6

Financial aspects of inventory management

Learning objectives

- Describe the cash conversion cycle and its importance to inventory management
- Identify and understand the four main costs of inventory, including purchase, ordering, carrying, and stock-out costs
- Understand the importance of avoiding stock outs and maintaining safety stock
- Describe and develop the economic order quantity and reorder point, then understand their importance in optimizing inventory control
- List and explain inventory management considerations

Introduction

Pharmacy managers face unique challenges when it comes to the proper management of inventory, with balancing inventory levels that satisfy patients' needs while minimizing costs the primary goal. This goal is not met when inventory is managed without careful planning and analysis – for example, just ordering substantial quantities of each formulary medication in an institutional setting. While this method of controlling inventory may result in meeting the objective of appropriate patient care, it will also result in excess levels of inventory sitting on the shelves and represent a significant use of cash. The second major consideration for pharmacy managers is to decide the appropriate level of resources (cash) to be committed to inventory. Recognizing that inventory is included on the balance sheet as a current asset, it is less liquid given its little value to the pharmacy operation until it is dispensed, billed for and payment/reimbursement collected, which is known as the *cash conversion cycle*. Recently in large chain/grocery chain/mass merchandise pharmacies, inventory control has become automated using barcode technology to provide identification of inventory and track transactions in real time as they occur.

These automated systems require less effort on the part of pharmacy managers – but the underlying principles and goals of inventory management must still be understood. Efficiently balancing patient needs and the right level of inventory investment is discussed in this chapter.

Cash conversion cycle

The flow of cash is vital to all companies and maximizing inflows while minimizing outflows can increase overall operating efficiency and, ultimately, increase profitability. The elapsed time between the purchase of inventory items and the collection of cash resulting from its sale is known as the cash conversion cycle. When the decision is made to purchase inventory, cash outlays are required to pay for the requested items. Once the inventory is received, it is placed on the shelves until it is needed for prescription orders, which represents a use of cash. Obviously, an unrestrained level of inventory items in stock does not meet the goal of minimizing cash outlays. The cash conversion cycle continues with the ultimate dispensing, or use, of the medications in stock. Correspondingly, the medications dispensed must be billed to the patient or their third party payer, which in turn creates an account receivable, another current asset shown on the balance sheet. Of note is that accounts receivable is more liquid than inventory, as there has been an expressed promise to pay for the inventory received. All accounts receivable have descriptions of the terms of payment, usually expressed in days. Often, additional finance charges, or interest, are added to the original balance if the agreed upon terms are not met. The cash conversion cycle is completed when the cash payment is received by the company (Figure 6.1).

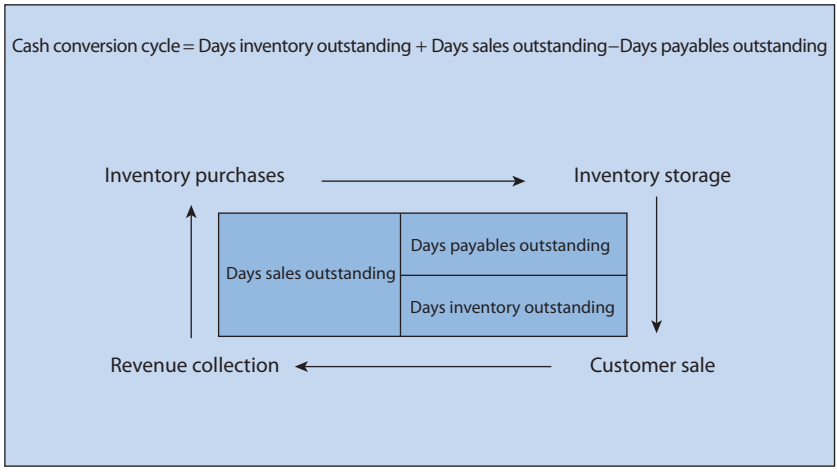

Figure 6.1 Cash conversion cycle.

The matching of inflows and outflows with regard to inventory and accounts receivable is vital to all companies, because the cash needs of the company resulting from the differences between these two processes must be funded from other sources. If additional borrowing is required by the company, the associated finance costs will reduce the profitability of the company. In addition, if payments are delayed to vendors for inventory purchases, problems can arise. Vendors may refuse to offer any type of discounts and possibly even begin to require cash payment upon delivery. Loss of discounts reduces gross profit and overall profitability. Accounts receivable must also be managed aggressively, as delayed payments may indicate severe financial difficulties from customers, which may ultimately result in non-payment. While management of accounts receivable may be beyond the traditional duties of a pharmacy manager, understanding the importance of the cash conversion cycle and its effect on the company's profitability is critical. Additionally, since the physical inventory maintained on site is a significant use of a company's cash flow, pharmacy managers in all practice environments must understand how appropriate management of inventory has its affect.

Basic inventory costs

When discussing inventory costs, most managers first think of the actual purchase cost of inventory. However, there are other basic costs attributed to the overall cost of inventory, including ordering, carrying, and stock-out costs. Purchasing costs are the most easily identifiable inventory cost. The purchase price is very objective, usually being stated outright with terms noted for prompt payment, rebates, or other incentives creating sales discounts. Discounts, such as the *prompt pay discount*, are offered by vendors to entice their customers for prompt, or even early, payment in order to help them maintain their own cash conversion cycle. Often '2% net 10', this means that a 2% cash discount of the total invoice may be taken if the entire balance is paid within 10 days instead of the traditional 30 days. Given the time value of money, sales discounts usually provide a large annual rate of return and should be taken by companies, even if short-term borrowing is required. Another common purchasing discount is known as quantity discounts, which give certain percentage discounts as the quantity purchased increases.

Case-in-point 6.1 Prompt payment discounts

Some large chain pharmacy operations, community based as well as hospital based, operate their own warehouses as their primary distribution method to individual pharmacy locations. These chains

also supplement their inventory needs with other full service wholesalers and distributors, when needed. Consider such a warehousing chain servicing a broad geographic, SB Pharmacy. SB maintains direct purchasing accounts with selected name brand and generic manufacturers which it stocks in corporate warehouses. With an average monthly corporate inventory purchase of approximately $20 million, taking advantage of a 2% prompt payment discount would result in an annual inventory cost savings of $4.8 million. On this large scale, it is easy to see the benefits of taking advantage of the prompt payment discount. However, regardless of the size of the pharmacy operation, the prompt payment discount provides a significant reduction in inventory costs. For example, consider a long-term care institution which purchases $65,000 of generic medications annually to provide prescriptions to its residents, staff, and family members. Contracting with a full line generic manufacturer offering a prompt payment discount (e.g., 2% net 10) would result in a savings of $1,300 off invoice pricing.

However, purchasing in today's business environment can become quite complicated. With contract bidding, buying groups and wholesaler source programs offering special pricing and purchase terms, most corporate buying is beyond the duty of the majority of pharmacy managers and handled within the accounting department. These programs can be a significant benefit for smaller pharmacy operations because they permit them to take advantage of volume purchasing through the larger buying group or wholesaler. Manufacturers like negotiating with these groups since they can represent significant increases in market share when their products are selected for distribution among members or buyers in the group.

Case-in-point 6.2 Wholesaler source programs

Most major wholesalers offer "source" programs for multisource medications, where certain manufacturers' products are featured and given distribution preference over other manufacturers' products. In these source programs, wholesalers and distributors negotiate directly with the manufacturers, trading preferred distribution, which increases market share, for larger discounts. The savings are then passed along to the members of the buying group or wholesale customer. Other benefits of source programs may include consistency of supply and one-stop shopping for a variety of products.

Other types of buying agreements can include competitive bidding or bundling the purchase price of one product with the amount of an additional product's purchase quantity. In many institutional or large warehousing chain practices, market share contracts are offered by various manufacturers. Under a market share contract, additional discounts or rebates are awarded if the percentage market share of all purchases within a certain category exceeds a contracted level. These contracts recognize the importance of individual retailers' professional purchasing decisions on manufacturers' market share. However, in most larger chain settings, pharmacy managers are not the individuals who negotiate these more complicated purchasing contracts. Pharmacy managers may, however, be asked to contribute information to the contracting, bidding or accounting department where these kinds of negotiations occur.

The next basic inventory cost is *ordering costs*, which are those costs associated with placing an order and processing the corresponding payment. Any costs associated with receiving the goods and getting them to the shelves for dispensing can also be included. For simplicity's sake, ordering costs are usually not separately identified, as most pharmacy environments place daily orders with their wholesalers and payment is made through the accounting department. Putting the order on the shelves is also considered part of routine daily duties of the pharmacy staff; although, if significant, these costs could also be identified separately. Though, if an institution wishes to make bulk purchases of intravenous supplies and these orders require additional outlays, such as offsite storage and labor to unload and re-distribute when needed, these costs should be added to the overall purchase price when placing orders.

Not all items in inventory generate the same level of profits. Further, some items require more inventory space than others. This is where the third basic inventory cost, known as *carrying costs*, comes into focus. The *capital investment*, or the inventory's actual purchase price, is the major and most easily identifiable component of carrying costs and the primary factor in relation to the cash conversion cycle. Inventory service costs, such as handling, insurance, and taxes are another component. Thirdly, storage costs outside of the actual pharmacy contribute to carrying costs of inventory. Finally, there are the risk costs, which are made up of *obsolescence*, damage, and *shrink*. Therefore, good inventory management is often a trade-off between the costs associated with keeping inventory on hand (e.g., carrying costs) and the benefits of having the inventory in stock (ability to sell the inventory and convert it into cash). In other words, the carrying costs of maintaining higher levels of inventory must be balanced with the less easily measurable costs of stock outs, lost sales, poor patient care/satisfaction and even the business's or institution's reputation.

Case-in-point 6.3 Inventory loss

Product obsolescence, theft (shrink), and natural disasters occur in all businesses. The impact of these events is obvious. However, for most retailers, there are more subtle risks that can impact inventories. For example, medications that need to be refrigerated can be placed at risk when power outages occur. Flooding and other types of water damage, such as that from a broken pipe or water heater, can also create inventory losses. Losses can also occur as a result of poor inventory storage, such as when inventory is improperly stored, e.g., boxes stacked too high and they become unstable and there is breakage. While some level of risk is inherent, proper management can reduce these kinds of risks to a minimum.

Considering all medications have an expiration date after which the value is substantially reduced, obsolescence is a major consideration in inventory management. Proper rotation of stock is essential, as is regular monitoring of expiration dates. Many wholesalers allow for a return of inventory items based upon their expiration dates, and effective pharmacy managers will keep a close eye on individual inventory items and their expiration dates to take full advantage of any return programs, given the magnitude of potential losses. Damage to inventory is possible at any time, just by the existence of the inventory on the shelves. Although damage is usually accidental, pharmacy managers should strive for proper housekeeping of inventory to minimize such occurrences.

Case-in-point 6.4 Damages/damage reports

Throughout the work day or week, medications are spilled, IV bags are broken or pills are crushed, leading to damaged inventory. To handle these situations, managers can keep an exact report/log of all damaged products and adjust the inventory accordingly, or properly dispose of the damaged product and let it exist as shrink on the year-end inventory. Either way, the inventory was purchased but not able to be sold and, at the least, recoup the associated cost. Pharmacy managers must diligently stress to the staff the negative impact damaged inventory can have on sales and work to reduce damages and, therefore, maximize sales potential.

The final risk cost included in inventory carrying costs is shrinkage, or simply "shrink". When the final calculated inventory value in a company's accounting records is compared with the final valuation from the physical inventory, any shortage is referred to as shrink. Inventory shrink is expressed

in the actual dollar amount difference, or as a percentage of the total inventory balance. Usually, theft is attributed to the existence of shrink, both by customer shoplifting and employee theft. Proper controls over access to inventory and good housekeeping by pharmacy managers can contribute greatly to keeping inventory shrink to a minimum.

Case-in-point 6.5 Employee theft

Theft of inventory, also referred to as "shrink," occurs across all industries. It may be particularly troublesome in pharmacy since medications have such significant implications when used improperly or abused. Shrink can be caused by shoppers or employees. A rule of thumb is that nearly one-half of all shrink occurs at the hands of employees. Employee theft occurs just like shoplifting, when an employee conceals merchandise and removes it from the business. Theft can also be the result of an employee allowing others to steal from the business. Regardless of how the theft occurs, the result is inventory loss. Ideally, there would be some way to identify a dishonest employee. Unfortunately, dishonest employees are found in all work settings and it is impossible to identify these individuals by some demographic or physical characteristic. Careful screening of employees (e.g., character, honesty, and integrity) and corporate policies (e.g., lockers for personal items such as coats or purses, clear policies that all theft will be prosecuted and result in termination) that reduce opportunity are the best defense against employee theft.

Not having a medication in stock, in any pharmacy arena, has expensive costs associated with it. These costs are the final basic inventory cost, stock-out costs. For example, if an extreme emergency requires that the out-of-stock item be procured overnight, a non-discounted price with additional overnight shipping charges is often paid. While these costs are readily quantifiable, sometimes they are not. Consider the case of an extremely upset customer at the independent community pharmacy. The lack of availability of the item may cause them to take their entire prescription business to a competitor, or worse, customers who are close friends of the irritated customer may sympathize and change pharmacies as well. This lost opportunity may exist for only a few weeks, or forever. Therefore, prevention of stock outs is a goal of proper inventory management. Stock outs may be avoided by maintaining a safety stock, or minimum amount to always be on hand. It is determined in relation to expected usage as well as any delivery lead times. Although there are carrying costs associated with safety stock, the potential cost of damaging customer relations and future business usually exceeds them and justifies having a cushion of safety stock.

Case-in-point 6.6 Stock outs

JB is a 40 year old diabetic who uses insulin 500 units/ml. This concentration is convenient and saves JB from having to give multiple injections because of his high insulin dose requirement. Even so, his insulin dose has remained relatively constant over time. He has recently changed pharmacies because the pharmacy he had been patronizing required him to call a day ahead so the insulin he needed could be ordered, rather than stocking it routinely. The pharmacy maintained that having this concentration was not desirable since it could be accidentally sold to a patient who might inject it as if it were the 100-unit concentration. JB was accepting of this, but, on several occasions over the past year, the insulin was not available from the wholesaler on short notice and JB had to resort to multiple injections. This prompted him to switch to a pharmacy willing to keep the 500-unit concentration in stock. In fact, the new pharmacy manager decided to order JB's supply after each purchase so that a safety stock could be maintained and JB's needs would be sure to be met.

Case-in-point 6.7 Stock outs – large chain pharmacy perspective

Most large-chain pharmacy district managers continually monitor ordering levels, especially for items typically available from the store's own warehouse. As discussed above, emergency overnight purchases through a wholesaler are made at much greater costs than from the chain's warehouse. District managers want to see as low a percentage of emergency/non-warehouse purchases as possible.

Inventory record keeping methods

There are two basic ways to keep a record of inventory values and quantities, known as perpetual and periodic methods. The *perpetual inventory* system is most commonly used, and, as implied by its name, this system can provide details of the inventory quantities and values whenever they are needed. When using the perpetual inventory method, each purchase is recorded along with individual sales when they occur. Since a beginning balance for any time period is available, this period activity is recorded and an ending inventory balance is shown as illustrated in Figure 6.2. Note that both dollar and quantity details of purchases and sales are shown.

Perpetual inventory Plavix 75 mg tablets 100 count bottles						
Date	Purchases		Sales		Balance on hand	
	No.	$	No.	$	No.	$
4/1/20xx	300	500.00 per bottle			300	1,500.00
4/5/20xx			60	300.00	240	1,200.00
4/17/20xx			90	450.00	150	750.00
4/29/20xx			60	300.00	90	450.00
4/30/20xx	300	525.00 per bottle			390	2025.00

Figure 6.2 Perpetual inventory example for single item.

The perpetual recording of activity produces both the inventory recording method's name as well as inventory details. When this process is replicated many times over for each individual item (referred to as SKUs, or stock keeping units), the sum of all SKUs will produce the final inventory amount, which is shown on the balance sheet. In theory, the actual inventory quantities on the pharmacy's shelves should exactly agree with the values shown in the perpetual inventory record keeping systems. Discrepancies between recorded quantities and actual quantities are a result of various factors, such as counting or recording errors.

Case-in-point 6.8 Perpetual inventory

When a retail pharmacy operation places an inventory order, either from a full service wholesaler or a company owned warehouse, the inventory received in each order must be added to the quantity on hand, to accurately reflect new inventory levels. This is usually done by "applying" the order to the existing inventory maintained in the pharmacy computer system. Applying the order serves to increase the inventory count of the products received. Invoices are then provided to the accounting department for collating and payment, as well as inventory auditing.

Description	Balance in $
Beginning balance	0
Add: April purchases	600,000
Total available	600,000
Less: 4/30/20xx physical count	390,000
Quantity sold during April 20xx	210,000

Figure 6.3 Periodic inventory example for single item.

The second inventory record keeping method, the *periodic inventory* system, is less often used because it provides fewer details. As one can imagine from the name, the inventory value is determined on a periodic basis. Since the periodic system is less sophisticated, many details regarding prices and quantities are not maintained as shown in Figure 6.3. Under this system, at the end of various operating periods, the inventory account is updated to reflect the actual value of the ending inventory on the balance sheet and the corresponding amount to be recorded as COGS. During the period, all of the inventory purchases are recorded only in the total dollar amount of purchases. At the end of an operating period, the ending inventory value is determined by taking a physical inventory.

A physical inventory is a labor-intensive process and each inventory item is physically counted on a specific date. Owing to the nature of taking a physical inventory, there are various vendors available for hire by companies to complete a physical inventory. By employing personnel trained in counting pharmacy inventory, a physical inventory can be completed quickly and efficiently with the appropriate preparation.

Completing the actual physical count is only half of the process. After obtaining details of all SKUs and their corresponding quantities, the appropriate cost information must be assigned. The extension process begins whereby the actual quantity on hand is multiplied by the current cost, which yields an extended inventory. The extended inventory provides the final dollar value of the inventory and is shown on the balance sheet.

There are benefits, as well as drawbacks, to each of these two inventory record keeping methods. If simplicity is desired, the periodic system functions

very well, although there is much less timely information available for pharmacy managers. Since only dollar amounts of purchases need to be reflected in the accounting records, summary entries can be made. In contrast, the perpetual system requires more recording effort; however, computers and automation have greatly reduced this impact with much of the information being provided electronically from wholesalers and other vendors. The periodic system has a significant limitation in being unable to provide COGS on a regular basis, thus preventing the preparation of a consistent income statement. Some pharmacy managers have operating environments that are able to function effectively in this manner, namely the independent owners of community pharmacies. They are often very skilled at understanding their pharmacy's operations and can estimate operating results through cash flow and visual inspection of inventory levels. On the other hand, the perpetual inventory system provides pharmacy managers and others with much more timely inventory details. Additionally, each accounting period may be closed and COGS be calculated along with the corresponding net income. One of the major strengths of the perpetual inventory system is the ability to perform individual item analysis and identify, assess, and correct inventory shrink.

Inventory valuation methods

As previously mentioned, the physical flow of inventory is implicit – oldest items are sold first, and then replaced with newer items. In pharmacy practice, this means medications with earlier expiration dates are dispensed first and normally replaced with medications that have much later expiration dates. When a company determines an inventory value at the end of any accounting period, there are three inventory valuation methods which may be used. It is important to emphasize that these inventory valuation methods are obtained through the accounting system information flow from detailed transactions of company activities. Therefore, the physical flow of inventory will not match the assumed flow of the accounting data. Under each inventory valuation method, assumptions must be made regarding the flow of inventory costs. As a result, COGS are different under each inventory valuation method, which in turn will yield different ending inventory balances, gross profit and net income amounts. Regardless of the inventory valuation method chosen, the flow of the actual physical inventory dispensed should always be based upon the earliest expiration date of individual inventory items. A detailed discussion of each of the three inventory valuation methods follows, using the detail of purchases for one month as shown in Figure 6.4. It is important to note that regardless of the inventory valuation method used, the inventory purchases are recorded in exactly the same manner.

Perhaps the easiest inventory valuation method to understand is the one that simulates the actual physical flow of inventory throughout a company.

Any Hospital Name
Detail inventory sheet
March 20XX
D5W, 1 liter bags, 12 count cases

Date	Cases received	Per case cost	Total cost
3/8/20XX	60	$15.25	$915.00
3/16/20XX	80	$14.93	$1,194.40
3/28/20XX	90	$15.37	$1,383.30
Total purchases	230	$15.19 (average case cost)	$3,492.70

Figure 6.4 Sample inventory purchases.

Therefore, the *first-in, first-out method*, known as FIFO, reduces inventory value for dispensed inventory in the same order in which shipments are received. Since the FIFO inventory valuation method results in the remaining inventory items being those most recently purchased, it is sometimes also referred to as *last-in, still here* or LISH. The advantage of the FIFO inventory valuation method is shown on the balance sheet, where the ending inventory value reflects the most recent purchase costs.

Under FIFO, the cost of goods sold (COGS) is based upon the cost of material bought earliest in the period, while the cost of inventory is based upon the cost of material bought later in the period. This usually results in inventory being valued at a higher level. During periods of inflation, the use of FIFO will result in the lowest estimate of COGS and higher net income.

As the name implies, the *last-in, first-out* (LIFO) inventory valuation method is the direct opposite of the FIFO inventory valuation method. The earliest inventory items purchased are the last inventory items sold, therefore LIFO may be referred to as *first-in, still here*, or FISH. Accordingly, since the last inventory items purchased are assumed to be the first inventory items to be sold, there is a better matching on the income statement with COGS reflecting the current cost of inventory items. Under the FIFO inventory valuation method, the income statement reflects earlier inventory acquisition costs, which may or may not reflect current inventory replacement costs. The importance of the closer matching of current inventory costs on the income statement under the LIFO inventory valuation method is critical in periods of inflation or rising costs. In essence, LIFO will produce the highest estimate of

Any Hospital Name Affects of inventory valuation methods D5W, 1 liter bags, 12 count cases			
Method	Ending quantity	Ending inventory value	COGS
FIFO	75	$1,152.75	$2,339.95
LIFO	75	$1,138.95	$2,353.75
WAC	75	$1,139.25	$2,353.45

Figure 6.5 Affects of inventory valuation methods. (See the chapter glossary for an explanation of the abbreviations.)

COGS and lowest corresponding net income estimate when compared with FIFO.

The effect of these two methods can also be seen on the balance sheet. LIFO will understate the inventory values on the balance as compared with the FIFO inventory valuation method. Some firms may use a LIFO approach for the tax benefits during periods of high inflation. When firms switch from FIFO to LIFO in valuing inventory, there is likely to be a drop in net income and a concurrent increase in cash flows (because of the tax savings). The reverse will apply when firms switch from LIFO to FIFO.

The *weighted average cost* (WAC) inventory valuation method is a compromise between FIFO and LIFO. The WAC per unit is calculated by taking the COGS available for sale and dividing this by the total number of units for the period. At the end of each accounting period, this weighted average cost per unit of inventory is determined and reflected in both the balance sheet and income statement as COGS. The WAC valuation method levels out the effects of market fluctuations in inventory prices, as seen with the FIFO and LIFO inventory valuation methods in periods where prices are rising. Therefore, in periods of fluctuating prices, the effects on both the balance sheet and income statements can be minimized through the use of the WAC inventory valuation method.

Figure 6.5 compares the various ending inventory valuations and corresponding COGS shown on the balance sheet and income statement when the three inventory valuation methods are used. This example assumes there was no beginning inventory balance and a periodic inventory system is used. A physical inventory count resulted in the ending inventory quantity remaining for March 20XX of 75 cases. Pay close attention to the variation in both the COGS and ending inventory values under each inventory valuation method. It

is important to note the selection of which inventory valuation method is employed by a particular company, especially in the chain and hospital setting, is often made by upper management or the accounting department, not pharmacy managers.

The ending FIFO inventory value of $1,152.75 is determined as if all of the remaining 75 cases were part of the last purchase of 90 cases at a cost of $15.37 per case. The COGS amount is calculated by the formula:

$$\text{Beginning inventory } (\$0) + \text{Purchases } (\$3,492.70) - \text{Ending inventory } (\$1,152.75) = \$2,339.95$$

Using the LIFO inventory valuation method, the remaining 75 cases are valued at $1,138.95, the cost of the initial 75 purchased [(60 cases @ $15.25) + (15 cases @ $14.93/case)]. WAC produces an ending inventory value of $1,139.25 and uses the average cost per case for the period to value the ending 75 cases (75 cases @ $15.19/case).

Managing inventory turnover

Other than physical facilities, inventory represents one of the largest uses of cash within a pharmacy. Once purchased, inventory must be sold and the funds from the sale received before the firm's cash can be used for various aspects of the pharmacy operation. In institutional and chain settings, pharmacy managers may not be directly responsible for the cash flow of the business, but these managers are acutely aware of the impact high inventory levels can have on operating efficiency. Inventory is perhaps the most carefully controlled of all operating costs and an expected function of all pharmacists involved in dispensing in any way.

Financial ratios (discussed in Chapter 5) are routinely used to assess the effectiveness of a pharmacy operations inventory control techniques. The most common of these ratios is the inventory turnover ratio. The *inventory turnover ratio* is a benchmark used by pharmacy managers to assess inventory control and measure how many times the inventory of a company is used up during a period, usually a year. The expression "turns" or "turn days" is calculated by dividing 365 by the annual inventory turnover. This number is used to estimate the number of days of inventory available for sale.

The inventory turnover ratio is calculated by the formula:

$$\text{Inventory turnover} = \text{Cost of goods sold} / \text{Average inventory}$$

Average inventory is calculated by averaging the beginning and ending inventory balance (from the balance sheet) and given by the equation:

$$\text{Average inventory} = (\text{Beginning inventory} + \text{Ending inventory}) / 2$$

For the year ended December 31, 20XX			
Description	Actual	Budget	Last year
Average inventory			
Prescription sales	$159,848	$150,980	$140,844
Other sales	65,716	56,624	52,130
Total	225,564	207,604	192,974
Cost of goods sold			
Prescription	$1,678,407	$1,670,545	$1,575,241
Other sales	536,748	411,002	331,105
Total	2,215,155	2,081,547	1,906,346
Inventory turnover ratio			
Pharmacy	10.5	11.1	11.2
Front end	8.2	7.3	6.4
Combined	9.8	10.0	9.9

Figure 6.6 Sample inventory turnover analysis report.

In general, an inventory turnover ratio of approximately 12 turns per year is considered optimal for most pharmacy operations. This means, on average, the pharmacy will operate with about 30 days, or one month, of inventory on hand. Some items may have higher turnover rates than the overall operation. These items, usually referred to as "fast movers" in the pharmacy environment, vary by area and represent the most commonly used medications. Fast movers may be purchased in larger quantities, turnover more frequently and can have a significant impact on profitability. Thus, it is important to price these items carefully, which is discussed in Chapter 8.

Using the information shown in Figure 6.6, the pharmacy's actual prescription inventory turnover of 10.5 for the year is determined by dividing the prescription COGS by the pharmacy average inventory.

Inventory turnover (IT) = COGS / Average inventory
Inventory turnover (IT) = $1,678,407 / $159,848 = 10.5

A separate turnover can be calculated for other sales (OTC, etc.):

Other sales IT = COGS / Average inventory
Other sales IT = $536,748 / $65,716 = 8.2

Accordingly, the overall inventory turnover ratio for the entire pharmacy business would be:

Overall IT = Combined COGS / Combined average inventory
Overall IT = $2,215,155 / $225,564 = 9.8

Generally, pharmacy managers track inventory turnover year by year to assess the effectiveness of their inventory control efforts. Industry averages or benchmarks are often used to further assess pharmacy operations inventory policies. When the inventory turnover ratio is lower than the benchmark (12 turns per year), this can be an indicator that inventory is too high. Possible reasons for this might include deterioration, damage, obsolescence or overestimation of need. When the inventory turnover ratio is higher, it usually means pharmacy managers are using inventory more efficiently. Higher inventory turnover ratios indicate the purchases of new inventory items are replacing the inventory actually being sold and fewer inventory items are sitting idle on the shelves. This means less cash is tied up in inventory and is available for other uses, including increased profitability.

Other inventory control techniques

In today's pharmacy business, inventory is often received daily and many pharmacy practice environments control inventory by ordering products to arrive just in time as it is needed for sale. This is known as a *just-in-time* (JIT) inventory control method. JIT is a quality-control process aimed at reducing inventory costs. This method can benefit a pharmacy business by reducing average inventory and even improving customer satisfaction when stock outs do not occur. JIT inventory control is generally not sensitive to rapid changes in demand, for example, during allergy season when there can be rapid increases in demand for certain allergy, cough, and cold medications.

While today's automated computer systems certainly facilitate a JIT system by maintaining a perpetual inventory, more information is needed to maintain an optimal inventory level and customer satisfaction. To assist the pharmacy manager in making purchasing decisions, the ideal inventory level is also needed. This is based on how much of a product a business uses, how fast they use the product and the costs associated with ordering and carrying the product. When a business places orders based on these variables, it can minimize total inventory costs (ordering and carrying costs). Using this information, a pharmacy manager can determine the most efficient quantity of product to order – known as the *economic order quantity* or EOQ. EOQ should be used as a tool to inform the JIT inventory process.

Inventory models for calculating optimal order quantities, such as EOQ; have been available to business managers for many years. Computerization has automated the decision making associated with these kinds of models, and is an excellent tool for pharmacy managers to use in determining when to purchase and how much to purchase. Mathematically, the quantity is given by:

$$EOQ = \sqrt{\frac{2(\text{Annual usage in units})(\text{Order cost})}{\text{Annual carrying cost per unit}}}$$

where the annual carrying cost per unit is the unit cost times the carrying cost percentage.

Based on the formula for EOQ, the total cost of inventory is given by:

Total inventory cost (TIC) = Purchase cost + Order cost + Carrying cost

or

Total inventory cost (TIC) = [(Cost per unit × Annual utilization) + (Annual utilization / EOQ) + (EOQ / 2)]

Example: Assume a pharmacy has an annual requirement of 1,000 bottles (units) of a product and the cost per order is $2. If the cost per unit is $10 and the carrying costs are 5%, the EOQ would be calculated as:

$$EOQ = \sqrt{\frac{2(\text{Annual usage} = 1000)(\text{Order cost} = \$2)}{\text{Cost/unit} = \$10 \times \text{Carrying cost } \% = 5 \text{ (or 0.05 numerically)}}}$$

$$EOQ = \sqrt{4{,}000 / 0.5}$$
$$EOQ = \sqrt{8{,}000}$$
$$EOQ = 89$$

The total inventory cost would then be calculated as:

TIC = Purchasing + Ordering + Carrying costs
TIC = (Cost/unit = $10 × Annual utilization = 1,000) + (Annual utilization = 1,000 / EOQ = 89) + (EOQ = 89 / 2)
TIC = 10,000 + 11 + 45
TIC = $10,056

The total cost for the year would be $10,056. This means it would be cheaper for the pharmacy to order 89 units at a time as opposed to any other quantity. All other quantities will result in higher total costs.

Once the EOQ is calculated, the number of orders per year is found by dividing the annual utilization by the EOQ, or 1,000 units / 89 = 11.2 or approximately 11 orders per year.

Along with knowing the optimal quantity of inventory to purchase, the pharmacy manager also needs to know when to place an order. This is known as the *reorder point* (RP). Calculating the RP also requires you to know the lead time from placing to receiving an order. Thus, the RP is computed as follows:

RP = Lead time × Average usage per unit of time

This tells you the inventory level at which a new order should be placed. If you need a safety stock to limit situations where there are stock outs, then increase the RP by a few days to ensure consistency of supply.

Case-in-point 6.9 EOQ example

Pharmacy operations are frequently presented with special pricing and deals associated with purchasing larger quantities of merchandise. EOQ is a useful tool for the pharmacy manager to use in determining whether or not the deal actually makes good business sense. For example, if a pharmacy purchases 1,600 bottles of cough syrup annually with a unit cost of $4, order cost of $25 and inventory carry costs of 5%, the EOQ for this product would be $\sqrt{(2 \times 1{,}600 \times \$25/(\$4 \times 0.05))} = 632$ units per order. The total cost of inventory would be $4/unit $\times$ 1,600 units + $25 (1,600/632) + 0.05 (632/2) = $6,479.05. If the terms of the deal were a $3.75 purchase price if ordered in quantities of 300 bottles at a time, the total cost of inventory for the purchase deal would be: $3.75 $\times$ 1,600 + $25 (1,600/300) + 0.05 (300/2) = $6,140.50. This analysis would imply that even though smaller quantities would be purchased more frequently, the deal will lower total inventory costs.

Optimizing inventory decisions

Using modern computer systems, knowledge of EOQ and RP, and understanding the needs of one's customers enables the pharmacy manager to make inventory management decisions that result in fewer out-of-stock situations and minimal inventory costs. Given the realities of modern day pharmacy operations, including lower profit margins, it should be clear inventory management is critical to the prudent pharmacy manager.

Summary

Pharmacy managers should routinely use the financial information from their businesses, along with knowledge of the marketplace and customer needs, to appropriately control the inventory of a pharmacy operation. Proper inventory control starts with an understanding of the four basic inventory costs described in the chapter (purchase, ordering, carrying and stock out). Applying the understanding of these costs, along with indicators such as inventory turnover, EOQ and RP, should result in optimal inventory levels which keep costs to a minimum while at the same time ensuring customer satisfaction. In managing inventory, a pharmacy manager must keep these principles in mind while routinely:

- monitoring the adequacy of inventory levels, balancing this with expected demand; this is especially important for products or services that fluctuate seasonally, such as Tamiflu® for influenza

- taking full advantage of pricing discounts such as prompt payment discounts and other price incentives
- conducting a physical review of the inventory periodically, to look for slow-moving or obsolete items; this will reduce inventory carrying costs and improve cash flow
- maintaining an awareness of the average inventory level, keeping it to a minimum, since this is the source of carrying costs and can dramatically impact profitability
- keeping enough inventory on hand to ensure patients' needs are met
- using the financial information to ensure inventory levels are providing sufficient profitability, in particularly by monitoring the financial ratios associated with inventory, EOQ, RP, and inventory turnover.

Suggested reading

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Review questions

1 The carrying costs associated with inventory management include:
   - A Insurance costs, shipping costs, storage costs, and obsolescence
   - B Storage costs, handling costs, capital invested, and obsolescence
   - C Purchasing costs, shipping costs, set-up costs, and quantity discounts lost
   - D Obsolescence, set-up costs, capital invested, and purchasing costs

2 The ordering costs associated with inventory management include:
   A Insurance costs, purchasing costs, shipping costs, and spoilage
   B Obsolescence, set-up costs, quantity discounts lost, and storage costs
   C Purchasing costs, shipping costs, set-up costs, and quantity discounts lost
   D Shipping costs, obsolescence, set-up costs, and capital invested

3 Shrink related to employees is not an issue to be concerned with in a pharmacy business. True or false?

4 The result of the economic order quantity formula indicates the:
   A Annual quantity of inventory to be carried
   B Annual usage of materials during the year
   C Safety stock plus estimated inventory for the year
   D Quantity of each individual order during the year

5 In inventory management, the safety stock will tend to increase if the:
   A Carrying cost increases
   B Cost of running out of stock decreases
   C Variability of the lead time increases
   D Variability of the usage rate decreases

6 Calculate the EOQ for a chain pharmacy using 15,000 bottles of Lipitor 10 mg per year at a cost of $100 per bottle. Assume carrying costs are 5% and it costs the pharmacy $50 to place a direct order from the manufacturer.

7 A JIT inventory can be used in conjunction with EOQ to optimize inventory control. True or false?

8 When the inventory turnover ratio is lower than the benchmark (12 turns per year), this can indicate:
   A Inventory levels are too low
   B Overestimation of the inventory needs
   C Efficient use of inventory
   D Increasing sales

9 Which inventory system provides the pharmacy manager with much more timely inventory details – periodic or perpetual inventory?

10 Discuss the impact of inventory management on customer service and store performance.

Answers

1 B is correct: Storage costs, handling costs, capital invested, and obsolescence.

2 C is correct: Purchasing costs, shipping costs, set-up costs, and quantity discounts lost.

3 The statement is false.

4 D is correct: The quantity of each individual order during the year.

5 C is correct: The variability of the lead time increases.

6 $$\begin{aligned} \text{EOQ} &= \sqrt{[2 \times (15,000)(50)]/[(100)(0.05)]} \\ &= \sqrt{[1,500,000/5]} \\ &= \sqrt{[300,000]} = 548. \end{aligned}$$

7 The statement is true.

8 B is correct: Overestimation of the inventory needs.

9 Perpetual inventory gives more timely details.

10 As discussed in the text, inventory management, customer service and store performance are all interconnected. In a primarily product-driven business, a pharmacy manager must have adequate inventory on hand to meet customers' needs. The main area where this becomes a problem and negatively impacts service levels and store performance is with partial fills and stock outs, especially with maintenance medications. A customer who has received a prescription for a new treatment just on the market, or one rarely used, can understand the product not being stocked and needing ordered. However, the same customer who comes to the pharmacy every month and gets the same three prescriptions will not appreciate having to make multiple trips to the pharmacy because you do not have enough or any of those medications. This decreases customer service and possibly negatively impacts store performance if that customer, and possibly many others, decides to patron another pharmacy.

Glossary

Capital investment	Actual purchase price of the inventory, major and most easily identifiable component of carrying costs and the primary factor in relation to the cash conversion cycle.
Carrying costs	Expenses associated with having inventory, including the capital investment or actual purchase price of the inventory, inventory service costs, such as handling, insurance, and taxes, and storage costs outside of the actual pharmacy.
Cash conversion cycle (or cash cycle)	The length of time, usually expressed in days, needed to return cash outlays for purchases of inventory (a use of cash) back into collected cash (a source of cash) after the sale of the inventory and the corresponding collection of the accounts receivable from the customer or third party payer.
Economic order quantity (EOQ)	Most efficient quantity of product to order and should be used as a tool to inform the JIT inventory process.
First-in, first-out (FIFO) method	Inventory valuation method which reduces inventory value for dispensed inventory in the same order in which shipments are received and results in the remaining inventory items being those most recently purchased. The advantage of the FIFO inventory valuation method is shown on the balance sheet, where the ending inventory value reflects the most recent purchase costs.
Inventory turnover ratio	A benchmark used by pharmacy managers to assess inventory control and measure how many times the company's inventory is used up during a period, usually a year. "Turns" or "turn days" are calculated by dividing 365 by the annual inventory turnover, which is then used to estimate the number of days of inventory available for sale.
Just-in-time (JIT) method	A quality control process aimed at reducing inventory costs control inventory by ordering products to arrive just before it is needed for sale.

	This method can benefit a pharmacy business by reducing average inventory and even improving customer satisfaction when stock outs do not occur.
Last-in, first-out (LIFO) method	Inventory valuation method which is the direct opposite of the FIFO method. With LIFO, the earliest inventory items purchased are the last inventory items sold. Accordingly, since the last inventory items purchased are assumed to be the first inventory items to be sold, there is a better matching on the Income Statement with COGS reflecting the current cost of inventory items.
Ordering costs	Those costs associated with placing an order and processing the corresponding payment. Any costs associated with receiving the goods and getting them to the shelves for dispensing are also included, for example, putting the order on the shelves is also considered part of routine daily duties of the pharmacy staff. If significant, these costs could also be identified separately. If an institution wishes to make bulk purchases of intravenous supplies and these orders require additional outlays, such as offsite storage and labor to unload and redistribute when needed, these costs should be added to the overall purchase price when placing orders.
Periodic inventory	Inventory maintenance method where a physical count of the inventory is performed at specific intervals. This method only keeps track of the inventory at the beginning of a period, the purchases made and the sales during the same period.
Perpetual inventory	Keeping book inventory continuously in agreement with stock on hand within specified time periods. In some cases, book inventory and stock on hand may be reconciled as often as after each transaction. This is useful in keeping track of actual product availability and determining the correct time to reorder.
Product obsolescence	Product condition that occurs when an existing product becomes out of date or obsolete.

Prompt pay discount	Discount offered by vendors to entice prompt, or even early, payment in order to help them maintain their own cash conversion cycle. Often quoted as, for example, "2% net 10", meaning a 2% cash discount of the total invoice is taken if the entire balance is paid within 10 days instead of the traditional 30 days.
Shrink	Any shortage after the final calculated inventory value in a company's accounting records is compared with the final valuation from the physical inventory.
Weighted average cost (WAC) method	Inventory valuation method which is a compromise between FIFO and LIFO. The WAC per unit is calculated by taking the inventory purchases and dividing this by the total number of units for the period. At the end of each accounting period, WAC per unit of inventory is determined and reflected in both the balance sheet and income statement as COGS.