EDUCATIONAL COMMENTARY – INVENTORY MANAGEMENT: MANAGING REAGENTS AND CONSUMABLES IN THE LABORATORY

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Learning Objectives

On completion of this exercise, the participant should be able to

- identify the primary components of inventory management;
- describe the first in, first out process;
- discuss two cost savings associated with good inventory management practices; and
- explain how to determine min-max volumes for stock.

What Is Inventory Management?

Inventory management, sometimes known as supply chain management, is a cycle that includes procurement as well as storage, use, and replacement of supplies needed to meet the needs of laboratory operations. It is easy to take access to supplies for granted, but there is a lot more to inventory management than just ordering supplies. Inventory management includes managing instruments, reagents, equipment, consumables, and all contracted services used by the lab. For purposes of this discussion, the focus will be on the reagents and consumables that make up the routine inventory in the lab.

Why Manage Inventory in the Lab?

While the most significant consequence of inventory problems is the impact to patient care, these problems are also disruptive, expensive, and frustrating for staff. If you have ever reached for a reagent and found either an expired unit or an empty shelf, you are aware of the impact inventory issues can have on your daily operations. How well these processes are managed has a tremendous impact on the efficiency of lab operations, cost to the lab, and work output. Poor inventory management can lead to multiple types of waste including excess inventory, back-orders, expired products, and the generation of a significant amount of manual effort to keep supplies on the shelf.
Good inventory management provides improved quality of operations with a lower overall cost.

**Better Patient Care**
- No delays and consistent turnaround of results
- Improved quality / accuracy of results
- Improved customer service

**Cost Containment**
- Reduced cost and improved budget management
- Reduced staff time
- Decreased waste

**Compliance**
- Meet regulatory and accreditation requirements / standards
- Manage product quality and integrity / reliability during storage and use

Figure 1. Benefits of inventory management.

**How Do You Start?**

A good starting point is understanding the current work flow in your organization. A flow chart will help to clarify the steps. You may find that one or more steps are combined or shared by other departments, making a version with swim lanes useful. After you determine the current state, move through each step using one of the standard evaluation tools (e.g., Plan-Do-Check-Act) to determine opportunities to improve and streamline the process. Include a monitor or audit system to track progress.

**Procurement**

Often called *purchasing and materials management*, procurement is the process of identifying what is needed, which vendor should be selected, and then managing the direct contact with the vendor for ordering and receiving products.

There is a great deal of variation in how this process is conducted. A small clinic may contact vendors and place their own orders, whereas a large system may have a purchasing department that handles everything up to and including delivering supplies to the lab storage room. Generating a workflow diagram helps to confirm which department or staff is responsible for each of the various steps in the process.

As you generate the workflow, identify who is responsible for each step and whether the appropriate policies, processes, and procedures are available to staff for reference.
Determining what to purchase and which vendor to purchase from is the first step in procurement. Identify what your expectations are for the product and then evaluate the vendor’s capability to meet your expectations.

Any evaluation of a vendor must include qualifications to provide the product, compliance with purchasing laws and regulatory guidelines, and ability to meet your needs during the time frame identified.

Cost is important, so this is a good time to identify which group purchasing organizations (GPOs) are affiliated with your system and whether there is a contract in place for the product you need. Some organizations have formed affiliations with outside entities to create a group purchasing network, generating additional cost savings. There are software applications that can perform side-by-side evaluations based on GPO contracts and specific technical requirements that you input.

You may choose to do your own research and contact multiple vendors. One way to compare levels of service, quality, and cost is to use one or more of the Request for Information (RFI), Request for Proposal (RFP), or Request for Quote (RFQ) processes. General descriptions are listed below in Figure 3.

**Figure 3. Descriptions of vendor comparators.**

**RFI: Request for Information**
- RFI is a formal request for information that allows vendors to be easily assessed for the ability to meet your needs.
- RFI/RFP/RFQ documents are usually requested in a format that allows multiple vendors to be easily compared.

**RFP: Request for Proposal**
- RFP takes the process to the next level by bringing more structure and clarity to the request and may include costing information.
- May be used as a stand-alone tool to determine vendor selection.

**RFQ: Request for Quote**
- RFQ is a variation of the RFP that may have more financial detail than the RFP.
- Often reserved for major capital expenses.
After the assessment and negotiations are completed and the contract is in place, procurement moves into the maintenance phase where the supplies or services are ordered, delivered, and reordered as needed. This is the phase that often has the most visible impact on daily operation of a lab.

**Receiving**

After the products are ordered, there should be a planned process for how and when they are delivered to the lab. Consider including in your process and procedure a way to address each of the following:

- **Time of delivery**—if deliveries are after hours or on weekends, is there a process for someone to receive and distribute?
- **Verify that all items are acceptable on receipt.** Some labs use a pass/fail checklist for each item, or you may break it down into categories of supplies.
- **Is there a process or instructions for how to handle items that do not meet acceptance criteria?** These could include items received outside of acceptable temperature range, too close to the expiration date, reagents that should have been part of a sequestered lot, items/reagents that were damaged in shipping, etc.
- **Have a process to take unacceptable products out of circulation and communicate that information back to the vendor.** Record the nonconformity, actions taken, and any concessions received. This information should become part of the ongoing quality program that evaluates suppliers and determines the approved supplier list.
- **Verify expiration dates and ensure that all items are labeled with date received into the laboratory.**
- **Temperature requirements**—is there a mechanism to identify and store room-temperature, refrigerated, or frozen products?
- **The receiving process should include a review of manufacturers’ inserts to assure that there are no changes in use, storage, or limitations of the products.**
- **Identify your process for reconciling what you receive with what was ordered.**

**Storage and Stocking**

Your process may combine receiving and storing into a single process, with each category of supply received and stocked before the next category is addressed. Always store materials in accordance with manufacturer instructions, noting all temperature, humidity, and special requirements such as protection from sunlight. Primary considerations for storage should include the following:
Temperature-sensitive materials must be received and stored as quickly as possible to maintain the integrity of the products. In the lab reagents, calibrators, quality control materials, and proficiency testing materials are often refrigerated or frozen. In some instances, the freezer temperature may differ (e.g., one product might need to be kept frozen at a temperature below the lowest range that is acceptable for a different product). Such requirements can result in a need for two separate freezers. Never assume temperature ranges are standard.

Room temperature must be monitored to ensure that temperatures do not exceed the ranges that have been validated by the vendor. Identify the tightest range that will encompass all products and set up controls to maintain the temperature within those parameters. Some environments are monitored electronically by an engineering department. If the laboratory is responsible for monitoring, electronic units can be used that record and save the minimum and maximum temperatures over each 24-hour period. This type of monitor (sometimes referred to as a min-max thermometer) allows records to be easily maintained in satellite locations or draw stations that are not staffed continuously. Specimen collection tubes are often overlooked but must be maintained within a specific “room temperature” range.

Humidity levels may need to be monitored if they affect supplies and instrument operation. Check to see if any of your inventory/instruments require a specific humidity range and determine whether humidity will be monitored at a system level (electronically monitored by engineering) or if the lab is responsible for installing and monitoring levels.

Location(s) for storage should be clearly defined and labeled. The space should provide the ability to easily place new inventory behind existing stock. This process, first in, first out, or FIFO for short, is a key concept in effective inventory management and can reduce wasted inventory resulting from outdated and/or mixed lots. Pass-through refrigerators and moveable racks facilitate easy access to stock the new supplies appropriately. Pullout shelves in refrigeration units are another tool for easier FIFO management.

One of the easiest ways to distribute and stock supplies is to build a master location directory to control where items are stored. A clearly defined process with clear procedures allows any member of the team to step in and store new inventory appropriately.
To develop a location directory:

- Start with a floor map of your storage area that identifies each storage/shelving unit, refrigerator, or freezer used for storing stock.

- Break down each storage unit into shelf numbers and location on the shelf where each type of item is stored. Taking this process to the next level, each supply location should be labeled with the item and order number. If possible, the minimum and maximum volumes should also be clearly listed.

- Visual clues should make it easy to see at a glance what needs to be ordered. Using colored tape to outline the area needed for the maximum inventory, a lean technique, identifies any item that is not fully stocked. Some labs use flags, cards, or even Excel sheets to manage stock, if they have a manual system. Automated systems that utilize barcodes or radio frequency identification (RFID) can track items as they are removed from the shelf and generate volumes for reorder.

- Cross-reference all inventory items to a specific location.

- Correlate all the necessary information for ordering and stocking on a master list. An Excel database can be customized to work in any environment. Determine what information is required for your operation to work effectively. As an example, see Figure 4.

<table>
<thead>
<tr>
<th>Area</th>
<th>Location</th>
<th>Item Description</th>
<th>Item #</th>
<th>Reorder point</th>
<th>Quantity per unit</th>
<th>Unit of Purchase</th>
<th>Vendor</th>
<th>Type of Order</th>
</tr>
</thead>
<tbody>
<tr>
<td>Supply Room</td>
<td>A,3.b</td>
<td>CLINITEK Strips</td>
<td>48206</td>
<td>8 boxes</td>
<td>100 strips per box</td>
<td>6 boxes per unit</td>
<td>Medline</td>
<td>Materials</td>
</tr>
<tr>
<td>Chemistry Freezer</td>
<td>B,2.a</td>
<td>Trop Calibrator</td>
<td>895c2</td>
<td>2 boxes</td>
<td>1 set/box</td>
<td>1 box/unit</td>
<td>BCI</td>
<td>Standing order</td>
</tr>
</tbody>
</table>

Figure 4. Master Inventory, Main Lab, XYZ Health Care System.
Orders for Replacement Inventory

Labs may place orders in a variety of ways, and the process depends on the structure of your organization. In a hospital or larger system, the lab staff will usually place orders through a materials management department that handles most of the work to order, receive, and distribute the goods to the lab.

Receiving and distributing supplies within the lab and reordering to maintain inventory levels are areas generally managed by lab staff.

To improve the efficiency of your daily operations, you can use specialized order protocols.

- Standing orders are particularly useful when a critical reagent has a short expiration date. The size and frequency of orders is based on historical use and monitored for changing patterns or volumes. Advantages include less time spent placing orders and often a reduction in shipping costs. There can also be an opportunity to negotiate lower purchase costs based on the guaranteed volume or usage over a long period of time, usually a minimum of 1 year.

- Sequestered lots offer a savings in time and cost by reducing the lot to lot calibrations required for most tests. This works well for reagents with a long expiration date or shelf life, when you know you will not be changing instrumentation or see large fluctuations in volume of work.

Establishing minimum and maximum (min-max) stock levels can make ordering and restocking an easier process. The challenge is identifying appropriate min-max levels that provide a balance between availability of product, lead time for delivery, and expiration dates.
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Average volume used over a full year can be a good starting point. It can be broken down by month or week, depending on your ordering requirements. That average is then adjusted to include variables that you have identified and could include the following:

- Seasonal fluctuations in use (e.g., flu kits)
- Vendor-specific shipping programs/holiday schedules
- Time from order to delivery
- Manufacturer’s history of delays or backorders
- Space available
- Weather or geography that would affect delivery
- Validation required before use

Each stock item will have its own unique set of parameters and should be reevaluated on a regular basis to assure the variables have not changed.

As the lead time to receive goods has decreased, labs have been able to operate with a smaller inventory than required historically, or even a just-in-time process. Just-in-time processes are common in larger organizations where a central supply management department can maintain stock for the lab and the lab can have an order delivered the same day it is ordered. Many labs operate on a weekly ordering system, but each location is unique and the frequency must be aligned with your specific needs.

Conclusion

Inventory management is a necessary part of lab operations and, when effectively controlled, will improve patient care while generating cost and time savings. It also ensures that the lab meets compliance and accreditation standards and should be included in your quality management plan (QMP).

Clearly defined processes reduce or eliminate delays and/or inability to provide testing due to lack of reagent, outdated reagents/supplies, or inadequate quality of product. They contribute to a seamless operation, allowing any member of the staff to step in and receive and put away stock.

References


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