DRUG INVENTORY MANAGEMENT WITH ABC & VED ANALYSIS OF IPD PHARMACY AT A MULTI-SPECIALITY HOSPITAL IN JAIPUR

Dissertation Submitted to

The IIHMR University, Jaipur

for the partial fulfilment for the award of the degree of

Master of Business Administration (MBA)

in

Pharmaceutical Management

By

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Under the Supervision and Guidance of

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2024

CK BIRLA HOSPITALS | RBH

RBH/2024/Jul/HRD/6153

Date: 01 Jul 2024

TO WHOM SO EVER IT MAY CONCERN

This is to certify that **Shreya Sikdar** has successfully completed her training in Supply Chain Management Department from 01 Apr 2024 to 01 Jul 2024.

We found her sincere, punctual & hardworking. We wish her every success in her future and career.

For **CK Birla Hospital - RBH**

Raju Kumar
Unit Head - HR

DECLARATION BY STUDENT

I hereby declare that this dissertation titled "**Drug Inventory Management with ABC & VED Analysis of IPD Pharmacy at a multi speciality hospital in Jaipur**" is the bonafide record of my original research work. I declare that it has not been submitted to any other university or institution for the award of any degree or diploma. Information derived from the published or unpublished work of others has been duly acknowledged in the text.

Signature

Shreya Sikdar

Shreya Sikdar

IIHMR UNIVERSITY

CERTIFICATE

This is to certify that dissertation titled "**Drug Inventory Management with ABC & VED Analysis of IPD Pharmacy at a multi-speciality hospital in Jaipur"** is a record of the research work undertaken by **Shreya Sikdar** in partial fulfillment of the requirements for the award of the degree of MBA (Pharmaceutical Management) from the IIHMR University, Jaipur under my guidance and supervision and her approach to the research study has been sincere, scientific, and analytical.

Faculty Guide
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Abstract

Background: Efficient drug inventory management is crucial for hospitals to ensure uninterrupted patient care and minimize financial burden. This study investigates the effectiveness of a combined ABC-VED analysis approach for optimizing drug inventory management in a hospital's Inpatient Department (IPD) pharmacy.

Objectives:

1. To establish a priority system by classifying inventory based on their ABC, VED, and ABC-VED matrix analysis.
2. To find out how much percentage of inventory value that each category of Drug constitutes and to calculate the expenditure of IPD pharmacy in a particular month.

Methodology:

This retrospective study analyzed historical drug consumption data and clinical information for a period of [insert time frame] from the IPD pharmacy of a [hospital type] hospital. Data collection included:

- Drug name, classification, and unit cost.
- Annual usage quantity for each drug.
- Expert evaluation by clinicians to determine the criticality of each drug (V, E, D).

ABC analysis was performed by multiplying the annual usage quantity by the unit cost for each drug, ranking them in descending order of total annual usage value. Cumulative percentages were calculated to categorize drugs into A (highest 70-80% value), B (next 15-20% value), and C (remaining 5-10% value) categories.

Key Results:

- The ABC analysis revealed that 8.44%% the drugs in the IPD pharmacy inventory constituted Category A (high value), 15.36% belonged to Category B (medium value), and 76.21% fell under Category C (low value).
- The VED analysis categorized 5% of drugs as vital (V), 84% as essential (E), and 11% as desirable (D) in terms of their criticality for patient care
- By combining the results, the ABC-VED matrix identified 165 of drugs as Category I (high value and critical), 1115 as Category II (medium value and medium criticality), and 107 as Category III (low value and low criticality).

Conclusion:

This study demonstrated the effectiveness of ABC-VED analysis in classifying drugs within the IPD pharmacy inventory. The analysis revealed a significant portion of the inventory comprises high-value and critical drugs (Category I), highlighting the importance of stringent control measures. This approach facilitates optimized inventory management by prioritizing control efforts based on value and criticality, potentially leading to reduced holding costs for less critical drugs and improved availability of essential medications.

Acknowledgments

The opportunity provided to do dissertation at the best multi
speciality hospital in Jaipur, I am highly obliged to have met so many experienced professionals who led me throughout my study period. I am sincerely grateful to them for sharing their truthful and illuminating views on several issues related to the project.

I would like to acknowledge, first and foremost Mr. Punnet Jain sir (unit head – supply chain management) who inspired, guided, and helped me to complete my project at his respected organization, I take this moment to recognize their contribution gratefully.

I am extremely thankful to my faculty at IIHIMR-Jaipur and specially my Mentor Dr. Saurabh Banerjee for being my support all through the internship.

I recognize this opportunity as a big milestone in the development of my career, I will strive to use the knowledge and skills gained in the best possible way.

Lastly, I want to express my respects and love to my parents, my siblings and my friends for constant encouragement and motivation in my higher studies.

Sincerely,

Shreya Sikdar

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ABBREVIATIONS

Sl no.	ABBREVIATIONS	FULL FORM
1	EOQ	Economic Order Quantity
2	VED	Vital, Essential, Desirable
3	ABC	Always Better Control
4	FSN	Fast, Slow, Non-moving

1. INTRODUCTION

The ever-growing demand for effective and often expensive medications necessitates a meticulous approach to drug inventory management within healthcare facilities. efficient management of a drug inventory forms the core takeaway in any hospital. This is because stock-outs are detrimental and may lead to lawsuits, increased morbidity, and loss of reputation for the hospital. Besides, overstocking drains budgets and resources from the hospital, impacting the ability to invest in new technologies and treatments. Effective management of a drug inventory forms the cornerstone of a well-functioning healthcare system. This ensures the continuous supply of medicines that are of utmost use to the patients while reducing costs and maximizing efficiency. A certain medicine buffer stock along with related inventory is maintained as insurance against both supply and demand variability. If too much of the inventory is maintained, then a high holding cost arises. Having too little increases ordering costs. Thus, inventory management should be properly managed to derive the low possible total cost.

This thesis project focuses on utilizing two established techniques: ABC and VED analysis to optimize drug inventory management and ensure patient access to critical medications while minimizing costs.

1.1 Background:

ABC-VED analysis is a widely used inventory classification technique in supply chain management. The supply chain is a critical strategic activity in hospitals that helps them make money through timely purchase procurement, effective inventory control, cost reduction, and optimal resource usage. Contemporary healthcare establishments are complex, varied, dynamic entities. Efficiently ensuring the right materials are in the right place at the right time is the core of both materials management and the Supply Chain Department. These functions achieve this by scientifically planning, organizing, and controlling the flow of materials, from initial purchase through internal operations to final distribution points.

In order to deliver world class quality services it is essential to have effective monitoring and control over external as well as internal lead time. Lengthy, inefficient process in placing of formal purchase orders is a common concern of hospitals. It not

only disturbs the efficient functioning of all clinical entities ,it is also is a cause of serious disappointment among indoor as well as out-door patients. . The primary role of the hospital is to provide efficient and patient care of international standards at optimum cost. To achieve the organizational goal the appropriate integration of 6M-man, money, material, machine, method, and minute is required. Objective of Supply Chain Management is to achieve an UN-interrupted supply of items in wards and departments at optimum cost.

1.2 Study Purpose:

Effective hospital inventory management of drugs is very important in order to ensure the safety of the patients and avoid breaks in access to medications that are very essential to healthcare; at the same time, avoiding extra expenditures is important for reducing the financial burden. This research project investigates the use of ABC and VED analysis as a coupled strategy in rationalizing hospital drug inventory management.

Problem Investigation The challenge for hospitals is to have a readily available stock of a wide range of medications at minimum cost. Stock-outs of some life-saving drugs delay treatment or compromise care. On the other hand, overstocking means wasted resources, expense that is not necessary, and probable expiration. Traditional practices in managing stocks are usually inadequate to balance these two conflicting interests.

1.3 Inventory Control:

The hospitals control their drug inventory by having a well-structured management of all drugs within the health institution. This in turn, it ensures that there is;

•**Optimal stock levels:** There are enough quantities of the critical drugs to meet their demand but at the same time minimize overstocking and possible expiry.

• **Cost-effectiveness:** It is aimed at bringing down expenditure on inventory through avoidance of wastage to a large extent, avoidable purchases, and exploring possibilities of better prices from vendors.

• **Efficiency Enhancing:** Streamlining of processes to ensure that drugs reach the patient at the right time.

Drug inventory control:

Effective Drug inventory control is a multidimensional exercise comprising of:

- **Stock classification:** medicine grouping based on parameter such as price, pattern of use ABC analysis, and critica1ity to patient care VED analysis in some cases.
- **Stock Level Management:** Setting a minimum and maximum limit of stock for individual drugs to prevent the D-out and overstock situation.

Inventory Control Techniques:

Implementing First-In, First-Out (FIFO) to consume the drugs older in nature first and frequent auditing of inventory to identify the variance as well as expired drugs.

- **Technology Utilization:** Through the inclusion of pharmacy management software, automation, accuracy of data, and ease of ordering processes are achieved.
- **Demand Forecasting:** It refers to an approximate calculation of drug needs in the future by studying historical trends in usage patterns and seasonal variations.
- **Supplier Relationships:** Building relationships with trusted suppliers ensures the delivery on time and reduces the risk associated with stockouts.
- **Staff Training:** Imparting knowledge of inventory management practices to the hospital staff for its successful implementation.
- **Balancing Demand and Supply**: The inventory levels have to be matched with respect to the demand anticipated, so as to avoid either stockouts or too much inventory holding.
- **Minimum-Maximum Levels:** Setting appropriate minimum and maximum stock levels for each item to trigger reordering when necessary and prevent overstocking.
- **First-In, First-Out (FIFO):** Utilizing a system where older inventory items are used first, minimizing the risk of expired goods.
- **Patient Safety:** The institutes must ensure that the patient gets safe and efficient drugs; ensure proper storage condition is maintained, expired drugs are not issued for consumption, and reduce the possibility of theft or drugs being diverted to unauthorized persons. Guaranteeing the safe and effective use of medications for patient well-being.

- **Financial responsibility:** Minimizing inventory costs and optimizing resource allocation.

1.4 INVENTORY ANALYSIS:

Inventory analysis is also known as "separating the vital few from the trivial many" because for any group of things that contribute to a common effect, a relatively few contributors account for a majority of effects.

The Pareto Principle in Inventory Analysis:

Inventory analysis follows the Pareto Principle, also known as the "80/20 rule." This principle states that, for many phenomena, a small percentage of inputs (the "vital few") accounts for a large portion of the overall outcome (the "trivial many").

In healthcare inventory management, applying this principle translates to focusing on high-cost and high-volume drugs. These drugs have the most significant impact on both the budget and clinical outcomes. Analyzing these "vital few" drugs first allows for a more targeted approach.

By identifying the most expensive medications and those with the highest consumption rates, we can prioritize efforts. This initial review will enable us to build strategies for studying their usage patterns. How the usage patterns for these specific drugs are understood can then inform the development of corrective measures in optimizing inventory management and probably clinical outcomes.

It is said to be the systematized examination of inventory data so that meaningful information is obtained for proper decision-making. This would thus include techniques such as ABC and VED analysis.

• **ABC Analysis:** ABC analysis is an inventory classification process implemented to assist in prioritizing inventory management efforts. This is a technique of stock classification on the basis of their annual consumption value; thus, sometimes it is termed as "Always Better Control." It keeps different groups according to their annual consumption value, which combines cost and usage. This grouping enables specific control methods to achieve the greatest efficiency at the least cost.

Criteria	A Class	B Class	C Class
Number of item	10%	20%	70%
Value of inventory	70%	20%	10%
Stock control	Strict	moderate	looses
Control effort	maximum	moderate	minimum
Forecast	accurate	estimate	moderate
priority	High	moderate	low

Table1.4 Criteria of ABC Analysis

items constitute the majority of total items (around 70%) . (e.g., common pain medications). They can be managed with less stringent controls, with ordering Categorizes drugs based on their **annual consumption cost** within the hospital.

- **A-category drugs (High Value):** Represent a small portion of the total inventory(typically 10%) but consume a significant portion of the budget(around 70%). They require the most stringent controls, including accurate demand forecasting and close monitoring. (e.g., expensive oncology medications)
- **B-category drugs:** Have a moderate consumption cost(20%) and contribute a moderate portion(20%) to the overall expenditure. They require a moderate level of control, with ordering based on actual needs and appropriate safety stock levels.
- **C-category drugs:** Have a low individual cost(typically 10%) contributing minimally to the total expenditure and based on usage estimates and potentially higher safety stock levels.

Similar to the Pareto Principle (80/20 rule), ABC analysis highlights that a small portion of your inventory (A items) drives a significant share of the overall inventory cost. By focusing control efforts on these high-impact items, you can achieve significant cost savings and improve overall inventory management efficiency.

Benefits of ABC Analysis:

- **Focused Control:** Enables concentrated efforts on managing critical A items, optimizing ordering, and minimizing stock-outs.

- **Reduced Costs:** Minimizes unnecessary control measures for less critical C items, potentially leading to lower inventory holding costs.
- **Improved Efficiency:** Streamlines inventory management by allocating resources efficiently based on item importance.
- **Enhanced Tracking:** Enables closer monitoring of high-value assets and overall inventory value.

Therefore, ABC analysis is a superb tool that helps decide the priorities for inventory control in a supply chain management system, and thereby aids in optimal allocation of resources.

VED Analysis: ABC analysis classifies drugs by means of their costs and uses. VED analysis, on the other hand, is used for spare parts in a hospital pharmacy. VED stands for:

- **Vital (V) drugs:** These are vital spare parts, which are vital for smooth running. Stock-out of vital spares may lead to huge disruption and stoppages in patient care; hence, adequate stocks are maintained for V items.Essential for life-saving treatments. (e.g., antibiotics for sepsis)
- **Essential (E) drugs:** These spare parts are considered high importance for efficiency but may be manageable with occasional short-term stockouts. Therefore, hospitals can take a risk regarding E items by maintaining enough stock needed for daily operation but having a reliable supplier who will, at short notice, re-supply stock as required. Important for managing patient conditions, but may have substitutes available.
- **Desirable (D) drugs:** These are items for which spare parts are freely available and can easily be obtained from the market in very minimal lead time. Items of this type are not necessarily stocked by a hospital but can be procured easily and in short time from the available external suppliers whenever required.Offer therapeutic options but are not irreplaceable.

While most of the drugs are critical to patient care in hospitals, spare parts are relatively classed under VED analysis. This could allow for more flexible inventory management for a balance of cost-effectiveness while ensuring smooth operations and patient care

Benefits of ABC Analysis:

Spare parts inventory management in a hospital pharmacy has various advantages of the VED analysis in enhancing efficiency, cost-effectiveness, and eventually better care to patients. These benefits include:

• **Improved Efficiency:** The VED analysis ensures that the critical spares are focused on, which keeps the equipment available and reduces equipment downtime, smothering the operations.

•**Improved Patient Care:** No equipment downtime, as a result of a stock out of any critical spare part, continues patient care and is delivered on time for treatments. Directly impacting patient care, reduced equipment downtime facilitates timely access to treatment equipment needed. VED analysis ensures that with the availability of spare parts for repair and maintenance, there are minimal disruptions in treatment delivery.

• **Cost Optimization:** Inventory management for minimal holding costs involves having only essential and vital parts in stock and relying on external suppliers of desirable items. Maintaining the inventory hundred percent only with essential and vital parts while desirable items are normally available with suppliers helps hospitals maintain an optimum inventory investment, minimizing all types of holding costs related to less critical spare parts kept in stock and procurable.

• **Better Risk Management:** Proper classification of spares based on criticality shall lead to a better process of risk assessment. The reduction in risk due to failure of equipment and related safety issues with delayed repairs is achieved by maintaining the required quantity in stock for crucial spares.

• **Data-Driven Decision Making:** This is the VED analysis promoting a data-driven approach towards inventory management. There is continuous improvement in VED categorization by reviewing the trending history of the usage data and spare parts' lead times so that supplier arrangements and stock levels can be optimized to achieve efficient use of resources while putting a rein on the risk of stock-out for critical parts.

1.5 Inventory Management:

Inventory management is the broader process that encompasses all activities related to planning, purchasing, storing, controlling, and distributing inventory. It involves:

- **Demand Forecasting:** Predicting future demand for inventory items based on historical data, market trends, and promotional activities.
- **Purchasing Management:** Negotiating with suppliers, optimizing order quantities, and managing lead times.
- **Inventory Control:** Implementing the strategies outlined above to maintain optimal stock levels.
- **Store Management:** Optimizing storage space, ensuring proper handling and security of inventory.
- **Inventory Analysis:** Regularly analyzing inventory data to identify trends, optimize stock levels, and identify potential waste or inefficiencies.

The Importance of Inventory Management

Effective inventory management balances two key objectives:

- **Meeting customer needs:** Ensuring the right drug items are available with right quality in the right quantities, at the right place, and at the right time.
- **Minimizing inventory costs:** Balancing the costs of ordering and holding inventory.

Challenges of Inventory Management

Poor inventory control can lead to both stock-outs (not having enough) and overstocking (having too much).Traditional inventory management methods often struggle to navigate this complex terrain. Manual processes can be cumbersome and prone to errors, leading to:

- **Stock-outs:** Delays in treatment due to unavailable medications can negatively impact patient outcomes.
- **Overstocking:** Excess inventory leads to wasted resources, unnecessary expenditure, and potential drug expiry, straining hospital budgets.
- **Inefficient Resource Allocation:** Limited resources may not be directed towards the most critical medications.

Inventory Management Procedures

- Departmental issues as per allocated monthly calendar and Upgradation.
- Maintaining periodic stock systematically
- Systematic and proper record maintenance
- Indenting of Inpatient medication before Discharge
- Updating Departmental Consumption regularly
- No stock out and excess stock
- Regular Interaction with Main Stores for issue resolution
- Obsolescence and expiry management
- Preventive and periodic maintenance for all the equipment for assuring its proper functioning

Inventory Management Department at the Hospital

- The supplies department coordinates with purchase department in a organized manner in order to meet all the demands of the pharmacy and stores in a timely and effective way.
- CK Birla Hospital has main stores as well as sub-stores from where the demand for consumables and non-consumables is generated.
- The main stores at CK Birla Hospital are as follows;
  (1) Main Stores
  (2) O.P.D Pharmacy
  (3) IPD Pharmacy

- **Functions of Stores**

- Indenting for items for patients
- Indenting for items for departments
- Receiving of the items and preparation of Goods Received Note (GRN)
- Proper storage of items
- Return to vendors
- Managing expired items

1.6 PROCESS MAPPING:

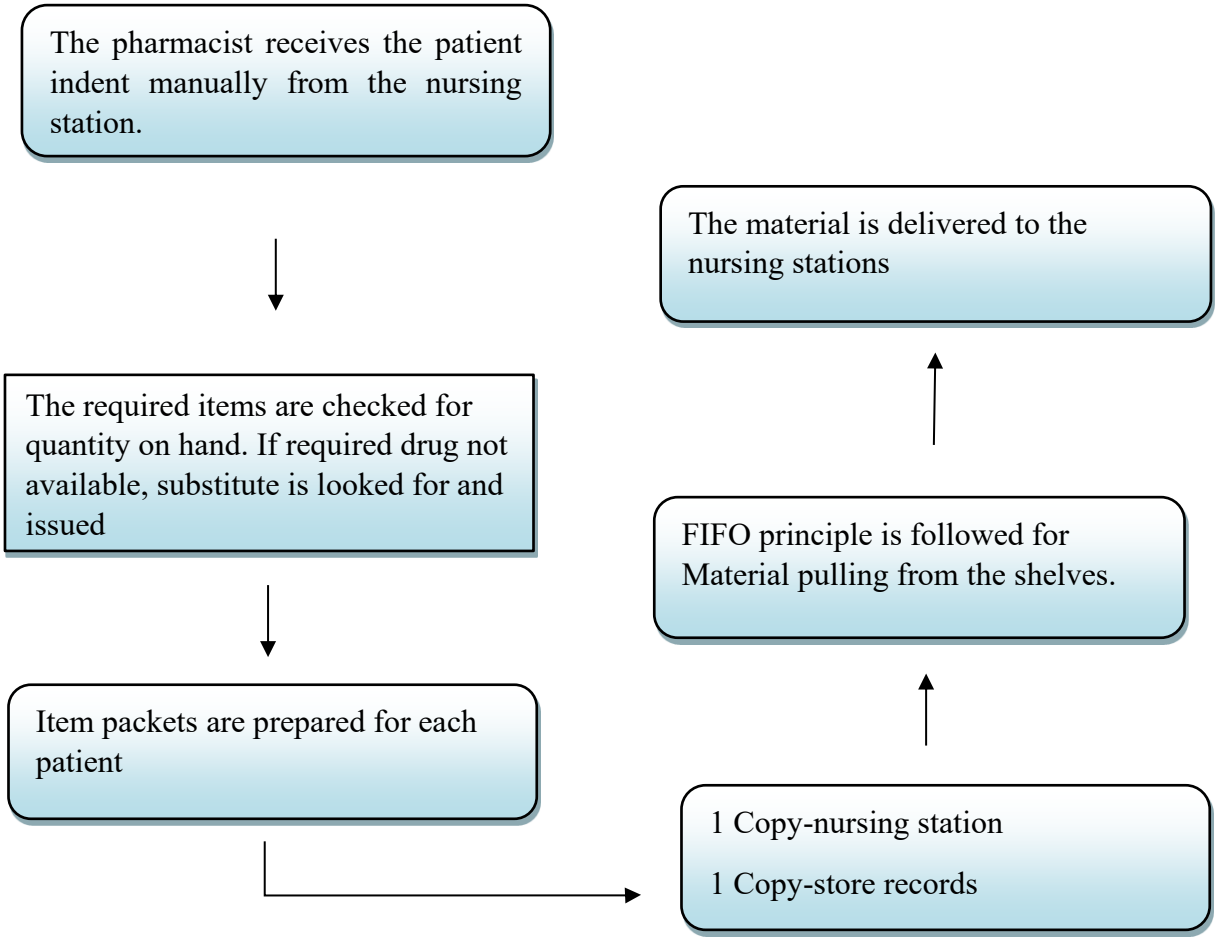


Figure:1 The process of issue of materials against patient indents from IPD stores

1.7 Terminology for Inventory Management:

To ensure clarity, let's define some key terms used in this report:

Buffer Stock (Safety Stock, Reserve Stock): This refers to the additional inventory held to mitigate fluctuations in demand and supply disruptions like shortages or delays (SV, 2012). It's calculated by multiplying the difference between the maximum and average daily consumption rate by the lead time for the item (Kumar, 2013).

Factors Affecting Buffer Stock Levels:

Several factors influence the required level of buffer stock (Walter Ramsey Crowe, 1977; Kumar, 2013):

- **Demand Uncertainty:** Variability in customer demand for a product.
- **Replenishment Period:** The time between placing an order and receiving the stock.
- **Delivery Time Variability:** Potential fluctuations in the time it takes to receive an order.
- **Required Product Availability:** The desired level of service for a product, impacting how often a stock-out can be tolerated.
- **Inventory Review Policy:** Whether inventory levels are continuously monitored or reviewed at specific intervals.

Lead Time: The time it takes to receive an order after it is placed. Lead time can vary depending on the supplier, product availability, and shipping methods.**T**his encompasses several stages:

- **Order Processing Time:** The internal time it takes for your company to process and finalize an order after it's been placed. This might involve tasks like verifying customer information, checking stock availability, and generating purchase orders.
- **Supplier Lead Time:** The time it takes for your supplier to manufacture, package, and prepare the ordered items for shipment.
- **Shipping Time:** The physical transportation time it takes for the goods to travel from your supplier's location to your warehouse or receiving point.

PURCHASE ORDER: a purchase order (PO) is a formal document issued by a buyer (your company) to a seller (supplier) to officially request the purchase of goods or services. It serves several key purposes:

- **Communication and Documentation:** The PO clearly outlines the specific items being ordered, quantities, unit prices, total cost, and desired delivery date. This creates a legally binding agreement between the buyer and seller, documenting the agreed-upon terms of the purchase.

- **Authorization and Control:** A PO acts as an internal authorization for your company's purchasing department to proceed with the order. It ensures proper oversight and prevents unauthorized purchases.
- **Tracking and Inventory Management:** Purchase orders play a crucial role in inventory management. They help track outstanding orders, facilitate communication with suppliers regarding deliveries, and enable accurate inventory updates when the ordered goods are received.

Here's a breakdown of the information typically included in a purchase order:

- **PO number:** A unique identifier assigned to the purchase order for tracking purposes.
- **Supplier information:** Company name, contact details, and address of the supplier.
- **Buyer information:** Company name, contact details, and address of the buyer.
- **Order date:** The date the purchase order is issued.
- **Delivery date:** The desired date for the ordered goods or services to be delivered.
- **Billing information:** The address where the supplier should send the invoice.
- **Item details:** A list of the specific items being ordered, including descriptions, quantities, unit prices, and total cost for each item.
- **Payment terms:** The agreed-upon method and timeframe for payment to the supplier.
- **Shipping information:** Instructions for shipping the ordered goods, including any special requirements.
- **Authorization:** Signatures from authorized personnel within your company approving the purchase order.

Document for supply of item(s) at agreed rates, terms & conditions. Important terms & conditions are payment terms, delivery period etc. It is a legal document and binding on both seller and buyer.

REPEAT ORDER: For those entire items, which have been purchasing regularly, falls in this category. The rates of these items are already frozen and therefore, the process of ordering starts from making the PO.

EPR (EFFECTIVE PURCHASE RATE): Landed cost of an item including all expenses. The inventory is always calculated in terms of EPR.

RECOMMENDATION NOTE: Based on technical recommendation (for specialized /technical items), the comparative statement based on commercial quotation is made.After due negotiations, decision is taken regarding the procurement and noting are made, which is called the recommendation note .It is signed by Head –Operations, Div.Head-PURCHASE & Finance Nominee / HEAD –Finance & is finally approved by Chief Executive Officer and than the order is released

RE-ORDER LEVEL: In inventory management, the **reorder level (ROP)** is a predetermined stock level that triggers an order for new inventory. It acts as a critical checkpoint to ensure you don't run out of stock before receiving a new shipment. Here's a breakdown of its significance:

- **Preventing Stockouts:** The reorder level is set strategically to maintain sufficient stock to cover customer demand during the **lead time** (the time it takes to receive an order). This helps avoid stockouts, which can lead to lost sales, customer dissatisfaction, and potential delays in fulfilling orders.
- **Balancing Inventory Costs:** Maintaining high stock levels can be expensive due to storage costs, potential product obsolescence, and the risk of damage or spoilage. The reorder level helps strike a balance by ensuring you have enough stock without incurring excessive holding costs.

Calculating the Reorder Level:

The reorder level is typically calculated using a formula that considers two key factors:

1. **Average Daily Usage (ADU):** This represents the average amount of inventory used per day. It can be calculated by dividing the total usage of an item during a specific period (e.g., month) by the number of days in that period.
2. **Lead Time:** As mentioned earlier, this is the time it takes to receive an order after it's placed.

Here's a common formula for calculating the reorder level:

Reorder Level (ROP) = Average Daily Usage (ADU) x Lead Time (in days) + Safety Stock

Or Re-order level = safety stock + lead time consumption

PURCHASE REQUISITION: Request raised by Main Stores to Purchase department for the items reaching reorder level so that the same can be procured.

a **purchase requisition (PR)** is an internal document initiated by a department within a company to formally **request the purchase of goods or services**. It acts as the initial step in the procurement process, preceding the issuance of a purchase order (PO). Here's a breakdown of its key functions:

- **Identifying Needs:** A purchase requisition allows employees to formally communicate their department's need for specific items or services. It typically contains the description of the product or service required, quantity, and reason for purchase.
- **Internal Approval Process:** On submission, a purchase requisition goes through an internal cycle of approvals within the firm. This may include approvals by different department heads, budget managers, or other competent authorities whose designation varies with the organizational structure.
- **Transparency and Control:** Making a documented record of internal purchase requisitions, serves the aspects of transparency. Also, the spending can be brought under control in that it needs justification at departmental levels with corresponding approvals before making any acquisition.
- **Differences between Purchase Requisition and Purchase Order:**
- Though both are highly important documents during procurement, there are some marked differences between purchase requisition and purchase order:
- Function: While a purchase requisition is an internal request, a purchase order is the formal agreement with a supplier.
- **Issuing Party:** A purchase requisition is initiated by a department within the company, while a purchase order is issued by the purchasing department to a supplier.

- **Approval Process:** Purchase requisitions typically go through an internal company approval workflow, while purchase orders represent a legally binding agreement between the buyer and seller.

STOCKED ITEM: Items, which are stocked in the STORES and issued from there as per indent raised from various departments. A requisition is raised through INDENT from stores with a requisition no. Then the order will be made through EXCEL and get approved as mentioned earlier.

NON-STOCKED ITEM: Items which are not stocked in the Stores and once it is received the material directly goes to the user department. The departments like Blood bank, Radiology, Housekeeping, Engineering, F&B, CSSD, and Biomedical etc. have their own store to keep material. Manual requisition is received for all non-stocked items duly approved by authorized signatory.

CONSIGNMENT ITEM: Consignment goods can be defined as goods procured after the consumption. E.g. Stents, balloons, pacemakers, Heart Valves etc. These items are kept at the hospital (just a custodian of it) with title of item remains with the vendor

COMMON/DEPARTMENTAL ITEM: Items which are not charged to the patients or used by the departments or nursing stations for their internal departmental consumption, such items are called common items. E.g. cotton, gauze, chemicals, UN-sterilized gloves, caps, masks etc.

DELIVERY CHALLAN: Goods are supplied by the vendor either against the challan or an invoice. A challan is a document mentioning the name and quantity of the Goods supplied.

INVOICE: Invoice is raised by the vendor for the material supplied. The invoice Mentions the value of the goods along with the other details like item name and Quantity. Vendor payments are made only against invoices and not against the challan

GRN (GOODS RECEIPT NOTE) / PURCHASE RECEIPT: After the material is Supplied by the vendor, details like Name, Qty, Batch no, Expiry date of the same are entered in the HIS. The document prepared for the same is called GRN. The GRN results in adding to the stocks in inventory.

INDENT: The indent is raised by the nursing stations and other departments to Main Stores. It can be defined as a request for the items intended to be used on a patient or for internal **consumption** of the department.

RGP (RETURNABLE GATE PASS) : The returnable gate pass is used, in case any item is issued to a second party and the same item is intended be taken back in lieu. E.g. in case the item is given on loan or any defective item is to be replaced with the same item.

NRGP (NON RETURNABLE GATE PASS): The non-returnable gate pass is used in case any item is issued to a second party in lieu of credit note.

CAPITAL ITEM: These are long life items like equipment and machinery. These can be purchased based on pre-approved budget only. Based on approved budget, a capital expenditure request (CAPEX) form is raised by user department and forwarded to purchase department for further action.

1.8 Problem Statement:

Hospitals, like many organizations that manage inventory, face significant financial burdens associated with stockholding. Optimizing inventory management can lead to substantial cost savings for healthcare facilities.

1. How can we determine the optimal inventory level to minimize costs while avoiding stockouts?
2. What strategies can be implemented to effectively maintain sufficient inventory levels for essential supplies?

1.9 Aim:

To establish a cost-effective inventory management system that minimizes stock-outs within the hospital.

1.10 Objectives:

- To establish a priority system by classifying inventory based on their ABC, VED, and ABC-VED matrix analysis.
- To find out how much percentage of inventory value that each category of Drug constitutes and to calculate the expenditure of IPD pharmacy in a particular month.

2. LITERATURE REVIEW

2.1 Studies on ABC Analysis:

- **2018, Fitriana et al.:** This study in an Indonesian veterinary hospital pharmacy analyzed annual consumption and expenditure of medications using ABC analysis. They found that 14.14%, 20.42%, and 65.45% of drugs fell into A, B, and C categories, respectively, contributing to 69.87%, 20.42%, and 9.71% of the total drug expenditure (ADE).
- **2011, Naveen et al.:** This study in a tertiary care hospital pharmacy in India found that 82.66%, 11.15%, and 6.19% of drugs belonged to A, B, and C categories, respectively on annual expenditure. The study highlights the role of

ABC analysis in identifying medications requiring stricter control for financial optimization and minimizing stockouts.

- **2020, Nadkarni & Ghewari:** This research emphasizes the challenges of inventory management due to supply and demand uncertainties. They differentiate ABC (on annual consumption value) from FSN analysis (based on usage rate) and suggest their combined use based on the material's significance.
- **2011, Gupta et al.:** This study in a medical store analyzed 325 medications. They found that 47 (14.6%) belonged to category A (highest consumption/expenditure), 73 (22.46%) to category B, and the remaining 205 (63%) to category C, highlighting the significant impact of a small number of medications on overall expenditure.
- **Fitriana et al. (2018)** conducted a study in an Indonesian veterinary hospital pharmacy. ABC revealed that 14.14%, 20.42%, and 65.45% of drugs fell into categories A, B, and C, respectively, contributing to 69.87%, 20.42%, and 9.71% of the total drug expenditure (ADE). This highlights the significant impact of a small group of high-cost, high-usage medications (category A) on overall expenditure.
- **Naveen et al. (2011)** investigated a tertiary care hospital pharmacy in India. Their findings indicated that 82.66%, 11.15%, and 6.19% of drugs belonged to ABC categories, respectively, based on annual expenditure. The study emphasizes the role of ABC analysis in identifying medications requiring stricter control for financial optimization and minimizing stockouts.
- **Gupta et al. (2011)** analyzed 325 medications in a medical store. They found that 47 (14.6%) belonged to category A (highest consumption/expenditure), 74 (22.46%) to category B, and the remaining 205 (63%) to category C. This reinforces the notion that a relatively small subset of medications contributes to a substantial portion of the overall expenditure.

2.2 VED Analysis:

- **Mohammed & Workneah (2020)** implemented an ABC-VED matrix for inventory control in an Ethiopian referral hospital. Drugs were categorized based on annual expenditure (USD): A (17%), B (20.18%), and C (62.83%), corresponding to 69.64%, 19.98%, and 10.38% of total expenditure, respectively. The study emphasizes the importance of stricter control for high-

cost, critical medications (Category A) to ensure availability and minimize stockouts.

- **Pittayac et al. (2019)** investigated inventory management for medical supplies within a hospital's surgical department. The study analyzed 862 inventory items with the objective of improving overall inventory management practices.

2.3 Other Inventory Management Techniques:

- **2017, Agaeda & Oagwuche:** The authors in this paper determine the probability EOQ model to handle drugs and hospital consumables inventory. They contributed that objects of every item can be ordered on its optimal EOQ and its re-order level to ensure efficient replenishment of the inventories.
- **2020, Mohammed & Workneah:** This study in an Ethiopian referral hospital implemented an ABC-VEN matrix for inventory control. They stratified drugs according to annual expenditure in USD: A (17%) versus B (20.18%) versus C (62.83%), which accounted for 69.64%, 19.98%, and 10.38% of the total expenditure, respectively. This study has lent further support to the notion of enforcing more stringent controls on high-cost, critical medication drugs in Category A so that their availability can be ensured and stockouts averted.
- **Agada & Oagwuche, 2017:** The authors examined the probability EOQ model for inventory management of drugs and consumables in a hospital. Results reveal that each item can be purchased or procured at its optimal EOQ with pre-defined reorder level, so that issues happen at the right time for inventory re–stock.

Overall, these studies demonstrate the effectiveness of ABC and VED analysis in optimizing inventory management for veterinary hospitals and pharmacies. These techniques help prioritize control efforts based on cost and criticality, ensuring efficient resource allocation and improved patient care.

3. Research Methodology

3.1 Materials and Methods:

Sample size: Total 1387 drug Items in Hospital IPD pharmacy

Sampling Technique: The non-probability convenience sampling method is used

Study Design: Analytical Study

Sampling Criteria:

Inclusive - In-patient medicines and consumables which is included on drug formulary (for one month)

Exclusive - out- patient medical items and all other general materials and medicines which is not in formulary.

Sampling Selection: secondary data was collected, directly from Management Information System from the Hospital.

Location of study: C.K Birla Hospital, Jaipur.

Duration of study: A study was conducted from 1st April to 1st July.

3.2 Data collection:

One month data has been taken from supply chain department of the hospital. For this study, data was collected through two primary sources:

• Primary data:

i. VED classification is done for all 1378 drugs.

ii. Observation of the process of stores and purchase dept.

• Secondary data:

i. ABC classification from the monthly consumption report generated by systems department.

ii. Information from SAP.

iii. Old records and files are maintained by stores and purchase department.

code	Item Name	Number of drugs	Cost rate
M-N-PH-R008-000002	ALBUREL INJECTION 20%/100ML	78	3727.5

Table:3.2 Data collection in excel sheet

Thus, total 1387 IPD medicines and other surgical items are collected with their quantity and unit cost for the the month of April,2024 in Hospital IPD pharmacy from the hospital Management Information System and formulate using excel for futher calculation.

3.3 Sample Size Calculation:

The availability of all drugs in a given treatment group was assessed during the study. If the drug is in stock on the survey date, it is considered available.

Data Analysis Tool: The data analysis was facilitated using Microsoft Excel, Version Microsoft 365. Data was entered and analysed in Microsoft Excel.

Drug Consumption Value Analysis:

From ABC analysis total expenditure is calculated that is Rs 7178612.923 at IPD pharmacy at the month of April.

List of total consumables was prepared including the monthly consumption quantity. Their per unit price and monthly consumption was determined.

Per unit price was multiplied with monthly consumption to get their annual usage.

3.3.1 Steps in ABC Data Calculation :

1. **Data Collection:** Gather information on all inventory items, including unit price and monthly consumption.
2. **Calculate Annual Usage Value:** Multiply the unit price by annual consumption for each item.

3. **Rank by Usage Value:** Arrange all items in descending order based on their monthly usage value.
4. **Calculate Percentages:** Calculate the cumulative percentage of the total annual usage value for each item.
5. **Define Category Boundaries:** Traditionally, the cumulative usage value is used to assign categories:

code	Item Name	No.of drugs	Cost rate	Consumption value	% of Annual consumption	Commulative	A B C
M-N-PH-R008-000002	ALBUREL INJECTION 20%/100ML	78	3727.5	290745	4.05%	4.05%	A
M-N-PH-E005-000008	HUMALOG KWIKPEN INJECTION 100IU 3ML	16	856.56	13704.96	0.19%	69.69%	A
M-N-PH-H003-000001	WASA MOUSSA SOLUTION 200ML	38	354	13452	0.19%	69.88%	A
M-N-PH-E006-000097	EMTIG 50 MG INJ	50	268.8	13440	0.19%	70.07%	B
M-N-PH-E004-000017	SOMAZINA 500MG INJ	122	109.37	13343.14	0.19%	70.25%	B
M-N-PH-N022	STERITALC F4	2	6609.6	13219.2	0.18%	70.44%	B

-000002	POWDER 4GM						

Table:3.3.1 ABC Data Calculation

- Category A: Typically, the top 70% of cumulative usage value.
- Category B: The next 20% of cumulative usage value.
- Category C: The remaining 10% of cumulative usage value. (These percentages can vary depending on the specific needs of the organization.)

3.3.2 Steps in VED Data Calculation:

1. Data Collection: Secondary Data was collected through review of the past records from the files of medical stores & from the hospital Management

- Gather a comprehensive list of all drugs within the medical facility.
- For each drug, collect relevant information such as:
  - **Drug name and classification:** This helps identify the medication's purpose and potential substitutes.
  - **Usage data:** Review historical data on drug usage, including average daily/monthly consumption rates.
  - **Clinical information:** Consult with medical professionals (clinicians, pharmacists) to understand the drug's criticality in patient care scenarios.

2. Criticality Evaluation:

- Establish a committee or team composed of medical professionals (doctors, nurses, pharmacists) familiar with the drugs and their applications.
- Based on the collected data and their expertise, the committee will evaluate each drug's **impact on patient care** and potential consequences of stock-outs.

4. Documentation and Review:

- Document the VED classification for each drug, creating a clear and accessible reference for inventory management personnel.

3.3.3 Steps in Combined Category (ABC-VED Matrix) Calculation:

The ABC-VED matrix combines two inventory classification methods: ABC analysis, which is based on the annual value of use, and VED analysis, which is based on criticality to patient care. This Fig. combines the two major approaches for the nuanced systemization of inventory items in a healthcare setting.

code	Item Name	Number of drugs	Cost rate	Consumption value	% of Annual consumption	Commulative	A B C	V E D	Combined Category
M-N-PH-R008-000002	ALBUREL INJECTION 20%/100 ML	78	3727.5	290745	4.05%	4.05%	A	E	AE
M-N-SU-N048-000001	EXAMINATION GLOVES MEDIUM NULIFE	61446	1.95	119819.7	1.67%	16.92%	A	D	AD
M-N-PH-B084-000001	PLASMANATE INJECTION 5% 250ML	16	5250	84000	1.17%	26.09%	A	V	AV
M-N-PH-M053-000005	PIZOWAVE 4.5MG INJECTION MANKIND	1185	70.56	83613.6	1.16%	27.26%	A	D	AD

Table:3.3.3 ABC-VED Data Calculation

3.3.4 Matrix Construction:

The ABC-VED matrix is obtained by cross-tabulating the results of both analyses. For example, it will contain nine subcategories such as AV, AE, and AD, where the first letter represents the ABC category and the second letter represents the VED category.

Class	V	E	D
A	AV	AE	AD
B	BV	BE	BD
C	CV	CE	CD

Table:3.3.4 Matrix Construction

3.3.5 Inventory Classification:

- **Category I (High Value & High Criticality):** Category I: High Value & High Criticality: These inventory items fall under the matrix classes AV, AE, AD, BV, and CV. They are high-cost inventory items with the most profound impact on patient care. Therefore, they should have very high control over their inventory levels and service priority to prevent stock-outs.
- **Category II (Medium Value & Medium Criticality):** Items falling under BE, CE, and BD subcategories belong to this category. They represent moderate value and criticality, warranting a balanced approach to stock management and service levels.
- **Category III (Low Value & Low Criticality):** Items classified as CD in the matrix fall into this category. These are low-value items with minimal impact on patient care. Service levels for these items can be less stringent, with a focus on cost-effective inventory management.

Benefits of ABC-VED Matrix:

- **Optimized Inventory Control:** Prioritizes control efforts and service levels based on a combined value and criticality assessment.
- **Improved Patient Care:** Ensures high availability of critical medications (Category I) while optimizing resources for less critical items.
- **Enhanced Efficiency:** Streamlines inventory management processes by allocating resources efficiently based on item classification.

4. RESULTS

So, the calculated Consumption Value is Rs 7178613 for 1387 items on the month of April.

4.1 ABC ANALYSIS FINDING:

Class	A	B	C	Total
ITEM COUNT	117	213	1057	1387
% OF ITEM COUNT	8.44%	15.36%	76.21%	100%
CONSUMPTION VALUE	5016460	1444221	717931.4	7178613
% OF CONSUMPTION VALUE	70%	20%	10%	100%

Table:4.1 Indicates that ABC Categorization of Medical Consumables

Category-A: It includes 117 inventories which need strict control. These are the inventories having highest percentage of consumption value that is 8.44% medical consumables accounts for approximately 70% of the total cost .

Category-B: It includes 213 inventories and needs moderate type of control. It is having second highest percentage of consumption that is 15.36% accounts for 20% of the total cost

Category-C: It includes the remaining 150 inventories which needs least/loose control. These inventories also have the least percentage of consumption. So, rest of the 76.21%items constitute for approx 10% of the total cost.

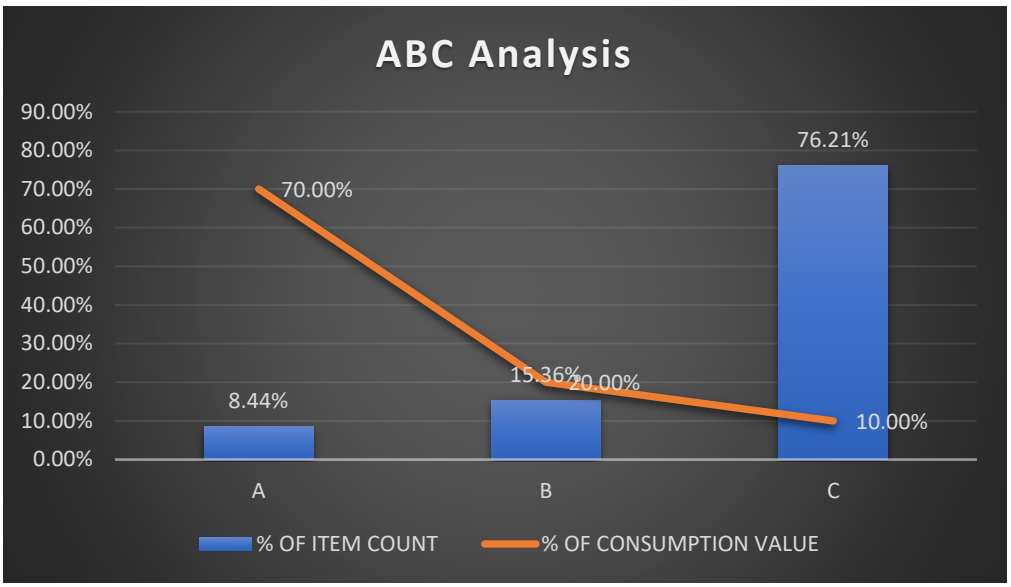


Figure 4.1 ABC ANALYSIS FINDING

from the above Graph, it was found that

8.44% of item constitute 70% of the inventory value (A)

15.36% of item constitutes 20% of inventory (B)

76.21% of item constitute 10% of item (C)

4.2 VED ANALYSIS FINDING

Here the name of drug for item code are same as per item code taken for ABC Analysis. VED analysis of the inventory was done in every six months.

Class	V	E	D	Total
ITEM COUNT	67	1167	153	1387
% OF ITEM COUNT	5%	84%	11%	100%
CONSUMPTION VALUE	869378.6	5165439	1143796	7178613
% OF CONSUMPTION VALUE	12%	72%	16%	100%

Table 4.2 indicates that VED Categorization of Medical Consumables

From VED analysis it was found that

67 Number of item are Vital which constitute value of worth ₹869379 of the total expenditure

1167 Number of item are Essential which constitute value of worth ₹5165439 of the total expenditure

153 Number of item are Desirable which constitute value of worth ₹1143796 of the total expenditure.

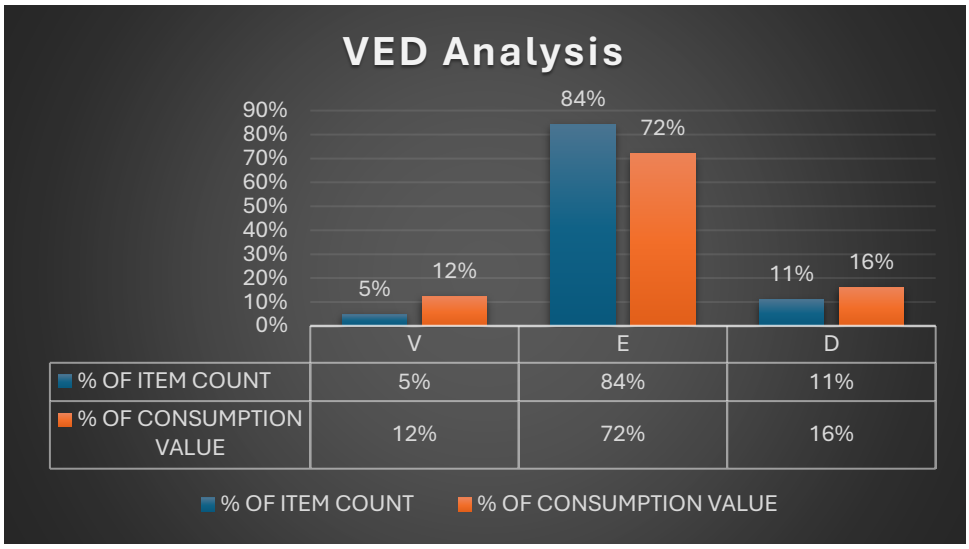


Figure 4.2 VED ANALYSIS FINDING

from the above Graph, it was found that

V: Out of 1387 inventories, 67 inventories fall in "**Vital**" class i.e., 5% of total inventories. 5% of item is found to be vital which constitute 12% of the total expenditure of the inventory

E: 1167 inventories fall under "**Essential**" class i.e., 87% of the total inventories.
84% of item is found to be Essential which constitute 72% of the total expenditure of the inventory

D: Remaining 153 inventories fall under "**Desirable**" class i.e., 26.79% of the total inventories.11% of item is found to be Desirable which constitute 16% of the total expenditure of the inventory

4.3 FINDING OF ABC-VED matrix

The combined matrix of ABC and VED analysis results into nine combined categories which are: AV, AE, AD, BV, BE, BD, CV, CE, and CD.

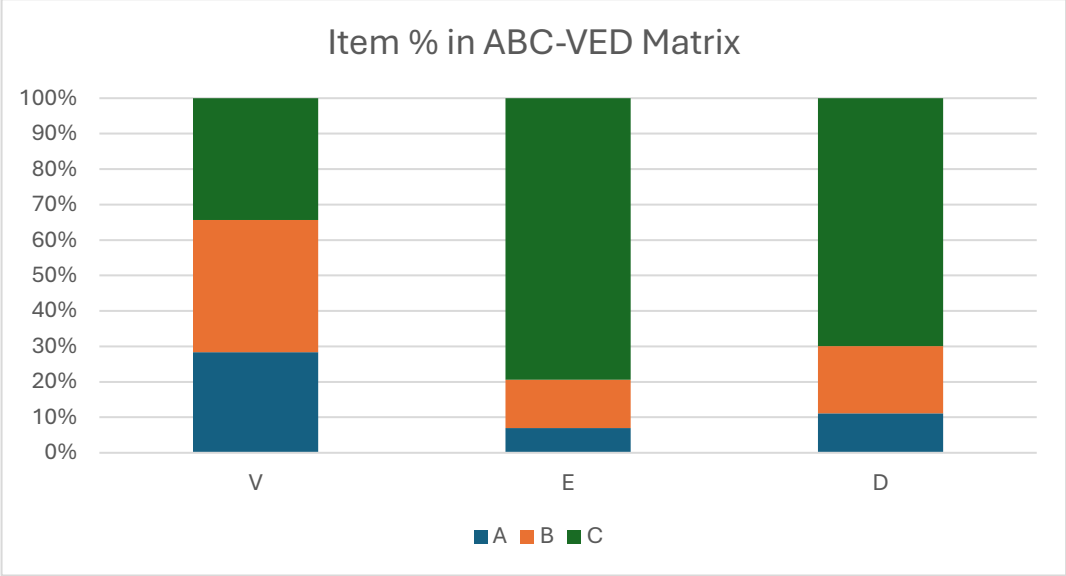
Class	Count of Item
A	**117**
D	17
E	81
V	19
B	**213**
D	29
E	159
V	25
C	**1057**
D	107
E	927
V	23
Grand Total	**1387**

Class	V	E	D
A	**AV** 19	**AE** 81	**AD** 17
B	**BV** 25	**BE** 159	**BD** 29
C	**CV** 23	**CE** 927	**CD** 107

Table:4.3 No. of drugs items based to the ABC-VED matrix

Class	V	E	D	Total
A	1%	6%	1%	8%
B	2%	11%	2%	15%
C	2%	67%	8%	76%

Table:4.4 No. of drugs items based to the ABC-VED matrix



4.4 FINDING OF Class I, II and III Categories:

The total number of items falling under AV is 19, AE category is 81, AD category is 17, BV category is 25, BE category is 159, BD category is 29, CV category is 23, CE category is 927 and CD category is 107.

The combined (ABC-VED) items are classified into three class: Class I, II and III.

Class	Class I					Class II			Class III
Combined Categories	AV	BV	CV	AE	AD	BE	CE	BD	CD
Item Count	19	25	23	81	17	159	927	29	107
Consumption Value	648398.995	192027.715	28951.9226	3517457.49	850603.75	1032003.451	6159777.7848	220190.09	73001.7248
% OF ITEM COUNT	1.36	1.8	1.7	5.8	1.2	11.4	67	2.1	8

% OF CONSUMPTION VALUE	9	3	0.4	49	11.8	14	8.6	3.1	1

Table:4.4 Class I, II and III item calculation

Class I items

These items are sum of AV AE, AD BV and CV

AV + BV +CV+AE +AD

Total Item Count = (19+25+23+81+17)

= 165

Total Consumption Value=

648398.995+192027.715+28951.9226+3517457.49+850603.75

= 52,37,439.87

% OF ITEM COUNT=(1.36+1.8+1.7+5.8+1.2)%=11.86%

% OF CONSUMPTION VALUE= (9+3+0.4+49+11.8)%

=73.2%

Class II items

These items are sum of BE,CE and BD

BE+CE+BD

Total Item Count =159+927+29=1115

% OF ITEM COUNT= (11.4+67+2.1)% =80.5%

% OF CONSUMPTION VALUE= (14+8.6+3.1) %

=25.7%

Class III items

These items are CD items.

CD = 107

% OF ITEM COUNT= 8 %

% OF CONSUMPTION VALUE=1%

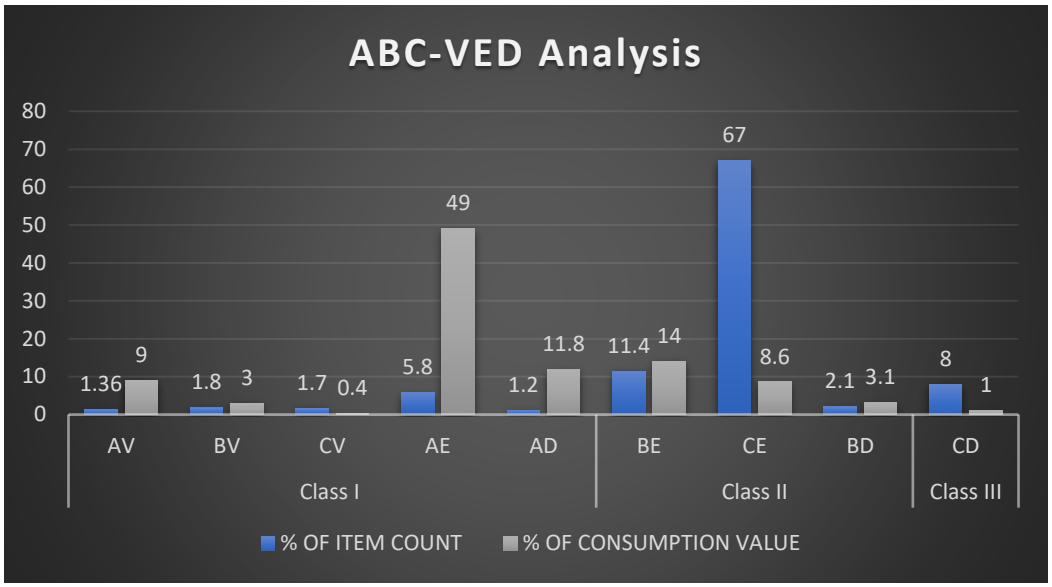


Figure 4.3 ABC-VED Matrix Analysis

The ABC-VED matrix above shows that category 1 (165 items) will help to verify the annual budget and its availability. The pharmacy supervisor manages the inventory of second-level (1115 items) and lower-level management of the inventory of third level (107 items) is desirable and lowest cost.

5. DISCUSSION

After analyzing the results, the current ABC analysis showed that the cost of only 1378 inventory items comprises 80% of the total cost. Since the data collected had marry inventories which free of cost during the purchase of machinery/diagnostic equipment, therefore, all the free inventories will have their costing from next purchase and hence ABC analysis of inventories will change accordingly.

5.1 Interpretation: There are only 19(AV) inventories which accounts for the highest costing and vital items. They requires strict attention on its availability with right price and right quantity. . Rest other inventories accounts for 9% of the total cost, therefore, there should not be any stock-out of the items which belong to category-A to prevent loss for the organization.

In this study, out of these two-inventory control technique ABC analysis is more efficient technique as it focus will be made on of item that is 117 number of item out of 332 item 70% of the inventory having value 36964812 out of total 53075668

Where as in VED analysis E Category of item which is 84% that is 1176 number of item out of 1387 items constitute only 72% of the value that is 9454027 out of 53075668 total value of inventory.

So, The above project was based on the two different inventory control technique so as a result the management of class A & VITAL material requires top managerial control and these materials must be constantly keep in stock for uninterrupted health care services, class B & essential materials should be under middle management and class C & desirable materials should be in lower managerial control.

ABC & VED analysis identifies the drugs requiring stringent control for optimal use of funds and avoid out of stock situations in.

The items that are from A category should be strictly scrutinized because they constitute maximum value of total inventory. Storage of A category items should be carefully done with maximum safety measures and movement of A category items should be strictly supervised and timely studied.

In drug inventory management, considering only ABC analysis effectively controls the recommended very less number of drugs alone from Group A, but be compromising on the availability of drugs of vital nature from B and C categories.

The ABC-VED Matrix shows that:

Category I: AV+ AE+ AD+ BV+ CV

It comprises items of high value and of critical nature.

Management of Class I drugs i.e165 drugs would help keep a check on the annual budget and their availability.

Clearly define minimum Stock levels and Safety Stock for AV, BV, and CV items.

For AE items, quantity purchase can be made considering consumption to get better prices.

An effort could be made to bring down the number of AD items, if any, which take away a good chunk of budget and their non-availability is not going to make much difference to the quality of health care services.
Their management should be under the control of the Manager Pharmacy.

Category II: BE+CE+BD:

Class II management of the 1115 drugs would help ensure availability of all the essential drugs. This category should be reviewed by the Assistant Managers.
Class III are all desirable and lowest cost drugs.

5.2 Limitation: This study focuses solely on quantitative data, neglecting qualitative factors that could influence categorization. ABC analysis is an ongoing process, requiring periodic reviews and reclassification of items to ensure its effectiveness.

6. CONCLUSION

Effective inventory management can significantly address the company's inventory challenges. This translates to reduced capital tied up in inventory, ultimately lowering costs and boosting profits. Implementing ABC analysis and adhering to proper inventory management practices will ensure optimal stock levels and minimize expenses.

6.1 Recommendation:

Improve forecasting accuracy: By categorizing items based on usage patterns, ABC analysis can inform more accurate forecasting, leading to better planning for future needs.
Develop optimal ordering plans: Identify what and when to order and how much to order for each item category (A, B, C) based on their cost and usage.

Set strategic inventory levels: Determine the appropriate amount of stock to hold for each category, reducing unnecessary investment in low-value items while ensuring adequate stock of critical items.

Inform inventory control policies: Establish clear guidelines for managing different item categories, ensuring efficient use of resources and minimizing the risk of stockouts or overstocking.

For Group- A: Onder should be placed frequently, and lead time should be as less as possible to prevent damage by overstocking and not utilizing items.

For Group- B: There should be sufficient stock which should be maintained, and orders should be placed less frequently.

For Group- C: Orders can be placed very low frequently.

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