Enhancing the Inventory Control Effectiveness of a Pharmaceutical Distributor in Egypt: A Case Study

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Enhancing the inventory effectiveness is critical in the pharmaceutical industry due to the numerous products, high operating costs, and low profit margins. This research paper studies the impact of the inventory classification techniques, handheld devices on the effectiveness of the inventory control system of a pharmaceutical distributor operating in Egypt. The distributor provided some KPI's to quantify the inventory effectiveness; such as nondelivered items, number of delayed orders, productivity, damages, etc. Results revealed that handheld devices had significantly decreased the non-delivered items and enhanced the labor productivity. ABC-VED approach identifies the drugs requiring stringent, moderate and low managerial control; used to plan a cycle counting schedule. This study recommends assigning service levels based on the VED results leading to higher safety stock for the vitally important drugs and lower holding costs for the other drugs. It further recommends classifying the inventory based on unit costs and using different packaging colors accordingly.

Keywords: Classification approaches, Cycle counting, Handheld device solution, Record accuracy, Inventory effectiveness

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I. INTRODUCTION

Pharmaceutical distributors spend significant amounts of money on inventory control system to ensure smooth and uninterrupted supply of drugs at lower costs. Schreibfeder (2016) introduced three goals for effective inventory management systems: good customer service, reasonable return on inventory investment, and elimination of surplus inventory and dead stock. Managers are in critical need for reliable and effective inventory control system in order to reduce costs and remain competitive (Oballah and Waiganjo, 2015). Ng'ang'a (2013) presented a study to identify the factors reducing the inventory control effectiveness: delay of procurement orders, high frequent stock-out occurrence events, prices are highly uncertain, and fund is not available on time. Koumanakos (2008) and Resia et al. (2014) studied the effect of the inventory control of the organizational performance. Resia et al. (2014) revealed that inventory management, warehouse management, order management, and supplier management influence the supply chain as well as the organizational performance. Stevenson (2012) presented the requirements of an effective inventory management: tracking system for the on-hand inventory, reliable demand forecast with estimation of possible forecast error, estimation of average lead time and its variability, inventory costs estimation (holding, ordering, shortage), and classifications of inventory items.

Bharat (2000) identified that information technology can be used to improve the supply chain inventory effectiveness. Massoth et al. (2008) indicated the technologies used to enhance the inventory tracking system as well as the accuracy of the inventory records; the handheld devices for handling warehouse activities are examples of that technology. The integration of mobile technology into inventory management provides opportunities for logistical operations, information exchange; facilitates communication and enhances the collaboration among different units in a company. It increases stock visibility, which is critical to time-sensitive business process. Wireless technology in mobile warehouse management systems are used to track inventory and screen movement throughout the warehouse. Rai et al. (2012) stated that information technology solution could be very useful in reducing costs, increasing supply chain flexibility and responsiveness. By utilizing and sharing technology with the key players in the supply chain, retailers can develop collaborative planning, forecasting, and replenishment programs. In this way, they can reduce stock-outs, increase inventory turns and margins, and ultimately deliver a convenient, fast, cost-effective service. Economides and Nikolaou (2014) presented an evaluation of the use of handheld device in the educational organizations. Rfgen (2014) has presented some criteria for selecting a mobile data solution: ability to integrate with the company ERP system, it will not require any changes regardless of ERP upgrades, less implementation time and cost, easy and affordable customization, ability to work with all mobile devices, and low software and hardware costs.

The inventory of drugs is classified in respective to: ABC analysis, VED technique, and ABC-VED matrix. These approaches sort inventory items into three categories based on the Annual Drug Expenditures (ADE), the degree of drug criticality and both criteria together. Thawani et al. (2004), Devnani et al. (2010), Khurana et al. (2013), Kumar and Chakravarty (2015), and Singh et al. (2015) employed the ABC, VED, and ABC-VED classifications to determine which drugs require stringent, moderate and low managerial control that optimize the resources used and reduce the likelihood of out-of-stock events. Thawani et al. (2004) used the specified techniques to analyze the expenditure of a governmental hospital. Devnani et al. (2010) conducted a study at the drug warehouse of a Tertiary Care Teaching, Research and Referral Hospital. Khurana et al. (2013) presented a study to identify the drugs requiring stringent managerial control as well as to analyze the annual usage of drugs at the pharmacy of the Tertiary Care Neuropsychiatry Hospital in Delhi-India during the financial year 2008-2009. In 2011-2012, a similar study was conducted at a hospital belonging to India's Armed Forces (Kumar and Chakravarty, 2015). Singh et al. (2015) conducted a similar study on the drug warehouse of a tertiary care of the Academic Institute of the northern India to determine the drugs that require stringent managerial control to optimize the use of resources and minimize the likelihood of the occurrences of out-of-stock events.

This paper presents a case study to determine the impact of using the ABC analysis; VED technique; ABC-VED matrix;

and the handheld device technology of inventory effectiveness in a multi-national pharmaceutical distributor operating in Egypt. The research questions for this study are as follows:

1. What are the drugs requiring stringent, moderate, and low managerial control?
2. What is the distribution of the ADE, Annual Drug Expenditures?
3. What is the impact of using the handheld device solutions on the inventory effectiveness?
4. How the ABC, VED, ABC-VED, and HML techniques influence the inventory effectiveness?
5. How the HML technique optimizes the drug allocation in a warehouse and improves drug handling?

The company has provided the following *Key Performance Indicators* (KPI's) as quantitative measures for inventory effectiveness: (1) non-delivered items that occur when a customer order does not include all requested items and/or the number of units requested is incorrect resulting in incomplete orders delivered to the customers, (2) returns occur when wrong forms and/or products are shipped to the customers; and (3) delayed orders, when the customer orders are delivered to the customers after their promised due-date. These inconveniences result in an ineffective inventory control system; leading to lower customer satisfaction and higher inventory costs.

This research contributes methodologies to enhance the health care inventory control systems effectiveness. It provides a classification method to optimize the allocation of drugs in the warehouse, and a rough estimate of a ratio to compare the numbers of planned physical counting. It also suggests an approach to select diverse service levels used to compute the safety stock of all drugs.

II. MATERIALS, METHODS, AND RESEARCH LIMITATIONS

This chapter presents the different methods and technology used to attain an effective inventory management system. Section 2.4 presents the research limitations.

2.1. ABC, VED, and ABC-VED Methods

The ABC classification concept is an extraction from an observation made by Vilfredo Pareto, an Italian economist, in 1906. That observation explained the unequal distribution of wealth in his country. Other similar observations, made by other economists at different parts of the world, followed the Pareto's observation. The observations affirmed that 20% of the population own 80% of the wealth. In 1940 Joseph M. Juran attributed the 80/20 rule to Pareto and refers to those observations as "Pareto principles" (Reh, 2016). Wong (2006) indicated that ABC analysis could be applied to inventory control to identify the level of importance of each item in the warehouse as well as the proper level of control required for each drug. The article suggests to classify 20% of the items as A, which accounts for 80% of the ADE, 30% classified as B and contribute about 15%, and 50% as C and contribute about 5%. Stevenson (2012) had indicated that ABC analysis divides inventory items into 3 categories based on a specific criterion, usually annual revenue of items: 10-20% of the inventory items are usually classified as A, 50-60 % as C, and the remaining items as B.

In healthcare industry, ABC classification is not good enough; drug criticality must be considered in the classification. VED classification approach classify inventory of drugs into three classes: V (Vital), E (Essential), and D (Desirable). ABC-VED approach divides the drugs into 9 subclasses: AV, AE, AD, BV, BE, BD, CV, CE, and CD. The subclasses were divided into 3 groups: I, II, and III. Group I consists of the drugs in subcategories AV, AE, AD, BV, and CV, group II contains the drugs in subgroups , BE, BD, and CE, group III consists of the drugs in subgroup CD.

2.2. Hypothesis Testing Methodology

Hypothesis testing is a statistical approach that uses sample data and probability theory to test the validity of a hypothesis; usually about a population parameter such as the population mean or standard deviation (Lind et al., 2012). The method requires defining two hypotheses: null and alternate hypothesis. The null hypothesis is a statement about a population parameter. The alternative hypothesis is the one to accept if the sample data provides enough evidence to reject the null hypothesis.

In this study, this technique is to test whether the average differences between the costs of undelivered items before and after using the handheld device is zero or more. If the result shows that it is zero, there will be no significant differences between the costs of non-delivered items. As a result, the handheld device has no impact on the nondelivered items. Otherwise, if the differences were more than zero, it signifies that the use of the device has reduced the costs of nondelivered items.

2.3. Handheld Device mobile Solution

This study considers using a handheld mobile solution. A private company proposes a handheld mobile solution for the drug distributor. They selected Honeywell's Dolphin® 6500. Rai et al. (2012) explain the benefits of using the automated data solution as: it improves accuracy, increases productivity, reduces labor cost, and increases the ability to track the products.

2.4. Research Limitations

The pharmaceutical distributor under study provided an excel sheet containing 6751 lines of data for the year 2015-2016 sales. The data sheet includes the drug names, serial numbers, unit prices and annual sales. Other drugs not carried by this distributor are out of the scope of this study. Data collected to test the significance of using the handheld device at several company branches include data from a newly open branch that was able to provide only a single line of data.

III. RESULTS

This chapter presents statistical data analysis; collected data comes from the database of the financial year 2015-2016 of the multinational pharmaceutical distributor. The company includes the amounts of nondelivered items before and after using the handheld device at different company branches. In addition, an Excel sheet including drug names, unit costs and annual sales.

3.1. Impact of Using the Handheld Device Technology on Inventory Effectiveness

Table 1 below presents the values of non-delivered items in terms of Egyptian pounds at six different company branches before and after using the handheld device. The non-delivered items are the items printed on the customer's invoice but not shipped to customers due to errors in both the assembly and control processes. The hypotheses to be tested are:

H_0: The average of the differences between the non-delivered items before and after using the handheld device is 0.
H_1: The average is more than 0.

The fourth column in table 1 contains the differences between the values of non-delivered items before and after using the device. The average and standard deviation of the differences were computed, the t-test with matched paired (t-test with Paired Comparison) was employed to test the significance of using the device (Montgomery, 1984, pages 32-35) to improve the precision of the hypothesis testing.

Step 1: Null and alternate hypothesis:

$$H_0: \mu_d = 0$$
$$H_1: \mu_d > 0$$

μ_d = Average differences between the non-delivered values before and after using the handheld device.

Step 2: Level of significance: $\propto = 0.05$

Step 3: Test Statistics - t test

The average differences between the figures before and after using the handheld device $\bar{d}$= 6,714 EGP, the sample size n = 21, number of degrees of freedom is 20, the standard deviation of the differences is S_d = 14,323.4 EGP.

$$t = \frac{\bar{d}}{\text{Sd}/\sqrt{n}} = \frac{6{,}714}{14{,}323.4/\sqrt{21}} = 2.148$$

Step 4: Accept or Reject the null hypothesis

TABLE 1. NONDELIVERD ITEMS AT DIFFERENT BRANCHES.

Branch	Before	After	Differences	Percentage decrease
16	3,798 EGP	3,603 EGP	195 EGP	5.1
17	23,403	4,011	19,392	82.9
19	3,411	18	3,394	99.5
43	829	218	611	73.7
80	66,395	655	65,740	99.0
81	4,043	553	3,490	86.3
16	1,684	462	1,222	72.6
17	9,647	1,121	8,526	88.4
19	2,628	86	2,541	96.7
80	7,853	1,996	5,856	74.6
81	989	24	964	97.5
16	2,541	1,988	553	21.76
17	11,602	1,188	10,414	89.8
19	3,206	61	3,145	98.1
16	1,991	1,095	896	45
17	11,233	2,038	9,195	81.9
19	2,832	429	2,403	84.9
16	1,483	1,114	369	24.88
19	1,684	564	1,120	66.5
19	2,163	1,219	943	43.6
19	509	484	25	4.9

Based on the t-table, results revealed the p-value ranges between 0.01 and 0.025. Also, the online social statistics calculator listed in the reference section indicated that the p-value is 0.022074, which is significant at the 0.05 level. Therefore, the null hypothesis is to be rejected and the alternative hypothesis will be accepted - H_1: There are significant differences between the values of non-delivered items before and after using the handheld device. Consequently, one can show that using technology will enhance inventory record accuracy and inventory visibility. This will lead to make the orders in the right time with the correct quantities; leading to minimum rate of occurrences of under or over-stocks; which enhances the level of customer service as well as minimize the total cost of inventory.

Statistical results revealed that the average and median percentage of the non-delivered items have decreased due to the use of the device from 68.5% to 81%; i.e. in more than or equal to 50% of the orders, the costs of the non-delivered items have decreased by more than or equal to 81%., in the other 50% of the orders, the costs have decrease by less than or equal to 81%.

3.2. Descriptive Summary for the Statistical Data

A descriptive summary of the statistical data illustrates that the number of drugs carried by this distributor is 6751, with average, medium and standard deviations of unit purchasing costs as 21.63 EGP, 10.96 EGP, and 44.53 EGP, respectively. Therefore, the unit purchasing costs of 50% of the drugs are less than or equal to 10.96 EGP, while that of the other 50% is more than or equal to10.96 EGP. Furthermore, the quartiles, the measures dividing the data set into four parts reveal that the first quartile of the unit purchasing cost is 5.37 EGP, the second is 10.96, and the third is 22.37EGP. Therefor 25% of the unit purchasing costs are less than 5.37 EGP, the other 25% is from 5.37 to 10.96 EGP, the third 25% is from 10.96 to 22.37EGP and the last is from 22.37 to the maximum value, which is 1522 EGP. The average, medium and standard deviations of the annual sales are 68,801, 14,460, and 258,273 units, respectively.

3.3. VED Classifications

The VED approach classifies drugs into three categories based on the drug criticality: V (Vital), E (Essential), and D (Desirable). A team of three pharmacists have identified the proper allocation of drugs to the classes V, E and D. Table 2 illustrate the results of the study. It displays the number of drugs, percentages of drugs, and percentages of ADE in each of the V, E, and D classes.

The table shows 3064 drugs (45.38% of the drugs) carried by this distributor are classified as vital, on which the distributor spends 64.74% of the ADE.

TABLE 2. VED CLASSIFICATIONS.

Class	Drugs	Percentage of drugs	Percentage of ADE
V	3064	45.38%	64.74
E	1926	28.53%	26.94
D	1761	26.09%	8.32
Total	6751		

TABLE 3. ABC CLASSIFICATIONS.

Class	Items	Percentage Of Items	Percentage of ADE
A	900	13.33%	70.27%
B	1351	20.01%	19.73%
C	4500	66.66	10.00%
Total	6751		

One can achieve the strategy of providing higher safety stock for the V items and lower for the D items by carrying large safety stock for the drugs belonging to class V, moderate level of safety stock for E and low level for class D. Those variations in the safety stocks can be achieved by assigning higher service levels to the safety stock computational formula for the drugs in class V, moderate for class E, and lower values for class D. Based on the results determined earlier, 45.38% of the drugs (with 64.74% of the ADE) will require high safety stock, 28.53% (26.94% of AED) moderate safety stock, and 26.09%(8.32% of AED) will require low safety stock.

3.4. ABC-VED Classifications

The results of the ABC classifications, illustrated in Table 3, reveal that the total number of drugs is 6751; out of which 900 drugs (13.33%) were classified as A, 1351 drugs (20.01%) as B and 4500 drugs (66.66%) as C. The data also reveal that 70.27% of the annual drug expenditures (ADE) were spent on the drugs in class A, 19.73% on class B, and 10% on class C.

Table 4 divides the number and percentage of drugs into 9 subcategories AV, AE, AD, BV, BE, BD, CV, CE, and CD. Table 4 also does the same for the ADE.

The table shows that out of the 3064 vital drugs, 600 of them fall in the A category, 770 in the B category and 1694 in the C category. Same was done for the E and D Categories. Table 5 presented the allocation of ADE among the nine subcategories. The percentage of ADE in V, E, and D: 64.74, 26.94, and 8.31; respectively. Therefore 64.7% of the ADE is spent on vital drugs, 26.94% on essential, and 8.32% on desirable.

The 9 subclasses were divided into 3 groups: I, II, and III. Group I consists of the drugs in subclasses AV, AE, AD, BV, and CV, group II contains the drugs in subclasses BE, BD, and CE, group III consists of the drugs in subclass CD. Table 6 illustrate those results as group I consists of 49.83%, 27.09% are in-group II, and 23.08% are in-group III. The ADE distribution is 81.88% in-group I, 15.63% in II and 2.49% in III.

Schreibfeder (2016) indicated the importance of inventory record accuracy as: (1) inaccurate records may lead to the disruption of the company operations, (2) service level will decline, and (3) inventory cost will incline. Enhancing the inventory record accuracy is attained through conducting regular physical counting. Stevenson (2012) stated that the record accuracy standard must be identified before planning cycle counting; and the APICS guidelines of accuracy levels for classes: A = ± 0.2%, B = ± 1%, and C = ± 5%. Based on those standards, one should physically count class A more often than B; and class B should be counted more often than C. The ratios between accuracy standard levels required of A, B and C classes are 1: 2: 10, respectively. Since drug criticality must be taken into considerations in the pharmaceutical industry, one should use categories I, II and III instead of classes A, B, and C. Assume that there is a linear relationship between the number of annual cycle counts and the accuracy levels (which we found no supporting evidence of in the literature), an estimated ratio of the number of annual counts can be identified inversely with the ratios presented. Therefore, the cycle count schedules for groups I, II, III should be according to the ratios 12: 6: 1.2. As a result, one needs to perform the cycle counting 12 times a year (once each month) for group I, 6 times a year (bimonthly) for group II and 1.2 times a year (every 10 months) for group III. Following the international standard will lead to accurate inventory records, which result in prompt replenishment orders, low out-of-stock events; leading to higher service levels and avoiding placing unnecessary orders thereby, minimizing total inventory costs.

TABLE 4. VED – NUMBER AND PERCENTAGE OF DRUGS.

Classes	V	E	D	Sum	Percentage
A	600 (8.89%)	236 (3.50%)	64 (0.94%)	900	13.33
B	770 (11.41%)	442 (6.55%)	139 (2.05%)	1351	20.01
C	1694 (25.09%)	1248 (18.49%)	1558 (23.08)	4500	66.66
Sum	3064	1926	1761	6751	
percentage	45.38	28.53	26.09		

TABLE 5. VED – ADE PERCENTAGES.

Classes	V	E	D	Percentage
A	48.69	17.62	3.96	70.27
B	11.61	6.27	1.86	19.73
C	4.45	3.05	2.49	10.00
Percentage	64.74	26.94	8.32	100%

TABLE 6. ABC-VED CLASSIFICATIONS.

ABC –VED Results	Percentage Of Drugs	Percentage Of Drug Expenditure
I	49.83	81.88
II	27.09	15.63
III	23.08	2.49

TABLE 7. DRUG ALLOCATIONS IN WAREHOUSE.

Class	Items	Percentage Of Items	Percentage of ADE	Average Unit price	Warehouse Location
H	900	13.33	32.49	86.65 EGP	High Security area
M	1351	20.01	22.93	24.86 EGP	Moderate Security Area
L	4500	66.66	44.58	7.66 EGP	Low Security Area
Total	6751				

3.5. HML Classifications

The HML approach is newly introduced in this research paper. It is required to allocate products in the warehouse based on their security levels and to differentiate between packaging and handling to reduce theft and product damages. ABC classification cannot be used in this case since the A items do not have to be the ones with the highest unit price. The most appropriate classification approach that will fit this case is to classify inventory based on the unit purchasing prices. In order to avoid confusion between the ABC classifications and this newly introduced one, the classes in this section are assigned the letters HML: H, drugs with high unit prices; M, drugs with medium unit prices; L, drugs with low unit prices as shown in Table 7. The items with higher unit prices (Class H) are to be stored in the highly secured area; drugs belonging to classes M and L will be stored in moderate security and low security areas in the warehouse.

We also recommend the use of different packaging colors for the drugs in classes H, M, and L. Those colors help provide the appropriate care in picking and handling the drugs. This strategy helps reduce damages and theft for the expensive drugs leading to less cost. Table 7 illustrates the HML classification results. Based on the results one should allocate 900 drugs in the secure area, 1351 drugs in an area with moderate level of security, and 4500 in an area with low level of security. The capacity of the secured area was not large enough for this number of drugs. It was found that 242 drugs fill the secured area to its maximum capacity; therefore, we recommend expanding the space of the secured area. The table also shows that the average unit price in classes H, M, and L.

TABLE 8. COMPARISON OF RESULTS.

Classes	% Drugs in classes						% ADE in classes					
	Present Study	1	2	3	4	5	Present Study	1	2	3	4	5
A	13.33	10.76	13.78	3.45	6.77	11.23	70.27	69.0	69.97	70.5	70.03	70.19
B	20.01	20.63	21.85	6.90	19.27	24.60	19.73	20.8	19.95	19.68	19.98	19.83
C	66.66	68.61	64.37	89.65	73.95	75.40	10.00	10.2	10.08	9.83	9.98	9.98
V	45.4	23.77	12.11	32.41	13.14	12.3	64.74	40.4	17.14	70.9	19.00	19.56
E	28.5	38.12	59.38	61.38	56.37	61.5	26.94	39.9	72.38	28.72	68.00	71.12
D	26.1	38.11	28.51	6.20	30.49	26.2	8.31	19.7	10.48	0.38	13.00	9.33
I	49.84	29.16	22.09	33.80	21.00	21.38	81.88	79.1	74.21	92.33	69.45	58.27
II	27.09	41.27	54.63	60.00	51.17	58.27	15.63	17.3	22.23	7.29	24.35	20.69
III	23.08	29.57	23.28	6.20	27.83	20.32	2.49	3.6	3.56	0.38	6.2	3.18

IV. COMPARATIVE STUDY

This section presents a comparison between the results of the present study regarding the use of ABC, VED and ABC-VED classification approaches and that of some previous studies; classifying the products of some drugstores belonging to some different hospitals in India. The purpose of this study is to prove the consistency of the results found in this case study with the results developed in the literature. Table 8 illustrates the results of those studies as well as the present one. The studies published are as follows; study 1: presented in Thawani et al. (2004), was conduct at a governmental hospital, study 2: was presented in Devnani et al. (2010), was conducted at the drugstore of a Tertiary Care Teaching, Research and Referral Healthcare Institute; study 3: was presented in Khurana et al. (2013) at the drugstore of the Tertiary Care Neuropsychiatry Hospital during the financial year 2008-2009; study 4: Kumar and Chakravarty(2015), conducted in an expandable drugstore at a tertiary care hospital and study 5, Singh et al. (2015) was conducted at the drugstore of a tertiary care of the Academic Institute of the northern India.

It is quite clear that the variabilities in most of the ABC analysis results are not significant; however, the results of studies 3 and 4 are quite different. The differences attributed to several reasons: (1) type of hospital considered in the study, (2) hospital demand distribution of drugs, and (3) selection of upper and lower classification limits. If a specialty hospital is considered, the results depend on the type of drugs used by the hospital. Study 3 considered data from the drugstore of the Neuropsychiatry Hospital; which serves patients with medical disorders attributed to nervous system. The purchasing cost distribution of the drugs adapted by such a hospital is significantly different from the ones adapted by the general-purpose hospitals. Study 4 of considers drugs that are mostly different from the ones carried in most drug stores. Those types of drugs will have their own price distribution that may be different from the regular distribution of a regular pharmacy.

Similarly, the differences between the results of the VED technique attributed to: (1) the drug criticality distribution of each drug store that depends on the types of drugs carried in each store, (2) ABC selected classification limits, (3) whether the warehouse considered in the study belongs to a drugstore or a distributer. The criteria used to classify the drugs carried in of a pharmaceutical distributer warehouse into Vital, Essential, and Desirable may differ from those used in any drug store. In our case, some drugs that are always in demand by the government but may not be vital, the distributer regarded those drugs as vital. Therefore, the result of this study is consistent with the published results.

V. CONCLUSION AND RECOMMENDATION

This research presents an analytical study to test the impact of using the ABC, VED, and ABC-VED classification techniques as well as the handheld device technology to enhance the effectiveness of a pharmaceutical distributors' inventory management system. The company has provided some of the KPI's used to quantify the inventory effectiveness: nondelivered items, returns, delayed orders, lost items, damages, and productivity. Results revealed that the handheld device technology significantly reduced the numbers nondelivered items and increased labor productivity. Furthermore, this study shows that classification techniques are necessary tools to enhance the effectiveness of the inventory control system of the pharmaceutical distributor. The following are some of the recommendations made to enhance the inventory effectiveness for the pharmaceutical distributor:

1. Classify the inventory based on the VED approach and use the results to assign appropriate service level coefficients to compute the safety stock; high values for class V, moderate for class E, and low for class D. This strategy will increase the product availability for the vital items as demanded in the pharmaceutical industry.
2. Classify the inventory based on the ABC-VED approach and use the results to plan a cycle counting schedule. This schedule will provide more counting times to class I drugs, moderate to II and the least time to III. It will result in higher accuracy for the inventory records of 49.8% of the drugs that accounts for 81.9% of the ADE. Having clean/accurate inventory records help the management place the replenishment orders on time; avoiding unnecessary replenishment orders; reducing the costs of holding unnecessary inventory, out-of-stock events, and the costs of counting because we focused on 49.8% of the drugs. As a result, this will lead to lower costs and higher customer service levels.
3. Classify the inventory based on the introduced HML approach; the criterion is the unit drug prices. HML refers to H, drugs with high unit costs; M, medium unit costs; and L, low unit costs. Use the results achieved in this classifications to:
    a. Assign a level of security to drugs i.e. to allocate high security level drugs in a secured location in the warehouse.
    b. Use different packaging colours or different labels on the drugs in classes H, M, and L. Drugs with higher unit costs as well as fragile items require that special care in handling are classified in class H. Those that require moderate care are to be classified in class M. Finally, those that require minimal care are to be classified in class L. This strategy help reduce the damages in the high cost items; leading to lower cost due to handling and delivery.

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