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Inventory Analysis in a Tertiary Care Teaching Hospital in Visakhapatnam City, Andhra Pradesh

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Abstract

Tertiary care dental treatment falls under the service industry. Activities across departments trace costs as there is a scarcity of literature pertaining to inventory analysis. So, the present study was conducted to undertake an ABC-VED coupling matrix analysis of dental consumables at stores being held by a tertiary care teaching hospital in Visakhapatnam, Andhra Pradesh to improve the management and control of inventory of stores.

Materials and Methods: An observational study was conducted from June-September 2023 during which secondary data for the financial year 2022-2023 regarding dental consumables was collected from the store's department. For ABC, VED analysis, and ABC-VED matrix the information regarding the total cost and consumption of materials will be taken from the stores. Data regarding dental consumables and expanded materials are included in the study whereas societal and patient individual costs and financial information of the human resources department are excluded from the study. The data is entered into Microsoft Excel.

Results: A total of 220 dental consumables out of which, approximately 29 (13.2%) accounted for 70% of annual expenditure and were classed as A. 54(24.5%) of the materials consumed 20% of the budget classed as B and 137 (62.3%) classed as C. In VED analysis 103 (46.8%) of the consumables as Vital, 77 (35%) as essential, and 40 (18.2%) as Desirable. In the ABC-VED matrix obtained for each category is Category I it is 47.7%, for Category II it is 36.8%, and for Category III it is 15.5%.

Conclusion: It is concluded that the use of inventory control techniques should be increased and made a normal practice in the current healthcare facility.

Keywords: ABC Analysis; VED Analysis; ABC-VED Matrix; Cost

Abbreviations: ABC: Always Better Control; VED: Vital Essential Desirable; FSN: Fast-Moving; Slow-Moving; Non-Moving; SDE: Scarce, Difficult, Easy, HML: High, Medium, Low; SOS: Season-Off-Season.

Introduction

Economics is constructed on the three fundamental principles of scarcity, choice, and opportunity cost and is concerned with maximizing the advantages of the resources that are accessible to us [1]. In the Indian scenario several dental benefits are not covered by health insurance in India, therefore it is challenging for the majority of people to afford dental care. Instead of invasive, expensive procedures, many patients choose other cheaper procedures like tooth extraction. Due to the discrepancy in spending between the

public and private sectors for high-quality, affordable dental treatment, dental diseases have a significant economic cost. Cost affects utilization, and the high cost of dental care is the primary reason cited by patients for not visiting the dentist. Also, there are demands for high-quality outcomes with shorter turnaround times and increasing workloads with a smaller staff [2].

Cost analysis is an essential step in their scientific development. To reserve adequate resources, it is necessary to understand the actual expenses of dental care services and employ them effectively and successfully. Cost and performance analysis is a useful tool for lowering expenses and enhancing operations [2]. A hospital supply system ought to ensure that there is adequate stock of the items that they need to maintain an uninterrupted supply of all essential items to provide optimal care. The development of cutting-edge medical technologies has enabled the cost of health care to rise disproportionately. Hence, a hospital spends roughly one-third of its budget on procuring various goods.

ABC (Always, Better, Control), VED (Vital, Essential, Desirable), FSN (Fast-Moving, Slow-moving, Non-moving), SDE (Scarce, Difficult, Easy), HML (High, Medium, Low), and SOS (Season-Off-Season) are a few examples of scientific approaches to inventory management [3].

Inventory is alluded to in finance as the total worth of raw materials, semi-processed materials, consumable maintenance items, and finished commodities at any particular time. "The operational definition of inventory would be the number of materials to be stocked for the smooth running of the plant." Since these resources are idle when kept in stores, inventory is defined as an idle resource of any kind having an economic value [4].

The most effective inventory control techniques are ABC and VED. The coupling matrix, however, is most pertinent for inventory analysis in hospitals since VED takes criticality into account while ABC analysis merely considers costs. ABC analysis, popularly known as "Always Better Control" is based on Pareto's principle of "Vital few and trivial many". Materials are classified as A, B, or C based on how often they are utilized annually. 10% of the products in Group An account for around 70% of the budget. Group B has the next 20% of items, which use 20% of the financial resources, while Group C contains the remaining 70% of items, which account for just 10% [5].

VED analysis is a method that is used in the control of drugs and medical materials. "V" is for vital items without which a hospital cannot function, "E" for essential items without which a hospital can function but may affect the quality of the services, and "D" stands for desirable items, unavailability of which will not interfere with functioning [6].

Tertiary care dental treatment falls under the service industry as there is a scarcity of literature pertaining to inventory analysis. So, the present study was conducted to undertake an ABC-VED coupling matrix analysis of dental consumables at stores being held by a tertiary care teaching hospital in Visakhapatnam, Andhra Pradesh to improve the management and control of inventory of stores.

Methodology

An observational study will be conducted from June – September 2023 during which secondary data for the financial year 2022-2023 regarding dental consumables will be collected from the store's department in Tertiary Care Hospital, Visakhapatnam, Andhra Pradesh. For ABC analysis, information regarding the total cost and consumption of materials will be taken from the stores. The value of the annual consumption of all the dental consumables will be calculated after multiplying the unit cost by annual consumption [7].

Data regarding the total cost of all the dental materials obtained and annual consumption in the financial year 2022-2023 and all expandable materials were included in the study. Societal and patient individual costs, financial information about human resources, and Non-expandable materials were excluded from the study. The ethical clearance was obtained from the Institutional Ethics Committee with reference number ANIDS/IEC/2023002. The study procedure was explained to the Head of the Institute and obtained permission from the particular Department HOD's and stores in charge of Tertiary Care Hospital, Visakhapatnam [8].

Data Collection

The entire cost and consumption of materials for the fiscal year 2022-2023 were acquired from the stores department. For ABC analysis after calculating unit cost by annual consumption, the total worth of all dental consumables was estimated. The resulting statistics were organized in descending order of Rupee value, and the dental consumables were then divided into three categories: A (70%), B (20%), and C (10%).

A list of all dental consumables was submitted to a team of nine dental personnel for VED analysis, consisting of a person from each department (periodontist, endodontist, oral medicine, prosthodontist, orthodontist, oral pathologist, oral surgeon, public health dentist, pedodontist) along with stores in charge who is in charge of material procurement. The list was created by them and approved by the Head of

Department. They were asked to categorize the consumables as vital, essential, or desired. The consumables that were shared by all departments were classified based on the panel member's 50% mutual consent.

For consumable inventory, ABC analysis alone is insufficient since it may miss the needed managerial control of critical products from the B and C categories. When solely VED analysis is used to determine a control strategy, some desirable (D) category consumables will be placed in the priority list, thereby impeding an efficient management mechanism. The ABC-VED coupling matrix model, on the other hand, can overcome the difficulty of prioritization in control mechanisms, notably for determining the reasonable strategy for recurrent order placement and effective vigilance. The data was combined into an ABC and VED matrix, resulting in the categorization of consumables as Category I, II, and III.

Statistical Analysis

The data collected were entered into Microsoft Excel Software.

Results

A total of 220 dental consumables were collected somewhere listed in Table 1.

Materials		
Gloves	Burs	Fluoride Gel and Trays
Mouth Mask	Glass Ionomer Cement	Rotary Files
X-Ray Flims	K-Files	Alloy Amalgam
Implants	Gutta Percha	Teeth Set
Rubber Base Materials	Composite Kit	Metal Brackets
Alginate	Pit And Fissure Sealant	Local Anesthesia

Table 1: List of some important materials in dental hospital.

A total of 220 dental consumables out of which, approximately 29 (13.2%) accounted for 70% of annual expenditure and were classed as A. Another 54(24.5%) of the materials consumed 20% of the budget which is classed as B, while the rest 137 (62.3%) accounted for barely 10% of the total annual expenditures which is classed as C which is listed in Table 2.

Dental Consumable Analysis	Category			Total
	A	B	C	
Total annual consumption (%)	70	20	10	100
Value of annual consumption (Rupees)	3182510	1564499	563407	5310416
Number of items	29	54	137	220
Number as percentage	13.2	24.5	62.3	100

Table 2: ABC Analysis of Dental Consumables.

According to VED analysis, (Table 3) the dental consumables were divided by the clinicians of particular departments as vital, essential, and desirable. Among them 103 (46.8%) of the consumables as Vital, 77 (35%) as essential, and 40 (18.2%) as Desirable.

Category	Number	Percentage
Vital	103	46.80%
Essential	77	35%
Desirable	40	18.20%

Table 3: Distribution of Dental consumables into VED Classification.

The ABC-VED matrix classification of the inventory shown in Table 4 revealed that 27 consumables in Category-I items were expensive and vital, 2 were expensive and essential, and none were expensive and desirable. Category II items consisted of 35 intermediate-cost and vital products, 13 were intermediate-cost and essential items, and 6 were intermediate-cost and desirable items. 41 items were low-cost and vital items, 62 items were low-cost and essential and 34 were low-cost and desirable in Category III.

Category	V	E	D
A	AV(27)	AE(2)	AD(0)
B	BV(35)	BE(13)	BD(6)
C	CV(41)	CE(62)	CD(34)

Table 4: ABC VED Matrix.

In the present study Categorization of ABC-VED matrix Table 5 the percentage obtained for each category is Category I it is of 47.7%, for category II it is of 36.8% and for Category III it is of 15.5%. Some of the categorized materials are listed in Table 6.

Category		No. of Items	% of items
Category I	AV+BV+CV+AE+AD	105	47.70%
Category II	BE+CE+BD	81	36.80%
Category I	CD	34	15.50%

Table 5: ABC VED Matrix Category.

Category I	Category II	Category III
Local Anesthesia	Avue Cal	Dental stone
IOPAR films	Burs	Sodium Hypochlorite
Glass Ionomer Cement	Pit and fissure sealant	Formocresol
Alginate	Rubber dam sheets	Wedges
Gloves	2ml syringes	crowns

Table 6: ABC -VED Matrix.

Discussion

The emergence of technology in medicine has been in tandem with both quality and cost concerns. The managerial staff of hospitals has a responsibility to the community to offer health care services of acceptable level and quality at an affordable price [9].

Administrators may enhance the efficiency of hospital departments and the hospital system as a whole by understanding the costs of various activities. The hospital management owes it to the community to offer the health services that the community requires at an acceptable degree of quality and at the lowest possible cost. Cost determination and analysis can assist department heads, hospital administrators, and policymakers in determining how well their institutions meet these public demands [10].

Cost accounting, sometimes known as costing, is a branch of accounting information systems that records, measures, and reports cost information. It relates to the strategy and process of determining cost, as well as its application in decision-making and performance evaluation. For the purposes of this study, costs were calculated generically under three key cost centers: Material cost, Manpower cost, and Utility cost [11].

In the present study there are total of 220 dental consumables were utilized by a tertiary care hospital in the financial year 2022-2023. According to ABC analysis approximately 29 (13.2%) accounted for 70% of annual expenditure and were classed as A which is similar to the study done by Gupta N, et al [3], Sunil VVN, et al [4], Gupta R, et al. [5], Manhas AK, et al. [7] and contrary to the a study done by Kumar S, et al. [12]. it might be due to the dental consumables in the A category are of high cost with large quantities useful in the tertiary care hospitals.

In the present study ABC analysis, another 54(24.5%) of the materials consumed 20% of the budget which is classed as B which is similar to the study done by Gupta N, et al. [3], Sunil VVN, et al. [4], Gupta R, et al. [5], Manhas, AK et al. [7], Mani, et al. [13], Singh et al. [14] it might be due to the dental consumables which are required with large quantities and are at better control.

In the present study ABC analysis while the rest 137 (62.3%) accounted for barely 10% of the total annual expenditures which is classed as C which is similar to the study done by Gupta N, et al [3], Sunil VVN, et al. [4], Manhas AK, et al. [7], Mani, et al. [13], Singh, et al. [14], Wandalkar P, et al. [15] and contrary to the study done by Kumar S, et al. [12] it might be due to variations in the usage of materials in different places.

In the present study according to VED analysis, the dental consumables were divided by the clinicians of particular departments as vital, essential, and desirable. Among them 103 (46.8%) of the consumables as Vital, 77 (35%) as essential, and 40 (18.2%) as Desirable which is in accordance with the studies done by Pund S, et al. [16], Gunergoren H, et al. [17], Gupta R, et al. [5], Khurana S, et al. [18] and is contrary with the studies done by Sunil VVN, et al. [4], Anand, et al. [19] it might be due to the different variations and different usage in each place and also a difference in materials used.

In the present study the ABC-VED matrix categorization of approximately 47.7% is of category I and 36.8% belongs to category II and at last 15.5% belongs to category III which is accordance with the study done by Sunil VVN et al4, Gupta N et al3, Pund S, et al. [16] and contrary with the studies like Kumar S, et al. [12], Gunergoren, H et al. [17], Vaz, et al. [20], Thawani, et al. [21].

The availability of services, precisely dental consumables, was a critical aspect in the provision of health care in the tertiary care dental hospital facility [22]. Aside from the criticality, the pricing of the things was also essential [23]. The stock of these dental consumables must be maintained throughout the term to ensure the hospital's proper operation, as their unavailability is undesirable [24]. To circumvent this, have low-cost interim supplies on hand at all times while keeping vigilant tabs on consumption and stock on hand [25].

In today's highly competitive world, the economics of material control is a question of self-presentation.

Materials control is a question of rupee control; it is self-evident that higher-value commodities must be subject to stricter controls. Inventory management reduces the opportunities for optimizing service costs while making supplies available to patients, improving supplies available to patients, which improves the quality of health care services. Thus, managing class I critical items would aid in keeping track of the annual budget and its availability. The management of class II items could aid in the provision of all necessary things. Low-level management can manage Class III objects [26-28].

Limitations of the study are as dental consumable varies from one hospital to another hospital based on workload and patient flow so generalizability cannot be done.

Recommendations

- Implementing Purchasing inventory only when it is needed.
- Implementation of an automated system for measuring the inventory index and other inventory control metrics.
- Dental consumables should be examined regularly to remove non-moving materials that have not been consumed in the last three months.
- Inventory coding and classification were critical for eliminating duplicate products in the warehouse and fulfillment of physical inventory management.

Conclusion

It is concluded that the use of inventory control techniques should be increased and made a normal practice in the current healthcare facility. The concept of selective inventory control, on the other hand, is universal for accomplishing the goal of the "Right Consumable in the Right Quantity at the Right Price and in the Right Place."

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