directions, a large purchase quantity maximize inventory carrying costs and minimize the ordering costs, while the converse is true when purchase quantities are reduced.

The Economic Order Quantity (EOQ) is that value of purchase quantity that will yield the minimum total cost of a lot. This occurs where the marginal holding cost (inventory carrying cost) is equal to the marginal set up or ordering cost. Thus, the quantities to be purchased in any one order is decided with a view to striking an optimum balance between the ordering of an inventory and carrying costs.

XIV. DISTRIBUTION PROCESS

The hospital materials manager is not only responsible for buying and storing hospital materials, but also for ensuring that the right supplies (which is according to the need of the user department, like posterior mirror laryngoscope can be used by the ENT department only) in the right quantities (right quantities of plaster of Paris cast, must be supplied to the orthopaedic departments, for closed reduction of fracture cases) are made available to the right locations (like instalment of whole body MRI for metastatic survey in the oncology department of a hospital set up) at the right time (like use of AED- AUTOMATED ELECTRONIC DEBFRILLATOR to give shock waves , in a patient of atrial fibrillation to control abnormal heart Rhythm) where these are required. Material is first moved from receiving to a storage area that is associated with Stores Management. It may then be done by keeping an inventory until it is transported to an ultimate user, who may then store it until the material is finally consumed. It is the responsibility of the consuming department in a hospital set up to come and collect the material from the central medical stores. There are many approaches to accomplish this:

A. Fetch and Carry System

Someone in the user department is delegated the responsibility for maintaining an adequate level of supplies, filling out the required requisition form for all the items needed and getting the requisition to the Central Stores for Processing. The Central Store in turn fills the order and delivers the requested items on a supply cart to the user department. Mostly, the distribution of materials to be supplied to PHCs and sub-centres by the district follows this system for dispensing the same to beneficiaries.

B. The Par Level System

Each department uses the local storage space as and when ordering from the Central Stores. Supply quotes for each supply items are established in conjunction with each department. These quotes are reviewed and updated at least quarterly. The quotes are maintained by the Central Stores. An attendant from stores generally makes the round of all user departments at frequent intervals, using a large transfer cart the attendant replenishes all the stock back to the pre-assigned 'par level'.

C. The Total-Supply-Cart Exchange System

It is the newest, mode of materials distribution. It works best when carts include all items used by a user department and when the quotes are established. Here too they need to be reviewed periodically. The par system is characteristic of both exchange cart and par distribution methods if it can identify usage by the user unit during the review period. The more frequent the review, the fewer inventories are needed in the user area. The empirical role is to review high level 'A' item daily and to review low value 'B' and 'C' items about twice per week.

XV. MAINTAINING STOCK LEVELS

It is necessary to ensure the correctness of the stock shown in the stock cards and to detect shortages, deterioration, or irregularities etc. Many discrepancies may go undetected for a long period if there is no stock verification. The stock can be verified periodically by checking all the stocks in a few days. The physical stock of various items is recorded in the stock card and then compared with the bin card balance. In the case of expensive and attractive items, continuous stock verification may be made by daily checking of stock of few items, thus covering all the items twice in a year. In addition, snap checks may also be made by the Officer In-charge of the Stores to ascertain the way the store is functioning.

XVI. TOP HOSPITAL INFECTION CONTROL TECHNIQUES

For patients and staff alike, the greatest threat to healthcare facilities is the failure to prevent and control infection risks. Infection control is a top priority for all clinical facilities across the country: so, let’s review the basics of infection control.

9 techniques to enhance infection control:

1 - Taking A Holistic Approach
2 - Create an Infection Control Policy
3 - Screen Patients and Isolate Contagion
4 - Education, Education, Education!
5 - Use PPE (Personal Protective Equipment)
6 - Avoid Cross Contamination
7 - Vaccinations
8 - Ventilation
9 - Protecting Medical and Healthcare Staff and Patients from Infection

A. Taking A Holistic Approach

The entire healthcare facility is accountable for supporting an infection prevention program, not just infection preventionists. Every interaction across departments can increase or decrease cross-contamination and infection risks. The pandemic has put a spotlight on how previously innocuous interactions and events can contribute to increased infection risks.

B. Create an Infection Control Policy

An infection control policy details which patients have the highest risks for contracting or passing along Healthcare Associated Infections (HAIs). The policy should include information for when patients should be placed on isolation precautions, or otherwise prevented from contacting other patients and staff.

C. Screen Patients and Isolate Contagious Individuals

Highly contagious patients, or patients with a contractable virus should be identified as early as possible. An example of this is testing for Clostridium Difficile, a bacterium which can be life-threatening.

D. Education, Education, Education!

Education is key for infection control in healthcare settings. Your organization should provide continuous education and training to staff on infection control. Education should include training on bloodborne pathogens, which can be contracted via needlestick injuries.

E. Use PPE (Personal Protective Equipment)

PPE has always been critical in healthcare settings, and the COVID-19 pandemic has underscored its importance. This includes but is not limited to masks and face shields, aprons, and gloves. Masks help prevent the spread of droplet-borne pathogens, and gloves are useful when meeting blood or bodily fluids.
Isolation-appropriate protective equipment includes waterproof aprons, gloves, shoe covers, face shields and masks. If patients have a contagious illness, appropriate isolation equipment should be readily available for use.

F. Avoid Cross Contamination

Utilize proper disposal techniques and containers to reduce risk of cross-contamination and spreading of bacteria. Between patients, rooms should be disinfected and sanitized. This will prevent transmission of infection between patients. Staff should properly sanitize & clean linens, and linens should not be left on patients' beds for extended periods. In addition to this, although it might seem simple, hand hygiene is still a major part of infection control. In the wake of COVID-19, handwashing was highly advised to help prevent the spread of the virus. Here are some tips from the CDC regarding hand washing techniques.

G. Vaccinations

Infection preventionists note that medical staff themselves may sometimes be the cause of the spread of healthcare-associated infections due to their close contact with patients with different diseases. This means that medical practices should routinely administer recommended vaccinations to their staff. You can access the CDC recommendations for COVID-specific vaccinations here. It might be challenging to tell the difference between some post-vaccination signs and symptoms from signs and symptoms of COVID-19 or other infectious diseases.

H. Ventilation

Improvements to building ventilation can reduce the spread of disease and lower the risk of exposure to HAIs. This method of infection control has been highlighted during the COVID-19 pandemic.

I. Protecting Medical and Healthcare Staff and Patients from Infection

One of the driving factors behind stringent infection control is the waste management and protection of those who are in contact with biohazardous waste. Measures to protect the workers who generate and handle medical waste include:

- Fit-for-Purpose and non-contact bins for the collection of infectious waste.
- Following OSHA guidelines for discarding regulated medical-waste items
- Employing waste handling practices that minimize the "touches" of infectious waste and its outer packaging.
- Tamper-proof containment before collection, ensuring waste is sealed in leakproof packaging.
- Waste Consolidation and readiness for storage and transport that minimizes risk of spillage and cross-contamination.

XVII. CONCLUSION

Materials management attempts with organizational goals. Materials management attempts to get the right goods, at the right price, at the right time to maintain a desired service level at minimum cost. Materials costs in hospitals vary from 30 to 40 per cent of the total hospital costs.

The health administrator must ensure the regular availability of all the essential materials to avoid the stock out situation of the vital and essential items. Materials management is now well accepted as a quantitative technique of operations research and has been successfully employed in the industry. Materials management is also known as logistics and supply management system. The word Logistic has economic connotations. The goal of material management includes Optimum materials acquisition, Optimum inventory turnover, good vendor relationship, Materials cost control, Effective issue and distribution, Elimination of losses and pilferage. The hospital material needed for the hospital should be Right material, in Right quantities, at the Right time, at Right price, from Right sources and at the Least cost.

Materials Management is concerned with the planning, organizing and controlling the flow of materials, from their initial purchase through internal operations to the distribution or to the service point Health care managers must at all times be aware of the seven cardinal principles or elements: 1. Right item / material, 2.Right quantity, 3. Right price, 4. Right source, 5. Right delivery time, 6. Right methods / systems, 7. Right people / attitude oriented towards innovation improvements. The four essential needs for materials management around which health care organizations should be focusing are 1. To have material on hand when needed, 2. To have material on hand when needed, 3. To minimize inventory investment 4. To satisfy demand during period of replenishment, to operate efficiently. Main functions of inventory maintenance are 1. To gain economy in purchasing, over short periods of time, 2. To stabilize fluctuations in consumption due to seasonal and other factors, 3. To provide reasonable levels of 'client service', which, in the case of health care delivery system, is not more than mere 'cosmetics'. Issues in Inventory Management are at the time of placing on order, either for purchase or procurement, what quantity should be acquired, at what point in time an order should be placed, either for purchase or procurement.

Lead Time is the period between placing an order receiving the items, or it is the time taken from the time the requisition for an item is raised, until the supplies are received, inspected, and taken into stock. Buffer or Safety Stock is the quantity of stores set apart as an insurance against the variations in demand and the procurement periods. Recorder Level is the stock level at which fresh orders must be placed. Safety Stock is also called buffer or reserve stock. It is the stock maintained to prevent a stock out position situation that hampers service activities and to guard against uncertainties in consumption rates and the lead time. Economic order quantity (EOQ) represents the optimum quantity, which minimizes the total cost of inventory control. In the case of drugs and consumables which have a relatively high cost (in terms of rupee value), the dilemma may be answered by trying to balance the two major groups of costs associated with purchase or procurement of such items. Inventory control technique represents the operational aspect of inventory management and helps realize the objectives of inventory management and control. Several techniques of inventory control are in use, and it depends on the convenience of the firm to adopt any of the techniques. some of the commonly used techniques are: Always Better Control (ABC Classification) classification, Vital Essential and Desirable (VED) Analysis, High medium and Low classification (HML), Fast moving, Slow moving, Non-moving (FSN), Scarce, Difficult and easy to obtain (SDE), Material Requirement Planning (MRP) classification, Economic Order Quantity (EOQ) Classification, Just - in - time (JIT) Classification, Minimum, Maximum technique (old methods), Two bin techniques (old method). The basic reason under lining ABC analysis is to exercise selective control on inventories thereby economizing the efforts and costs involved in inventory management without materially reducing the extent of control exercised. The main objective of carrying out the ABC analysis is to develop policy guidelines for selective control of items. Just in time (JIT), or the Japanese method of integrated philosophy by team approach, is applicable not only to the various components of inventory but also in most of the day-to-day activities. Logistics or materials management, as already defined, is that activity of management, which primarily concerns with the efficient flow of materials, to, through and out of an organization for its optimum use.

The Aims and objectives of Inventory Control are to maintain availability of materials whenever and wherever required in optimal quantity, Minimize the ineffective stock, Optimize the various costs associated with inventories. For the better management of inventory, one must classify the inventory so that control of the inventory becomes much easier and effective. The types of selective inventory control are ABC, VED, SDE, GOLF, FSN, XYZ, and SOS. The functions of the inventory control are mainly stocking of an adequate amount, number, and range of stores (or kind of stocks or materials) at all service outlet points; to provide maximum supply service consistent with maximum efficiency and optimum investment, to provide a cushion between the forecasted and actual demand for a material; and give an optimal outlay of financial and human resources.

An efficient inventory control system can reduce costs, improve service delivery, increase return on investment, improve liquidity, improve service conditions, increase efficiency of man and machine, and hence improve patients, satisfaction, and good will of the hospital / health centre in the community. Factors Involved in Determination of Inventory Policy are Requirement, Lead time, Cost Factors, Liquidity / Financial Availability, Credit Obsolescence, Government Policies, Storage etc. ABC analysis, popularly known as "Always Better Control' or the alphabetical approach, has universal application in many areas of human endeavour. The main aim of this technique is to distinguish those items that have the most bearing on the inventory costs, so the management can concentrate efforts on those items that promise the highest possible pay offs in terms of savings. The Economic Order Quantity (EOQ) is that value of purchase quantity that will yield the minimum total cost of a lot. The Total-Supply Cart Exchange System is the newest, mode of materials distribution. It works best when carts include all the items used by a user department and when the quotes are established. Maintaining a stock level is necessary to ensure the correctness of the stock shown in the stock cards and to detect shortages, deterioration, or irregularities etc. Many discrepancies may go undetected for a long period if there is no stock verification. The stock can be verified periodically by checking all the stocks in a few days.

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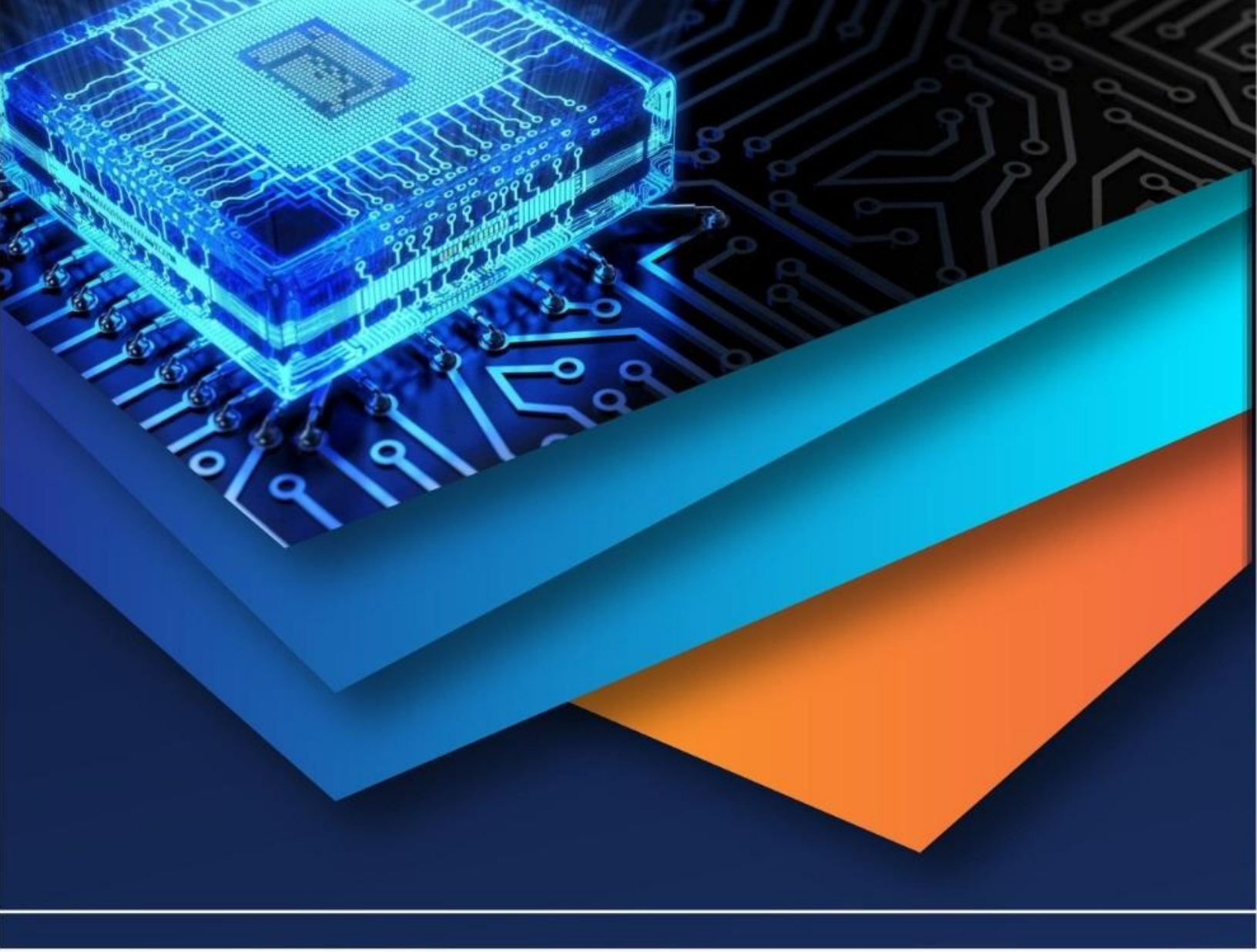

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