

**Inventory Management in Pharmacy Practice: A Review of Literature****Ayad K. Ali**

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Citation: Ayad K. Ali. **Inventory Management in Pharmacy Practice: A Review of Literature.** Archives of Pharmacy Practice. 2011; 2(4) pp 151-156.**Abstract**

In pharmacy operations, inventory is referred to as the stock of pharmaceutical products retained to meet future demand. Inventory represents the largest asset in pharmacy practice, and its value continues to rise because of the growth in variety and cost of pharmaceutical products. From both financial and operational perspectives, efficient inventory management plays a great role in pharmacy practice. Inventory management aims at reducing procurement and carrying costs, while maintaining an effective stock of products to satisfy customer and prescriber demands. The author reviews methods of inventory management in pharmacy practice, and highlights approaches by which the process of inventory management is evaluated. Factors affecting inventory management, including the role of information technology, are summarized. The author outlines, with recommendations, the impact of inventory mismanagement on patient safety.

Key words

Pharmacy Inventory Management, Inventory Turnover Rate, Percent Net Profit

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Introduction**Inventory Management: Why Is It Important?**

Among the essential eight roles of the pharmacist that are described by the World Health Organization and the International Pharmaceutical Federation, managing resources (money, material, manpower, time, and information) is a key factor to professional success on individual level, as well as organizational level [1].

In pharmacy operations, inventory is referred to the

stock of pharmaceutical products retained to meet future demand. Inventory represents the largest current asset, as well as liquid asset in pharmacy practice and its value continues to rise because of the growth in variety and cost of pharmaceutical products [2]. From both financial and operational perspectives, efficient inventory management plays a great role in pharmacy practice. From financial viewpoint, efficient inventory management enhances gross profits and net profits by reducing the cost of procured pharmaceutical products and associated operational expenses. In addition, cash flow will improve upon saving on purchasing and storing less costly products. Such cash flow can be used to pay operational expenses and invest in other services. From operational viewpoint, effective inventory management ensures meeting customer and patient demands [3]. Unavailability of a product when needed may cause the community pharmacy to lose a customer and predisposes inconvenience to the prescribing physician; and may adversely affect patient's wellbeing in hospital pharmacy settings, especially when the product is an essential lifesaving one.

In addition to the negative impacts on financial outcomes from the pharmacy's business perspective, inventory mismanagement could have deleterious corollaries on patient safety. Such outcomes can be attributed by the availability of expired, counterfeit, substandard, or spoiled products; unavailability of essential products; unclaimed prescriptions; and not updating formularies. To enhance patient safety, it is recommended to conduct stock reviews on weekly basis to check the quantities, and on monthly basis to search for expired products. This can also be accomplished by utilizing software systems that alert the pharmacist when reaching a critical threshold amount or a near-expiry date of stocked products.

Inventory-Associated Costs

There are four types of costs associated with inventory in pharmacy practice: acquisition costs, procurement costs, carrying costs, and shortage costs [3-6]. Acquisition cost is the net amount of money the pharmacy pays for the products. Procurement costs are costs associated with purchasing the products, which include placing and receiving orders, stocking and paying invoices. Carrying costs refer to costs associated with

product storage, which also include costs incurred as a result of crises, e.g. theft or damage. Shortage costs—also known as stock-out costs are the costs of not having the product on the shelves when needed.

Methods of Inventory Management

Inventory management is defined as the continuing “process of planning, organizing and controlling inventory” that aims at “minimizing the investment in inventory while balancing supply and demand” [2]. Specifically, the process aims at reducing procurement and carrying costs, while maintaining an effective stock of products to satisfy customer and prescriber demands. Managing materials (pharmaceutical products) in that process is an integral part of the business model for all pharmacy settings, especially community and hospital practices. On the other hand, inventory mismanagement causes unnecessary rise in procurement and carrying costs and an imbalance in the supply and demand equation. Proper training of pharmacy students and pharmacists in management skills is an imperative course of action.

There are three methods used in pharmacy to manage inventory: the visual method, the periodic method, and the perpetual method [2-4]. The visual method implies the pharmacist (or other designated personnel) to visually compare the stock on hand with a listing of the amount of products that should be carried. The pharmacist places a purchasing order when the stock number falls below the desired listed amount. The periodic method requires the pharmacist to count the stock and compare it with a listing of minimum desired level of the inventory on regular basis at predetermined periods of time. When the quantities fall below the minimum amount, the products are ordered. The perpetual inventory management method is the commonest method in industrialized countries, and it is the most efficient method to manage pharmacy inventory. It involves a computerized system that monitors the inventory at all times on a continuous systematic basis. In this system, the inventory on hand is entered into the computer software, and the appropriate amount of products is automatically reduced from the inventory when a prescription or medication order is filled.

Pharmacists can employ a hybrid of methods, e.g. conducting annual physical count (visual and periodic methods), while maintaining a computerized system (perpetual method). This strategy enables the pharmacist to compare the quantities of products in computer with what is actually on shelves. By virtue of this approach, potential variances owing to fluctuations in supply and demand will be identified and corrected, and the accuracy of pharmacy's financial records will be evaluated and verified. Furthermore, pharmacists should adhere to the regulations of their pharmacy boards/associations with regard to inventory management of specific entities, such as controlled substances, vaccines, and biological products. Table 1 lists the pros and cons of the three methods.

Evaluation Of Inventory Management

Given the great deal of resources invested in pharmacy inventory management, evaluating how well a pharmacy is

managing its inventory is crucial. The most practical approach is calculating the inventory turnover rate (ITOR), which can be determined for the entire pharmacy stock, or specific department (e.g. parenteral products), or a specific individual product [2]. The ITOR is calculated as the ratio of the cost of products sold to the average inventory. Average inventory is calculated by averaging beginning inventory and ending inventory values during a specified period of time.

According to the National Community Pharmacists Association, ITOR value of 10 and greater is consistent with the US national average for independent community pharmacies, which indicates that the pharmacy sold the entire stored inventory a total of 10 times during a given time interval [2]. The ITOR should be interpreted in light of the ITOR values for the previous period of time (e.g. past year) in order to draw conclusions about how well the inventory is managed. Higher ITOR values indicate the inventory was quickly purchased, sold, and replaced within a specific time interval [2,4]. On the other hand, lower ITOR values indicate poor management of pharmacy inventory, and the products were sitting on the shelves and not being dispensed. In such situation, the pharmacist should consider whether too much quantity of the right product was ordered, the wrong product was ordered, or other systematic errors in inventory management were occurred, e.g. inputting the wrong product or quantity in the computerized software with absent physical count of the products on shelves.

Moreover, besides the ITOR, the pharmacist should determine the relationship between the net profit and the inventory turns during the specified period of time. This can be accomplished by calculating the percent net profit (PNP), which is expressed as the percent ratio of net profit to average inventory. Higher PNP values indicate the products being sold with higher mark-ups [2,4]. When the calculations show an increase in the ITOR value over time, while the PNP trends downward during the same period of time, this suggests more products were sold but the profit was lower, because the products are sold with lower mark-ups. However, percentage values for the net profit are relative quantities, and the absolute net profit in total currency amounts (e.g. US\$) should also be compared across relevant time periods. Similar to the ITOR, the PNP should be compared with the previous period of time to draw more informed conclusions about the efficiency of pharmacy inventory management. Table 2 shows an example of calculating these estimates.

Factors Affecting Inventory Management

Pharmacists should consider the following factors when evaluating their pharmacy inventory management: product type (generic, brand), inventory size, returned-product policies, unclaimed prescriptions, inventory shrinkage, and use of formularies [2]. Generic products have lower acquisition costs compared to brand-named counterparts, thereby minimize inventory costs. Basic product lines carry smaller inventory size compared to full product lines; although this will reduce the investment

in inventory, however; this decision should be weighed with patient and prescriber demand. Most product vendors (manufacturers and wholesalers) have policies regarding products that may be returned. Examples of such policies include providing credits for future orders, product replacement, and cash back to the pharmacy. Efficient inventory management enable pharmacists to use these benefits before such policy expiration take effect. About 1.5% of all prescriptions filled by American community pharmacies remain unclaimed [7]. Pharmacists should monitor such prescriptions and specify a threshold time period (e.g. two weeks) for returning the products to the shelves. Every attempt should be made to remind the patient or caregiver about the filled or refilled prescriptions, especially patients with chronic diseases and elderly patients, who increasingly show poor medication adherence.

Up to 4.5% of community pharmacy sales is lost due to inventory shrinkage [8]. Inventory shrinkage referred to losses due to theft, shoplifting, and robbery. Unfortunately, employee theft comprises the largest source for inventory shrinkage in community pharmacy settings [2]. While pharmacists should hire credible and candid employee, proper security and observation training and monitoring strategies are also important. In addition, apt security regarding controlled substances should be a priority in monitoring shrinkage, especially when theft of these substances is ever more challenging.

In hospital pharmacies, formularies are utilized to enhance inventory management, where pharmacists can carry one therapeutic equivalent product within a class of medications; thereby reducing overall inventory costs [9]. However, limited lists and formularies could serve as an impediment in balancing supply and demand in community pharmacy settings.

The Role Of Information Technology In Inventory Management

The value of information technology can be recognized in pharmacy inventory management, where computerized systems are broadly available in virtually all pharmacy practice settings in industrialized countries. Technology makes methods of inventory management and methods of evaluating inventory management more efficient, more precise, and more accurate. Examples of the role of technology in inventory management include utilizing hand-held scanning devices for periodic inventory control by scanning the barcodes on the product packaging or shelf labels, submitting purchasing orders electronically after inputting the scanned information into a computer via a web-based system, e.g. e-procurement.

Nowadays, technology is utilized in almost all pharmacy operations, from ordering, procurement, storage, to paying for products. Pharmacists should employ the benefit of newer technologies in their practice for better management of their pharmacy inventory. An example of newer technology to improve product distribution from manufacturers to wholesalers to pharmacies is the use of radiofrequency identification (RFID) microchips, or "tag" [10]. Such tags are intended to store information about the pharmaceutical product from the manufacturing date until arriving to and

removing from the storage shelves in pharmacies. Furthermore, automation in pharmacy inventory management creates additional time for pharmacists to provide pharmaceutical care and other pharmaceutical services to patients and customers [11].

Undoubtedly, information technology can be employed in pharmacy operations to improve inventory management and evaluation by appreciably minimizing procurement costs and protecting against inventory shrinkage because of theft. In addition, the potential for medication errors is further curtailed when product barcode scanning is employed in pharmacy practice, especially in hospital pharmacy settings [12].

Recommendations

From both financial and operational perspectives, efficient inventory management plays a great role in pharmacy practice. Thus, both methods of inventory management & methods of evaluating inventory management should be integrated into the curriculum of pharmacy programs, in addition to including them in the continuing education courses for registered pharmacists.

Given the great deal of resources invested in inventory management, the pharmacist should periodically calculate the ITO to evaluate how well a pharmacy is managing its inventory. Information technology makes methods of inventory management and methods of evaluating inventory management more efficient, more precise, and more accurate. Thus, relevant software should be employed in pharmacies and pharmacists should be trained on utilizing such systems for managing inventory.

Pharmacists cannot take the impacts of inventory mismanagement lightly. Improper management of pharmacy inventory has deleterious impacts on patient safety. Pharmacists should consider details pertaining to pharmacy inventory management when assessing a potential medication error or other drug therapy problems (e.g. patient needs a medication but not receives it due to product unavailability; and loss of efficacy due to incorrect storage conditions).

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References

1. Wiedenmayer K, Summers RS, Mackie CA, Gous AGS, Everard M, Tromp D. Developing Pharmacy Practice: A Focus on Patient Care. Working Draft for Field Testing and Revision. Geneva: World Health Organization & International Pharmaceutical Federation; 2006. 15 p.
2. West D. Purchasing and Inventory Management. In: Desselle SP, Zgarrick DP, editors. Pharmacy Management: Essentials for All Practice Settings, 2nd ed. New York: McGraw-Hill Co., Inc.; 2009. 383 p.
3. Carroll NV. Accounting for Inventory and Cost of Goods Sold. In: Carroll NV, editor. Financial Management for Pharmacists, 2nd ed. Baltimore: Williams & Wilkins; 1998. 41 p.
4. Bouldin AS, Holmes ER, Garner DD, Devoe AH. Purchasing and Managing Inventory. In: Chrisholm-Burns MA, Vaillancourt AM, Shepherd M. Pharmacy Management, Leadership, Marketing and Finance. Sudbury: Jones & Bartlett Publishers, LLC. 2011; P: 149.
5. Huffman DC. Purchasing and Inventory Control. In: Effective Pharmacy Management, 8th ed. Alexandria: National Association of Retail Druggists. 1996; 355 p.
6. Silbiger S. The Ten-Day MBA, rev. ed. New York: Quill William Morrow; 1999.
7. McCaffrey DJ, Smith MC, Banahan BF, Frate DA, Gilbert FW. A Continued Look into the Financial Implications of Initial Noncompliance in Community Pharmacies: An Unclaimed Prescription Audit Pilot. *J Res Pharm Econ.* 1998;9(2):33-57.
8. Garner DD. Pharmacy Security. In: Effective Pharmacy Management, 7th ed. Alexandria: National Association of Retail Druggists. 1994; 415 p.
9. Pearce MJ, Begg EJ. A Review of Limited Lists and Formularies: Are they Cost-Effective? *Pharmacoeconomics.* 1992;1:191-202.
10. Food and Drug Administration Counterfeit Drug Task Force Report: 2006 Update. [cited 2011 Oct 1] Available from:
www.fda.gov/oc/initiatives/counterfeit/report6_06.html
11. Awaya T, Ohtaki K, Yamada T, Yamamoto K, Miyoshi T, Itagaki Y, Tasaki Y, Hayase N, Matsubara K. Automation in Drug Inventory Management Saves Personnel Time and Budget. *Yakugaku Zasshi.* 2005 May;125(5):427-32.
12. American Society of Health-System Pharmacists. ASHP Statement on Bar-Code Verification During Inventory, Preparation, and Dispensing of Medications. *Am J Health Syst Pharm.* 2011 Mar 1;68(5):442-5.

Table 1 Comparison Of Inventory Management Methods Commonly Used In Pharmacy

Method	Strength	Limitation
Visual	<ul style="list-style-type: none"> • Inexpensive and convenient • Requires less pharmacy personnel 	<ul style="list-style-type: none"> • Less efficient method, because it only focuses on the amount of the stock rather than the cost • High likelihood of staff oversight and overlooking low stock
Periodic	<ul style="list-style-type: none"> • Requires less record keeping • Physical inventory enables purchasing pharmacist to account for fluctuations in supply and demand 	<ul style="list-style-type: none"> • Doesn't reflect the actual amount of inventory. It measures inventory at a single point of time • Physical inventory is required in order to generate accurate financial statements • Cost and personnel time intensive
Perpetual	<ul style="list-style-type: none"> • Maintains up-to-date and accurate records of product stock and associated costs • Quick and accurate assessment of inventory value • Reduces procurement and carrying costs • Does not require physical inventory, however; products need to be entered into the computer, which can be done by hand-held barcode scanning devices • Can easily measure inventory shrinkage by comparing computerized inventory with physical inventory • Cost of products sold is calculated on continuous basis • Generate reports and analyses that are beneficial in maintaining adequate supply and minimum overstock 	<ul style="list-style-type: none"> • Requires much record keeping by including all the purchases and sales in the computerized system • Fluctuations in supply and demand need to be considered in updating the system on regular basis • Requires moderate staff training in efficient computerized system application • Different software and hardware vendors have different systems and associated maintenance policies

Table 2 Example of using inventory management evaluation tools

2010 Data from Pharmacy Income Statement			
Parameter	Value (US\$)		
Sales	1,000,000		
Cost of Products Sold	800,000		
Gross Margin	200,000		
Total Expenses	150,000		
Net Profit	50,000		
Beginning Inventory (January 1, 2010)	120,000		
Ending Inventory (December 31, 2010)	130,000		
Average Inventory: <i>[Beginning Inventory+Ending Inventory Value]/2</i>	125,000		
Percent Net Profit: <i>[Net Profit/Average Inventory]*100%</i>	40%		
Inventory Management Efficiency Indicators			
Inventory Management Evaluation Method	Year		
	2008	2009	2010
Percent Net Profit (PNP)	41.5%	41.1%	40%
Inventory Turnover Rate (ITOR): <i>Cost of Products Sold/Average Inventory</i>	6.1	6.2	6.4