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Review Article

## REVIEW ON: INVENTORY MANAGEMENT

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### Abstract:

*The pharmacy is one of the most extensively used facility in healthcare where a large amount of money is spent for purchasing medicinal items. In pharmacies, various drugs are being stored for supporting the therapy of patients. Due to the variety of pharmaceutical items, it is a difficult task to control and manage the quantity of drug. For a better and effective service management in a pharmacy, it is required a drug that must be provided continually at correct time and quantity to sustain steady in supply. This can be accomplished by efficient inventory management of pharmacy by providing control on important drugs, and deciding on priorities in purchase and distribution. Therefore, the inventory management ensures significant improvement for both patient care and optimal use of resources. Three important methods regarding inventory management practice were studied such as ABC (Always, Better, Control) analysis, VED (Vital, Essential, Desirable) analysis, and ABC-VED matrix analysis.*

**Keywords-** Drug Inventory Management; Pharmacy; ABC; VED

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**INTRODUCTION:**

The advent of advanced medical technology is resulted in a disproportionate increase in the expenditure on health care. Therefore, a hospital spends about one-third of its budget on purchasing materials and supplies including medicines.[1] In pharmacy, a few areas where a large amount of money is spent on buying items and it is one of the most extensively used therapeutic facilities of the hospital.[2] Hospital supply system should ensure adequate stock of all the required items to maintain uninterrupted supply. This evokes the effective and efficient inventory management of pharmacy store by keeping a close supervision on important drugs, prevention of pilferage, and priority setting in purchase and distribution of drugs. A study suggested that review for expensive drugs could bring out 20% savings in pharmacy store budget. Hence, the essentiality of inventory management is articulate.[3] Inventory is represents an important decision variable at all stages of product manufacturing, distribution and sales, in addition to being a major portion of total current assets of many business. Inventory usually represents approximately 40% of the total capital of industrial organizations. It comprises 33% of company assets and 90% of working capital. Inventory constitutes a major segment of total investment. It is crucial that good inventory management be practised to ensure growth and profitability.[4] The principal goal of inventory management is to balance the conflicting economics of not wanting to hold too much stock.[5] Drug inventory management desire at cost containment and improved efficiency.[6] The inventory management is bring out significant improvement not only in the optimal use of resources but also in patient care. Continuous management can provide the value added services to the patients.[3] Inventory control is very essential in a developing country like India. India is a country of scarce resources and it is the primary responsibility of each hospital to ensure optimum utilization of available resources to provide good service or quality patient care.[7]

**Historical review of inventory management**

Historically, inventory management is often meant too much inventory and too little management or too little inventory and too much management. Inventory management is generated as technological progress has increased the organizations abilities to produce goods in greater quantities, faster and with multiple design variations. There can be severe penalties for excesses in either direction. The public has compounded the problem by its receptiveness to variations and frequent design changes.[8] Since in mid 1980s, the strategic benefits of inventory

management and production planning and scheduling have become evident.[9] World Health Organization suggested that no single individual should have total control of pharmaceutical purchasing and procurement. A designated purchasing committee will review and approve all purchases.[10]

**Inventory**

Any stock that a firm keeps to meet its future requirement of production and sales is called "INVENTORY". The basic reason for holding inventory is to keep up to the production activities unhindered. It is neither physically possible nor economically justifiable to wait for the stock to arrive at the time when they are actually required. Therefore, keeping of inventory is necessary for the efficient working of an organization.[11]

The proper control need in inventory as it is one of the largest assets of an organization. Inventories should be neither excessive nor adequate. If inventories were kept at a high level, higher interest and storage costs would be incurred; on the other hand, a low level of inventories may result in frequent interruption in the production, schedule resulting in under utilization of capacity and lower sales. The main objective of inventory management is to determine and maintain the optimum level of investment in inventories, which help in achieving the required objective. The Inventory Management is control operating costs and provide better understanding.[12]

**Definition and Concepts**

In pharmacy operations, inventory is referred to the stock of pharmaceutical products confined to meet future demand. Inventory represents the largest current asset, as well as liquid asset in pharmacy practice and its value continues to rise because of the growth in variety and cost of pharmaceutical products. Inventory management is defined as the continuing "process of planning, organizing and controlling inventory" that aims at "minimizing the investment in inventory while balancing supply and demand".[13] Inventory management refers to all the activities which is involved in developing and managing the inventory levels of raw materials, semi-finished materials (work-in-progress) and finished goods so that sufficient supplies are available and the cost of over or under stocks are low.[14] The cost of maintaining inventory is included in the final price paid by the consumer. Good inventory represents a cost to their owner. The manufacturer is the expense of materials and labour. The wholesaler also funds tied up. The basic goal of the researchers is to maintain a level of inventory that will provide optimum stock at lowest cost.[15]

Another author accent that inventory management in its expansive perspective is to keep the most economical amount of one kind of asset in order to facilitate an increase in the total value of all assets of the organization – human and material resources.[16] The chief objective of inventory management and control is to inform managers how much of a good to re-order, when to re-order the good, how frequently orders should be placed and what the appropriate safety stock is, for minimizing stock outs. The overall goal of inventory is to have what is needed, and to minimize the number of times one is out of stock.[17] In future demand, inventory is a stock of goods that is maintained by a business in apprehension.[18] This definition is also supported by author who stressed that inventory management is an impact on all business functions, particularly operations, marketing, accounting, and finance. He established that there are three motives for holding inventories, which are transaction, precautionary and speculative motives. The transaction motive occurs when there is a need to hold stock to meet production and sales requirements.[19]

#### **Inventory-Associated Costs**

The four types of costs associated with inventory in pharmacy practice: acquisition costs, procurement costs, carrying costs, and shortage costs.[20-21] Acquisition cost is the net amount of money the pharmacy pays for the products. Procurement costs represent the costs associated with purchasing of the products, which include placing and receiving orders, stocking and paying invoices. Carrying costs refer to costs associated with product storage, which also include costs induce as a result of crisis, e.g. theft or damage. Shortage costs, is also known as stock-out costs, that are having the costs of not having the product on the shelves when needed.

#### **Types of Inventory**

The three main types of inventories are raw materials, work-in-progress, & finished Goods.

- **Raw Materials:**  
Raw Materials are those inputs that are converted into finished product through the manufacturing process. Raw material inventories are those units which have been purchased and stored for future productions.
- **Work-in-Progress:**  
Work-in progress, also called stock-in-progress. These inventories are semi manufactured products. They represent products that need more work before they become finished products for sales.

- **Finished Goods:**  
Finished goods inventories are those completely manufactured products which are ready for sale. Stock of raw materials and work in progress facilitate production. While stock of finished goods is required for smooth marketing operation. Thus, inventories serve as a link between the production and consumption of goods.[22]

#### **Functions of Inventory:**

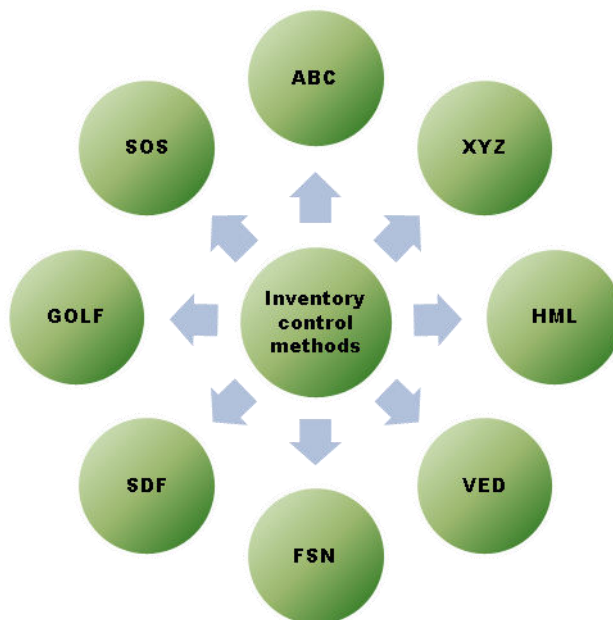
1. **To meet anticipated customer demand.** These inventories are referred to as anticipation stocks because they are held to satisfy planned or expected demand.
2. **To meet production requirements.** Firm that experience seasonal patterns in demand often build up inventories during off- season to meet overly high requirements during certain seasonal periods. Companies that process fresh fruits and vegetable deal with seasonal inventories.
3. **To decouple operations.** The buffers permit other operations to continue temporarily while the problem is resolved. Firms have used buffers of raw materials to insulate production from disruptions in deliveries from suppliers, and finished goods inventory to buffer sales operations from manufacturing disruptions.
4. **To protect against stock-outs.** Delayed deliveries and unexpected increases in demand increases the risk of shortages. The risk of shortage can be reduced by holding safety stocks, which are stocks in excess of anticipated demand.
5. **To take advantage of order cycles.** Inventory storage enables a firm to buy and produce in economic lot sizes without having to try to match purchases or production with demand requirements in short run.
6. **To hedge against price increase.** The ability to store extra goods also allows a firm to take advantage of price discounts for large orders.
7. **To permit operations.** Production operations take a certain amount of time mean that there will generally be some work-in-process inventory.[23]

#### **Inventory Management Process**

Among the essential eight roles of the pharmacist that are described by the World Health Organization and the International Pharmaceutical Federation, managing resources (money, material, manpower, time, and information) is a key factor to professional success on individual level, as well as organizational level .[24]

**Inventory management tools**

The tools of inventory control / inventory management are as follows:



**Table: 1 Selective inventory control categories and criteria [25]**

Sr. No.	Category	Criteria	Application
1.	ABC Analysis	Annual value(Consumption rate* Price Rs./Piece )	For material which go in to the production
2.	XYZ Analysis ( Use for 2-D study	Closing stock value of inventory at the time of physical stock verification	A category status eg. A category in X: watch C category in X: reduce stock level
3.	HML (High, Medium, Low) Analysis	Unit price	To keep in check high cost items
4.	VED Analysis (Vital, Essential and Desirable)	Criticality or Loss of production	For controlling maintenance for spare and manufacturing equipment.
5.	FSN Analysis (Fast, Slow and Non-Moving)	Issues from store give idea. Dispose non-moving inventory	Fast moving items should be kept in high level
6.	SDE Analysis (Scars, Difficult and Easily available)	Procurement difficulties (Source of Procurement)	To keep vigil on availability, should be kept in stock keeping in mind difficulty in procurement and may follow forward buying
7.	GOLF Analysis (Govt., Ordinary, Local and Foreign )	Govt.- Lead time more for retrieval, advance payment Foreign- Procedure long through bank, port , permission, duty etc.	Government supplies need patience to get material; canalizing agency can be used, foreign procurement lead time factor counts.
8.	SOS Analysis (Seasonal and Off- Seasonal)	Soya bean, farm produce, high off season price, low in harvest season.	Should buy in harvest season to get price advantage and good quality supply.

**ABC Analysis**

ABC (Always, Better, Control) analysis is a significant and well-known analytical tool in inventory management.[26] It was first developed in the 1950s and aims to gain managers interest on the critical few (A-items) and not on the insignificant many (C-items). It divides items into three classes as A, B and C. It can be managed and controlled separately. A-items constitute only 10% of all inventory items. They have to be under strict control of higher management. as they consume the top 70%-80% of the total inventory consumption value of the company. B-items is the interclass items which include 20% of total inventory items. They require to moderate control by middle management since they consume 20% of annual consumption value, on the contrary, C-items is needed control by lower management, account for 70% of total inventory items and consume 10% of the annual consumption value. The main restriction of ABC analysis is that it depends upon price and the percentage of usage of the products. The importance of items cannot be considered entirely. It is not enough for inventory management since an item which has low capital investment and consumption may be staminal or life-saving. The criticality (vitality) of an item is also be considered for development of management tool for inventory control. The limitation of ABC analysis is based only on monetary value and the rate of consumption of the item. In a hospital, an item of low monetary value and consumption may be very vital or even life saving. Their importance cannot be overlooked simply because they do not appear in category A. Therefore, another parameter of the materials is their criticality.[27]

**VED Analysis**

VED analysis is based on priority and importance to patients. health.[28] It divides the items into three categories as Vital (V), Essential (E) and Desirable (D). V class drugs are life-saving like vaccines, and it is needed for life support (e.g., some antibiotics, serums, insulins, digoxin etc.) It must be available in the pharmacy stocks at all times. E class drugs, is lower severity, are efficient for therapy of less life threatening, but still serious diseases (e.g. antibiotics, ranitidine, chloroquine, phenytoin and etc.) It may be available in the pharmacy stocks. The remaining drugs with lowest severity, which is used for therapy of slight diseases, it is included in D class drugs. The absence of these drugs is notnoxiousto the health of the patients e.g., Vitamin E capsules, sun screen lotions.[6]

**ABC-VED Matrix Analysis**

Effective and efficient inventory control can be practiced on the items by considering both VED analysis and ABC analysis. Table 2, ABC-VED inventory matrix analysis is created, by combining the ABC and VED analysis. By cross-tabulating of these analysis nine different subcategories (AV, AE, AD, BV, BE, BD, CV, CE, and CD) are obtained.[29] ABC-VED matrix provides more meaningful control over the material supplies and divides items into three main categories: Category I, Category II, and Category III. Category I items includes vital and expensive. It is consist of six subcategories (AV, BV, CV, AE, and AD).And it is need control by top of management. Category II includes essential with low cost items (BE, CE, BD). Category III consists of the desirable with least cost items (CD).

**Table 2.ABC-VED inventory decision matrix[29]**

ABC-VED Matrix		Criticality of item							
		High ←————→ Low							
		V			E	D			
Consumption Value	High	A	Continuous Review	High Safety Stock	Low Order Quantity		Continuous Review	Low Safety Stock	Low Order Quantity
	↑	B							
		Low	C	Periodic Review	High Safety Stock	High Order Quantity		Periodic Review	Low Safety Stock

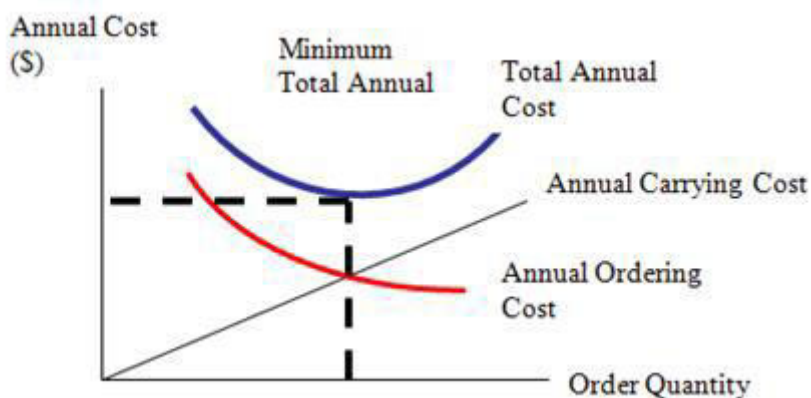
Among various inventory control model ,Economic order quantity (EOQ) has been commonly used, which attempts to the balance the carrying cost with the cost of running out of the items.[30] It is the level of inventory that minimizes total inventory holding costs and ordering costs. EOQ only applies when demand for a product is constant over the year. and each new order is delivered in total when the

inventory reaches zero. A fixed cost is charged for each order placed, regardless of the numberof units ordered. EOQ along with ABC-VED analysis is proposed to be the most effective and efficient model for inventory control.[31] Most of the savings with the ABC-EOQ is reported with the low valueitems (B and C items) which were being purchased too frequently.[32]

**Representation of EOQ:** EOQ can be determined with the help of the following formula :

$$E.O.Q. = \sqrt{2OcD/Hc}$$

Where, Oc= Cost Of Order, D = Annual Demand, Hc= Holding Cost/Carrying Cost [in Rs. or Unit]



**Figure 2: EOQ Model Cost Curves[33]**

#### **Factors affecting inventory management**

The following factors is taken in account when evaluating pharmacy inventory management:product type (generic, brand), inventory size, unclaimed prescriptions, inventory shrinkage,returned product policies and use of formularies.[13] Generic products consist lower acquisition costs compared to brand-named counterparts,thereby minimize inventory costs. Most product vendors (manufacturers and wholesalers) have policies regarding products it may be returned. Examples of such policies include providing credits for future orders, product replacement and cash back to the pharmacy. About 1.5% of all prescriptions filled by community pharmacies remain unclaimed. Pharmacists should monitor such prescriptions and specify a threshold time period (e.g. 2 weeks) for returning the product tothe shelves.[34] Up to 4.5% of community pharmacy sales is lost due to inventory shrinkage. Inventory shrinkagereferred to losses due to theft,. shoplifting, and robbery. Unfortunately, employee theft comprises the largest source for inventory shrinkage incommunity pharmacy settings. While

pharmacists should hire credible and candid employee, proper security and observation training and monitoring strategies are also important. In addition, relevant security regarding controlled substances should be a priority in monitoring shrinkage, especially when theft of these substances is ever more challenging. In hospital pharmacies, formularies are utilized to enhance inventory management, where pharmacists can carry one therapeutic equivalent product within a class of medications; thereby reducing overall inventory cost. However, limited lists and formularies could serve as an impediment in balancing supply and demand in community pharmacy settings.[35]

#### **The Role of Information Technology in Inventory Management**

The value of information technology can be recognized inpharmacy inventory management, where computerized systems are broadly available in virtually all pharmacy practice settings in industrialized countries. Technology makes the methods of inventory management. and methods of

evaluating inventory management more efficient, more precise, and more accurate. Examples of the role of technology in inventory management include utilizing hand-held scanning devices for periodic inventory control by scanning the barcodes on the product packaging or shelf labels, submitting purchasing orders electronically after inputting the scanned information into a computer via a web-based system, e.g. e-procurement. Nowadays, technology is utilized in almost all pharmacy operations, from ordering, procurement, storage, to paying for products. Pharmacists should employ the benefit of newer technologies in their practice for better management of their pharmacy inventory. An example of newer technology to improve product distribution from manufacturers to wholesalers to pharmacies is the use of radiofrequency identification (RFID) microchips, or "tag". [36] Such tags are intended to store information about the pharmaceutical product from the manufacturing date until arriving to and removing from the storage shelves in pharmacies. Automation in pharmacy inventory management creates additional time for pharmacists to provide pharmaceutical care and other pharmaceutical services to patients and customers. [37] Undoubtedly, information technology can be employed in pharmacy operations to improve inventory management and evaluation by appreciably minimizing procurement costs and protecting against inventory shrinkage because of theft. In addition, the potential for medication errors is further curtailed when product barcode scanning is employed in pharmacy practice, especially in hospital pharmacy settings. [38]

### CONCLUSION:

After reviewing several articles it was seen that inventory analysis plays an important role in the management of pharmacies. In this review, we have conveyed concern the usage of inventory control techniques in the healthcare provides significant improvement in patient care, customer relationships and optimal use of resources. Pharmacy spends a large amount of money for buying pharmaceutical items. Therefore, pharmacy management requires planning, designing and organizing of the medical stores.

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