ANALYSIS OF DRUGS IN HOSPITAL PHARMACY BY INVENTORY MANAGEMENT

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ABSTRACT
The objective of this paper is to analyze the current process of drug inventory control and to find possibility for improvement. The study was conducted by using qualitative research method. Relevant information was collected from both primary and secondary sources. Different inventory methods such as ROP, EOQ, fixed order interval approach and two-bin analysis were presented and explained. Nine drug groups, generated from coupling ABC and VEN, require different inventory methods and types of management. Therefore, utilization of inventory methods should be decided based on their suitability. The study can propose the possibilities to improve drug inventory management in the hospital pharmacy.

KEYWORDS: Inventory Control, Reorder Level, Economic Order Quantity, ABC And VEN Analysis.

INTRODUCTION
Inventory control is more challenging in business. It can directly affect business performance. The reason for having inventories or stocks is to buffer against demand and supply. Having too much inventory on hand means high holding cost, and having too little leads to a rise in ordering cost. Therefore, inventory management should be well planned in order to achieve the lowest possible total cost. Managing and controlling inventory are compulsory practices for firms that seek for profitability. The goals for controlling inventory are minimizing the total cost and maximizing service level by balancing demand and supply. When it comes to hospital pharmacy, being proactive is the most crucial qualification. Generally, order or demand is not confirmed beforehand since number of patients is really difficult to predict. Medicinal products are really unique compared to the other commodities since they deal with illness and life saving.

Literature Review
The different inventory procedures have been developed to enhance inventory management in different purposes. According to ABC classification, it suggests that the more analysis should be applied to materials with high inventory value. Class A should be most
extensively handled and Class C is analyzed little. Advantage of ABC classification is that controlling small numbers of items amounting to 10-20% will result in the control of 75-80% of the monetary value of the inventory held. VEN classification is a method that pays attention to criticality of drugs. Drugs are categorized into three groups based on basis of priority and importance to patient’s health. V – Vital drugs potentially involve lifesaving. E – Essential drugs: N – Nonessential drugs.

Many approaches are used in order to control inventory. Each method has different objectives and procedures. Selecting and utilizing methods of inventory control depends on feasibility and suitability. In a hospital pharmacy, a combination of different methods is recommended because of numerous drugs in the inventory. Methods of inventory control are Open-to-Buy (OTB) Budget Method is an inventory control method with regards to purchasing policy, Short-List Method emphasis is to provide accurate and timely inventory information to the person who is responsible for order placement and Stock Record Card Method is used to record information about movement of products in the storage area. Under the condition of certainty when lead time and demand are certain, fixed order quantity approach can be applied to determine order quantity. An existence of uncertainties seems to be a very common and regular situation in business. Uncertainty includes change in demand, damage during transportation and delay delivery. In health care industry where size of hospital, number of visitors (OPD, IPD), seasonal factor, specialization, epidemics etc affected drug consumption rate. For this EOQ is

\[
Q = \sqrt{\frac{2D_o (C_o + C_s)}{C - C_A}}
\]

Where Q is order quantity, \( C_o \) is ordering cost, \( C_s \) is expected stock out cost per cycle, \( D_A \) is annual demand, \( C_A \) annual inventory carrying cost and C is average cost.

When there is an existence of demand fluctuation, then reorder point (ROP) model helps protect service level and prevent stock out should be reformulated as well. The ROP can be determined by adding cycle stock and safety stock. Two types of stocks are taken into account when it comes to determination of ROP. For cycle stock the average demand during lead time will be calculated by multiplying average daily demand and average lead time. The safety stock is calculated as follows:

\[
s = \sqrt{\left[\frac{\sigma_{LP}(\sigma_{D})^2}{D} \right]^2 + \left[\frac{\sigma_{sD}}{D} \right]^2}
\]
Where $\sigma$ is standard deviation of demand during lead time, $\bar{t}_{LT}$ is mean lead time length, $\sigma_{D}$ is the standard deviation of daily demand, $\bar{D}$ is mean daily demand, $\sigma_{LT}$ is standard deviation of lead time length. The reorder point associated with cycle stock and safety stock can be calculated as addition of mean and standard deviation with variable value. According to the normal distribution, if variable value is 1, the probability that demand during lead time will not exceed the available inventory is approximately 84.13%. At 2 and 3 standard deviations, the stock out protection level reveals at 97.72% and 99.87% respectively.

Model Formation

We collected the data from a nursing home which is situated in Faridabad. There are eight departments in the nursing home: Surgery, Pediatrics, Medicine, ENT, Obstetrics and gynecology, Eye, Dentistry and Anaesthesia. During the year 2012, there were 1,256 visits of OPD patients and 576 visits of IPD patients. There are pharmacy department and pharmacy store also. The kinds of drugs are: Tablets, Capsules, Injections, Liquids, Ointments, Drops, Powders, Fluids and Miscellaneous.

The pharmacy department acts as a middle party between suppliers and distributors (OPD and IPD departments). The main responsibilities that the pharmacy has to perform are engaged with procurement process and inventory management, in which several activities are involved. The major activities regarding regular inventory process are purchasing, receiving, storing, issuing, monitoring, reporting and waste management.

Analysis

ABC & VEN Classification

We should be applying some methods to categorize and organize the inventory of 510 items. The ABC classification is a strong method to classify the items as 75-80% to A, 15% to B and 5-10% to C. The ABC analysis should be good with VEN classification which concentrates on the criticality on drugs. ABC analysis alone is not effective enough to be applied in the hospital pharmacy since it is not only about values that matters in hospital operation. Vital, essential and nonessential drugs should be also classified. In the following table VEN and ABC analysis is showed:
In the above table 79.4% of the total cost was spent on class A and remaining 20.6% on Class B and C. The class A showed that four out of eight drugs are in nonessential category which contributed 46.9% of total budget. A combination of ABC and VEN classifications provides nine categories AV, AE, AN, BV, BE, BN, CV, CE and CN. The coupling matrix of ABC and VEN models has proved to be a useful essential tool for drugs prioritization of hospital pharmacy, especially when the budget of expenditure is limited to cover all medical requirements.

**Reorder Point**

Let the past consumption of Insulin HM 100 ml April – September 2012 provides required values as follows: Average daily demand was 25.12, standard deviation of daily demand was
17.34, average lead time was 5.54, standard deviation of lead time was 3.78 and maximum daily usage was 97. For cycle stock, Average demand during lead time = average daily demand x average lead time length

\[ = 25.12 \times 5.54 = 139 \text{ (Approximately)} \]

An average demand at 139 injections is needed during the replenishment cycle when lead time varies from 4 to 15 days. For safety stock, Standard deviation of demand during lead time

\[ = \sqrt{[5.54^2(17.34)^2 + (25.12)^2(3.78)^2]} \]

\[ = 103.35 \text{ or } 104 \]

<table>
<thead>
<tr>
<th>Reorder point</th>
<th>customer Service level</th>
<th>stock out situation</th>
</tr>
</thead>
<tbody>
<tr>
<td>139 + 104 = 243</td>
<td>88.51%</td>
<td>11.49%</td>
</tr>
<tr>
<td>139 + 208 = 347</td>
<td>99.62%</td>
<td>0.38%</td>
</tr>
</tbody>
</table>

By second method safety stock = (97 – 25.12) x 5.54 = 398, Reorder point = 139 + 398 = 537. So this indicates that Insulin HM 100 ml should be reordered when the inventory level falls to 537 units.

**EOQ level**

EOQ model is used in fixed order quantity approach. Implementing EOQ can be complex and time consuming, it is hence recommend using with expensive items. As number of patients and their demand cannot be accurately predicted, using simple EOQ is not the answer of inventory control when fluctuation in demand takes place. Fixed order interval approach is performed by predetermining required inventory level of an item and placing the new order at quantity that will bring stock on hand back to desired inventory level. This method is not costly since it does not require complex procedures. Two-bin system is the simplest and most inexpensive method discussed in this research. It does not require high level management and closely monitoring. This method can be used with low valued C class items whose priority of medical treatment is not severe. Whenever placing an order of seasonal medicine, the information of the past usage should be reviewed and gathered at least 2 years back in order to ensure the best estimation of the next quantity ordered.
Conclusions and Recommendations

These information are collected from primary and secondary data, interviewing involved parties and observation at premises. It is found that there are two major concerns regarding purchasing process. Order quantity and reorder point are determined based on the policy. There are two steps are involved in improving inventory control are classifying inventory and selecting effective and efficient inventory control methods. There are approximately 730 items in the pharmacy store. The matrix which is derived by coupling ABC and VEN approaches can narrow down the number of items that needs to be strictly handled. Regarding safety stock level and ROP determination, it is recommended to stock expensive items less than the inexpensive ones. On the other hand, vital drugs should be available at all times. Therefore, decision making regarding the inventory level should be done by balancing these two policies. There are two methods purposed to determine ROP, it is difficult to specify which method is better than the other since they are implemented to serve different purposes. EOQ method can be used to determine order quantity of high valued drugs and less expensive method such as fixed order interval can be utilized for lower valued items.

References