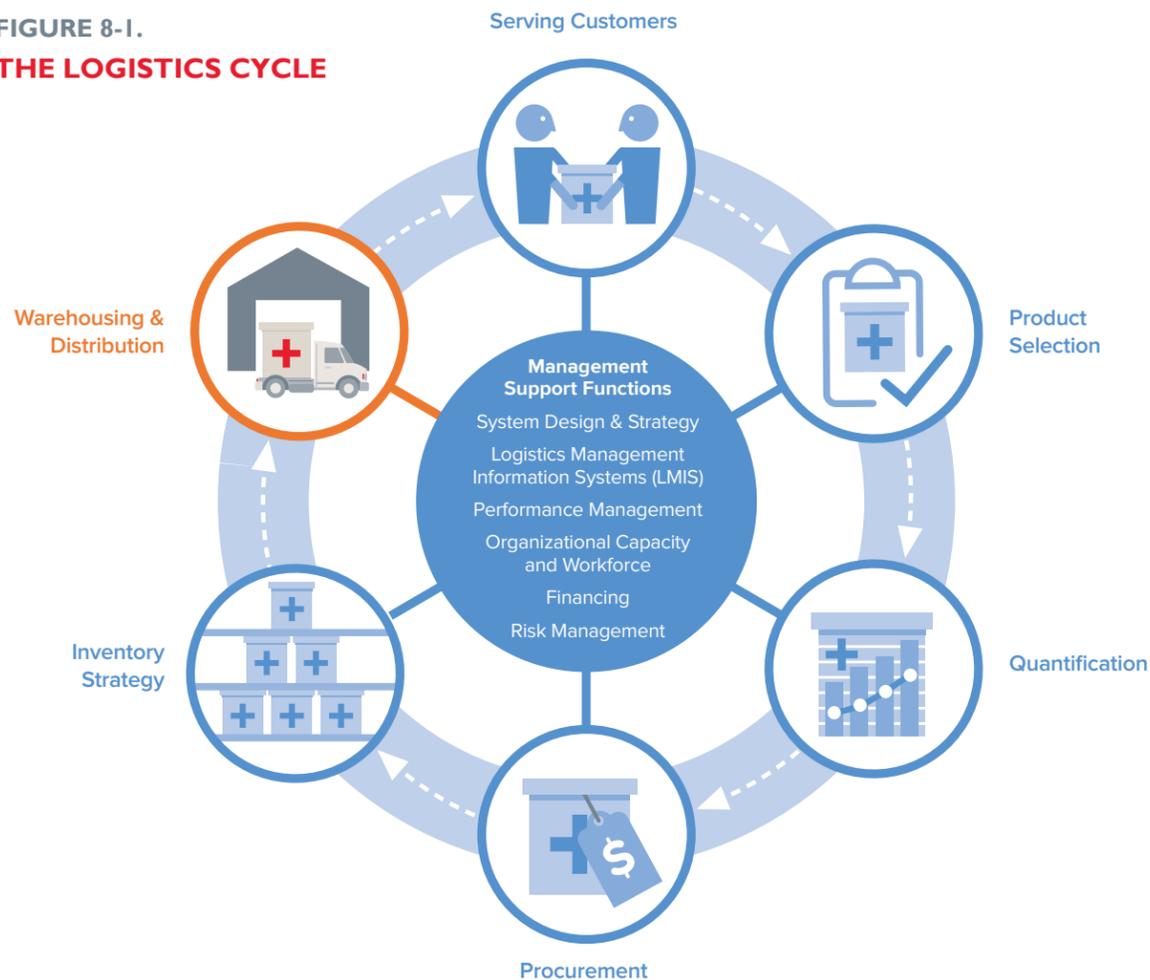




CHAPTER 8

WAREHOUSING AND DISTRIBUTION

FIGURE 8-1.
THE LOGISTICS CYCLE



WHAT A SUPPLY CHAIN MANAGER NEEDS TO KNOW:

Warehousing and distribution are the two supply chain activities that often require the largest proportion of a supply chain operation's budgets. When a supply chain manager has well-functioning warehousing and distribution management systems, he or she can extend the working life of public health infrastructure, reduce the overall costs of transport, and improve the provision of public health services.

The supply chain manager needs to know the following about warehousing and distribution, which are covered in this chapter:

- How to carry out the key warehousing activities of receiving, storage and shipping
- How to plan warehouse space requirements and warehouse layout
- The key components of inventory management
- Issues to consider in positioning warehouse assets to optimize storage and distribution
- Issues to consider in designing the transportation network and managing the transportation function

8.1 WAREHOUSING

It is important that supply chain managers have an overall strategy for commodity warehousing, particularly in resource poor environments where warehousing can provide a buffer against uncertainties and breakdowns within the supply chain. Managers need to think of warehouses not simply as four walls, a ceiling and a floor where inventory rests, but as dynamic operations centers housing a varied range of distinct yet complementary activities that combine to collect and hold products for subsequent shipment to service delivery points.

Products are warehoused at every facility in the pipeline. Good warehousing ensures the physical integrity and safety of products and their packaging throughout the various storage facilities until they are dispensed to clients. The various activities that occur within a warehouse should be aligned so that products can be managed efficiently and orders can be filled and distributed expeditiously. Requirements for good warehousing practices include:

- 1 A facility with adequate storage and working space as well as infrastructure components that will protect commodities from harmful environmental conditions
- 2 Application of proper procedures so that commodities are always available, accessible, in good condition, and pose no risk of injury to workers
- 3 Availability of timely and accurate inventory data for decision-making
- 4 Qualified human resources in sufficient quantity to meet operational needs

Regardless of storage facility size—from a small health center to a central warehouse—the main operational activities for storage are very similar. How complex these activities become varies based on the volume of products to be managed and storage facility size; as well as particular product handling requirements, such as cold storage.

8.1.1 KEY WAREHOUSING ACTIVITIES

8.1.1.1 MATERIAL RECEIVING AND INCOMING INSPECTION

This activity occurs during the unloading of inbound vehicles and includes the visual inspection of delivered packages to ensure that products were not damaged during transport. It is also important during this activity that staff verify the quantities of products received against the packing slip or shipping invoice and report any discrepancies.



SHELF LIFE

Shelf life is the length of time from the manufacturing date that a product can be safely and effectively used assuming it is stored according to the manufacturer's specifications. All pharmaceuticals have a shelf life specified by the manufacturer and that shelf life is validated by the national drug regulatory authority when the product is registered in-country. Shelf life can range from several months to several years depending on the product. After a product's shelf life has expired, its usability, purity, and/or potency may be adversely affected. For some medicines, the expiration date also affects the safety of the product. As a safety precaution, the expiration date should be considered the last date the customer should use the medicine. Expired products need to be segregated from usable products and be properly disposed. All medicines should be managed according to a first-expiry, first out policy to avoid potential expiry and waste.

8.1.1.2 PUT AWAY

This process includes moving products from the unloading dock, or receiving area, after they are released for storage; and assigning them to their designated storage area (rack, shelf, floor, etc.). It is important that every product moved into or out of the racks, shelves, or any storage area is correctly recorded on the stockkeeping records.



STORAGE GUIDELINES

Annex 8-1 provides detailed storage guidelines that should be followed, regardless of the size of the facility. Though some of these rules may be adapted based on the facility, others should always be applied. For example, it is unreasonable to expect a small health center to have more than a small closet or cupboard for storing medical supplies. Using pallets in such a small space would be inappropriate. Small shelves that keep products away from exterior walls and off the floor may be sufficient. Conversely, cartons should always be stacked with the arrows pointing up regardless of the type of facility. It is also helpful to bear in mind that although some budget and resources are necessary to adhere to these guidelines, others, such as the example with stacking cartons correctly, can be followed by all staff at all facilities without requiring additional funding.

8.1.1.3 VISUAL INSPECTION

The quality of storage conditions may vary along the supply chain and a manager may occasionally need to verify the quality of some products. Visual inspection is the process of examining products and their packaging to look for obvious problems with product quality. Maintaining appropriate storage conditions and ensuring that damaged or expired products do not reach a service delivery point where they could be inadvertently given to a client is essential. To ensure the quality of the product in your warehouse and pipeline, conduct a visual inspection when you do any of the following:

- Receive products from the manufacturer (usually at the central level)
- Conduct a physical inventory count
- Receive a complaint about a product you issued
- Identify a product that is about to expire
- Identify a damaged product
- Notice that a product has not been stored properly.

Two basic types of damage may occur during shipping and storage that affect product quality: mechanical and chemical. Mechanical damage is caused by physical stresses, such as crushing or tearing when the products are loaded, off-loaded, or when cartons or inner boxes are stacked. This kind of damage is usually limited to crushed or torn parts. Chemical damage is more difficult to detect and confirm during a visual inspection. Laboratory testing is usually required. Some indications of chemical damage may include changes in the color, odor, or consistency of the product.

Generally, mechanically-damaged items are removed from stocks; the remainder of the box, or carton, is distributed as usual. Chemically-damaged items should be removed from inventory, along with all like items (i.e., from the same lot), quarantined, and tested or disposed of according to national drug authority guidelines.

8.1.1.4 ORDER FULFILLMENT

The activities that take place between the warehouse receiving the order and the consignee taking possession of it is sometimes referred to as order fulfillment and in this handbook we break this down into picking and packing and shipping.

8.1.1.5 PICKING AND PACKING

To fill shipping requests (or picking lists), products must be located, pulled from inventory, and prepared for shipment. But before that can take place, a request needs to be processed through the inventory system to reserve those commodities that are available for picking. The individual items that make up that order can then be picked from the storage locations throughout the warehouse by warehouse staff and transported to a packing station. At the packing station, staff will conduct a series of quality control checks to confirm that the right products have been picked in the right quantity. To guarantee good shipping accuracy, the list



Photo courtesy of A. Makulec, Ethiopia



Photo courtesy of C. Keddem, Myanmar

of products and their quantities must be checked against shipping orders, or requests, prior to assembling the order into secure packing and making it ready for shipping.

8.1.1.6 SHIPPING

Shipping includes preparing commodities for shipment to customers and placing those commodities on vehicles.

- After an order has been picked and packed, it will be ready for dispatch to the intended recipient. At the dispatch location, the shipment will be weighed, labelled, and recorded on a shipping manifest that provides a record of when the order was picked and when it leaves the warehouse.
- In some cases, products need to be packed into shipping containers or palletized; and, sometimes, bundled with other products into kits before being shipped. When any packing or repacking activity takes place, the new package must be labeled correctly.
- To avoid damage during transit, products must be appropriately arranged and secured within the vehicle
- The last step in processing the order is to update the warehouse inventory to reflect that the commodities have left the warehouse

The routine of picking, packing and shipping operations should ideally follow a schedule that is agreed upon between higher and lower levels in the supply chain and will depend on the defined inventory strategy. Depending on the type of commodities being distributed and the number

of delivery points being serviced, the ordering frequency may vary. However, supply chain managers should aim to have warehousing picking, packing, and shipping activities occur on a regular schedule rather than in an ad hoc manner in order to gain efficiencies and to set clear expectations for ordering and delivery for the warehouse staff as well as downstream recipients.

8.1.2 INVENTORY MANAGEMENT

Warehouses, clinics, and any facility that stores products within the public health system need to have inventory management systems to maintain an appropriate stock level for all products to avoid shortages and oversupply.

In general, there are two methods for managing inventory in a warehouse—automated or manual.

8.1.2.1 MANUAL

Public health warehouses often use manual inventory systems, which are hand-written stockkeeping records, such as ledgers, stock cards, and bin cards. Managing inventory manually is a low-cost way to keep track of a limited number of stock keeping items (SKUs).

A manual system is organized according to date and transaction reference, which is the unique number of the corresponding transaction record for a receipt or issue, and/or the name of the facility from which products are received and issued. They record receipts; issues, losses, and adjustments; balance on hand; and, sometimes, batch or lot numbers and expiry dates. They also record the date and results of physical inventories; i.e., when items are counted to verify the quantity in storage.

8.1.2.2 AUTOMATED

As the quantity and volume of commodities moving through or being stored in the warehouse increase, automating inventory management might be considered if the benefits are enough to justify the initial and ongoing costs. Automated systems are becoming more and more appropriate for intermediate level warehouses as technology evolves and experience with information and communication technology grows. However, their use must be carefully considered based on human resources, ICT resources and skills, existing eLMIS infrastructure, volume of transaction, number of SKUs, and available budget.

A WMS is primarily used to help manage materials within a facility and aids in processing the associated transactions. When set up correctly, a WMS should direct picking, replenishment, and put aways and, if set up and used correctly, it can also do the following:

- Increase inventory accuracy
- Increase labor productivity
- Reduce reporting time
- Reduce information errors
- Optimize space utilization
- Improve service to end users

A WMS may reduce labor costs through the labor efficiencies gained by significantly reducing the time spent on unproductive activities, such as looking for lost products or shutting down operations to conduct physical inventories. However, a WMS requires more training and system maintenance, which could exceed the labor saved on the warehouse floor. A WMS might also increase storage capacity by optimizing where commodities are stored but this improvement will depend on how disorganized the storage spaces in the warehouse were before implementation of the WMS.

8.1.3 PHYSICAL INVENTORY COUNT

Throughout this handbook, we have discussed how stock-on-hand information is recorded in stockkeeping records. But how do you know if the information recorded on the stock card or WMS is correct? The only way to be certain is to conduct a physical inventory count. A physical inventory count is used to compare actual stock-on-hand for each commodity with the amount recorded in stockkeeping records.

While conducting the physical inventory count, be sure to compare the quantities-on-hand with the quantities that have been entered in stockkeeping records (for example, inventory control cards). A physical inventory count enables you to confirm how much stock you have and whether forms are being completed correctly.

For quality assurance, a physical inventory count is also an opportunity to inspect your products visually, as described above.

Large central warehouses should conduct a physical inventory count at least once a year. Depending on the level of the facility, you may want to conduct a physical inventory count more often. At the clinic level, for example, you may want to conduct a physical inventory count as often as once a month when completing the monthly report. If the stockkeeping records do not match the actual stock, conduct a physical inventory count more often and take steps to improve recordkeeping.

When conducting a physical inventory count, remember that when boxes are sealed and the rules of proper storage followed, only one box or carton is open at a time. A physical inventory count, therefore, can be a quick, routine exercise, especially if good storage practices are followed.

One factor that may deter storekeepers from conducting a physical inventory count is the large number of products in a warehouse or storeroom that must be counted. Some facilities are able to shut down for a few days each year to do a complete physical inventory count, but many situations make this impossible.

Some options for conducting inventory counts in this situation include:

Cycle counting. Warehouse managers conduct a physical inventory count for a fraction of items each month. By the end of the year, all items have been counted. When the next year starts, they

begin the process again. Regular cycle counting can keep physical inventory up-to-date without disrupting store operations.

Vital, essential, or nonessential (VEN) analysis. As discussed in Chapter 7 on Inventory Strategy, this involves counting the most essential, or most expensive items, more often. This analysis categorizes products as vital, essential, or nonessential, enabling you to assess stocks of vital items more often than nonessential items.

ABC analysis. As discussed in Chapter 7 on Inventory Strategy, ABC is another way of classifying inventory, using annual value. As a logistician, you might also use an ABC analysis that is not based on cost, but on how often a receipt or issue is made. Antibiotics can be issued more often from the warehouse, whereas x-ray equipment may be rarely issued. In this situation, count and assess antibiotic supplies more often.

As with assessing stock status, having many items to count does not need to be a barrier to conducting regular physical inventory counts, or regular assessments of stock status.

8.1.4 PLANNING WAREHOUSE LAYOUT AND SPACE REQUIREMENTS

In determining warehouse space requirements, the supply chain manager will need to consult with public health policy makers to understand the context for current and future supply chain needs. This includes the overall public health priorities and implementation strategies, proposed budgets for capital and human resources, and new products and services that may be offered. This will help the public health supply chain manager plan rationally for future warehouse requirements.

Proper storage includes the efficient use of warehouse storage space. If too much space is continually left unused, then the investment to maintain the storage infrastructure is not being optimized. But, if products are crammed into too small a space, they may be damaged because good storage procedures are harder to follow. Thus, supply chain managers must learn how to calculate the space needed to optimally manage the overall flow of commodities into and out of their facilities and determine how that space will be used for internal warehousing operations. (Note that contemporary supply chain strategy often does not plan for products to be stored for very long periods in one warehouse. Efficient supply chain practices may call for relatively rapid inventory turnover.)

Layout planning is not simply assessing the space requirements of a warehouse storage facility, but also specifying how that space should be organized to facilitate identifiable warehouse activities. The main objectives of layout planning are to:

- Use space efficiently
- Promote the efficient handling of commodities
- Provide economical storage
- Allow for flexibility to meet changing warehousing requirements

STEPS TO FOLLOW WHEN PLANNING THE LAYOUT OF A WAREHOUSE

Examine the scale of the subset of activities related to receiving, storage, retrieval and shipping that require layout planning.

- Receiving includes the tasks related to accepting usable commodities from outside suppliers and preparing those commodities for storage in the warehouse
- Storing includes activities associated with the actual storage of usable commodities in the warehouse, usually on pallets, shelves, and/or racks, as well as moving usable commodities from one or more locations—for example, the floor, shelves, or racks—and transporting
- Shipping includes the tasks that help prepare usable commodities for shipment to customers and the placement of those commodities on vehicles for transport to the customers

Determine the space requirements and ideal layout for each warehouse activity.

- You'll need to develop a workable layout and calculate storage requirements for any storage facility, which may serve multiple purposes. To accomplish this, it is important to identify the various warehouse activities that would influence layout planning, determine the space requirements and ideal layout for each activity, and then reconcile space requirements with any constraints. To optimize storage space, larger warehouses may require pallets, racking, shelving, and/or material-handling equipment, such as forklifts.

To determine space requirements, you may need to consider some, or all of the following:

- Total stored pallet equivalents, by commodity, based on a peak month
- Stored pallet orientation
- Required space for receiving, inspection, and quarantine
- Required space for picking, packing, and shipping
- Type of storage media, per commodity (i.e., pallet rack, gravity flow rack, shelving)
- Required operation aisle distances
- Type of material handling equipment required
- Special storage requirements such as those for narcotics or items requiring cold storage, secure storage, or flammable storage

The calculations begin with the total number of units for the product being stored. If calculating space for a single shipment, use the number of units in that shipment. If calculating space requirements for the entire quantity of a product to be kept in the store, use the maximum quantity. If making a long-term plan for your storage needs, use the largest quantity you might need to store during the period of the plan.

In addition to knowing the total number of units to be stored, the storeroom manager needs to know —

- Number of units in a carton (exterior packaging)
- Size of the carton.

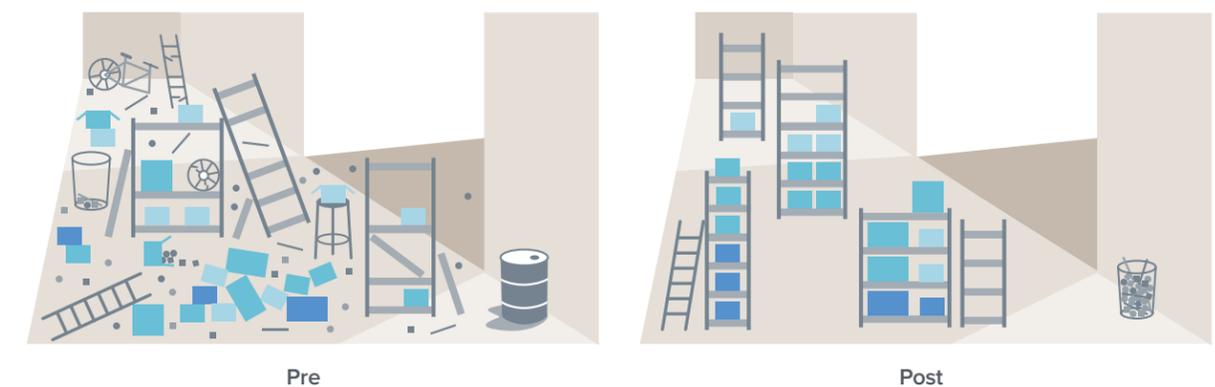
With this, the manager can calculate the total volume to be stored, convert it to square footage required, and factor in space for handling to get an estimate of the total floor space required (see Annex 8-3 for more detail on these steps).

Develop a realistic layout by reconciling space requirements with existing constraints.

It is possible that the warehouse will not be able to accommodate the needed storage space because of warehouse size limitations. In these cases, consider alternative layouts. This situation can be managed in many ways, without installing a new racking scheme.

- Change the desired inventory level. The average inventory level used to determine the volume requirements to store the commodities is based in part on a desired buffer stock. It may be possible to reduce the desired buffer stock without jeopardizing the warehouse's ability to fill orders. Lowering the desired inventory level can dramatically affect the space requirements. However, be sure to model the reduce inventory levels prior to committing to them so that customer service is not compromised.
- Reduce space allocated for receiving/shipping. Be sure to consider the average size of an inbound and outbound shipment and the length of time they remain in the shipping or receiving area before resizing these spaces.
- Consider adding shifts to use the existing space during an extended working day
- Free up space by disposing of items in the warehouse no longer requiring storage (see dejunking below). This may include expired, damaged, and obsolete items.

FIGURE 8-2.
WAREHOUSE DE-JUNKING



DEJUNKING means removing all damaged and expired products, as well as other items that are cluttering the warehouse or storage room—sometimes for many years—to free up space and use best practices to organize the warehouse. The dejunking effort can create additional storage space in warehouses, limiting the need for expensive new construction.

8.2 DISTRIBUTION

Because most product manufacturers are based internationally, the most common in-country distribution system is a system where products flow from central medical stores to districts and/or regions; and, ultimately, to service delivery points. As with warehousing, distribution plays an essential role in the health logistics system. Distribution consists of moving products down the pipeline from the national central warehouse until they are dispensed to the final customers.

8.2.1 DISTRIBUTION MODELING

Distribution modeling is the process of planning commodity deliveries so that they are both efficient and effective. With effective distribution modeling, it is possible to reduce distribution costs while still meeting the needs and demands at all points along the health service supply chain. Distribution modeling is most often carried out using fit-for-purpose software. A number of factors will influence which distribution model is the most appropriate and efficient for each supply chain manager. These include recipient location; transport costs; available vehicle types and other modes of transport (e.g., motorcycle and boat); the size, location, and cost of a distribution center or warehouse; order size and frequency, and range of products).

When designing a new distribution network or redesigning an existing one, consider the following questions:

- What is the ideal distribution network, given current transport resources? Will it provide a satisfactory service level, without stockouts, at dispensing facilities?
- What would be the ideal distribution network if more resources were available?

The points listed below are essential for any transportation network design, regardless of the size or complexity. By analyzing this information, you will be able to determine suitable transportation routes for delivery sequence and frequency to each facility. You can then use this information to identify the efforts and resources that could build an ideal distribution system.

These points include:

- Monthly demand of products supplied to each health facility (total quantity, weight, and, particularly, packaged volume)
- Location and distance of facilities from their supplying facility (national, regional, or district warehouse) by road, rail, air, or sea. Project this information on maps for easily viewing, either on hard copy maps, or preferably in electronic form using a geographic information system (GIS).
- Fleet details: list of vehicles in use; their type; load capacity; and length of time, in days, the vehicles are available for health product delivery (in some cases, vehicles may not be solely for delivering health products)
- Staff trained in activities related to transportation—proper equipment operation, safety, delivery schedule planning and execution, material handling, and reporting

During the distribution network design process, managers should also identify the types of vehicles best suited to the requirements of the products they will carry and the customers they

will serve. For example, heavy-duty vehicles may not do well on bumpy or narrow roads that small pick-up trucks could easily pass. Also, some products, notably vaccines, require cold storage during transport, while others do not.

The transportation design process can also inform financial planning. You can project the fixed transportation costs, including vehicle depreciation and insurance; as well as variable costs, such as fuel, staff per-diem, and vehicle maintenance.

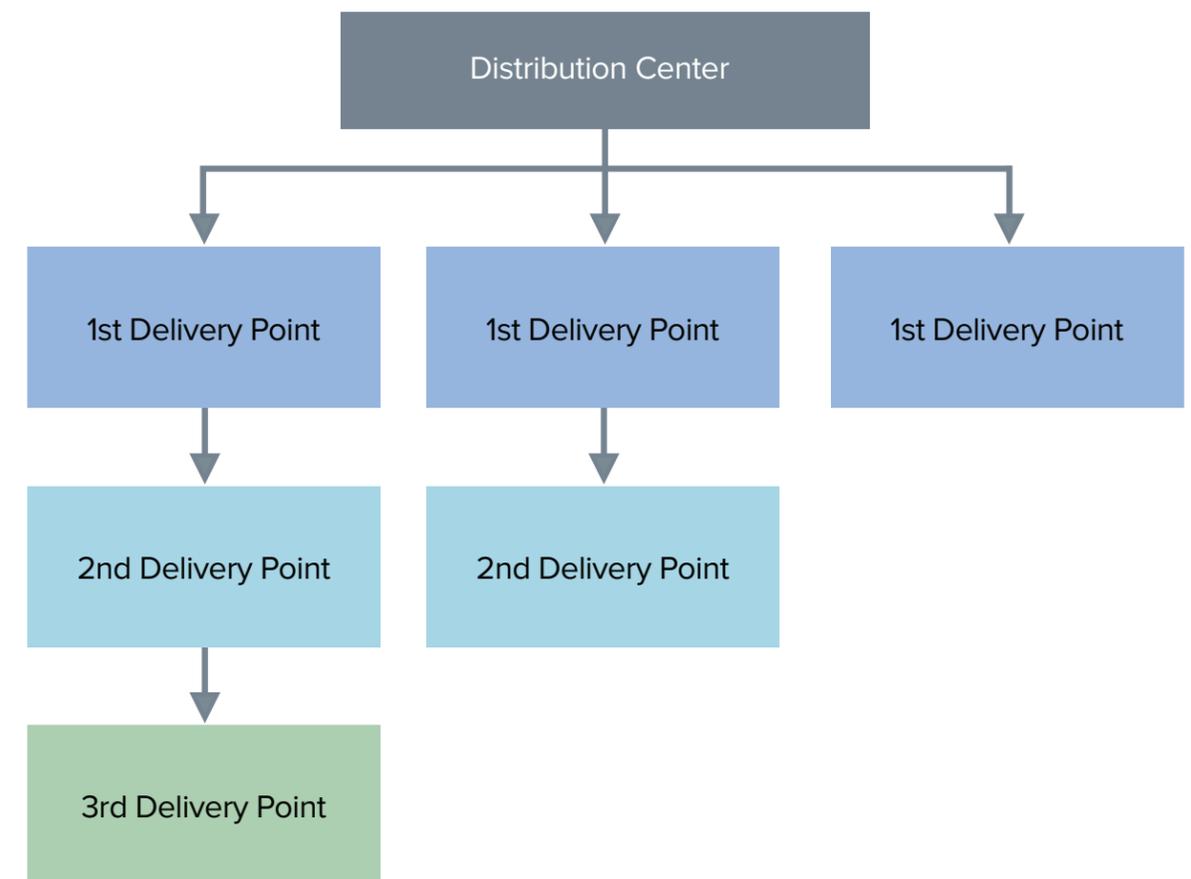
BASIC DISTRIBUTION MODELS

There are two basic distribution models, direct and network.

DIRECT

In the direct distribution model, a centralized distribution center or centers deliver directly to service delivery points. Where there is good road access to all facilities, this may make sense

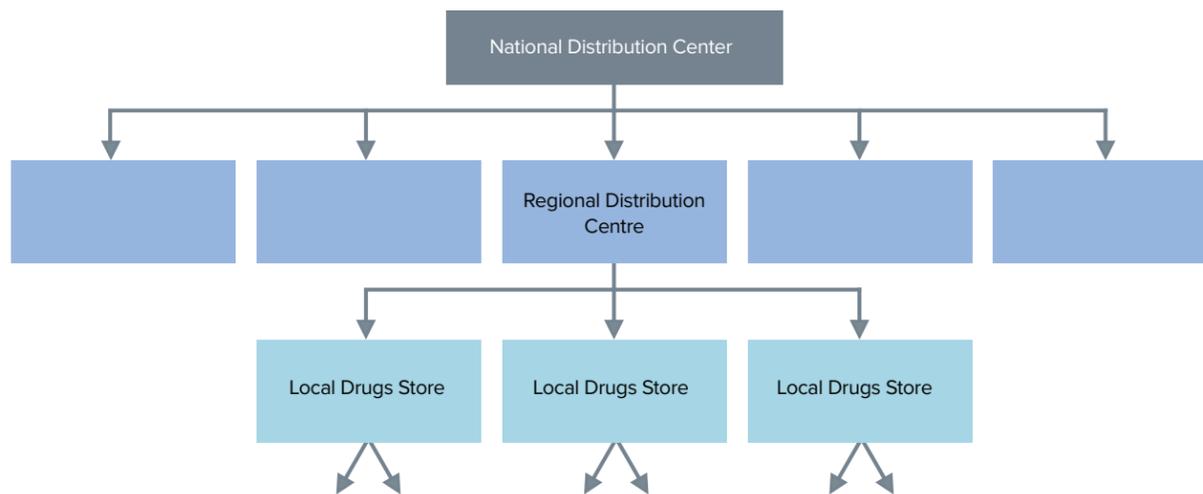
FIGURE 8-3.
BASIC DISTRIBUTION CENTER MODEL



Distribution Network

In a distribution network, there are national distribution centers who serve individual facilities and subnational distribution centers. The subnational centers then supply additional service delivery points. This makes sense when distances are long or transportation infrastructure is not uniformly good.

FIGURE 8-4.
BASIC DISTRIBUTION NETWORK MODEL



8.2.2 TRANSPORT MANAGEMENT SYSTEM (TMS)

Simply designing a distribution network and allocating resources does not guarantee a well-functioning system. It requires rigorous day-to-day management and planning. Development and implementation of a formal TMS can contribute to supporting and sustaining a successful distribution network.

A comprehensive TMS should include the following activities:

Operations management. To ensure that transportation practices are aligned with policy, include the scheduled delivery planning, vehicle allocation, control over fuel consumption, and monitoring of performance in this activity.

Fleet management. Transport vehicles are an expensive, yet essential, component of health product delivery. To guarantee vehicle availability and good working conditions, you must monitor the proper use of vehicles and plan for their preventive maintenance and eventual replacement and disposal.

Human resources. It is important to ensure the availability of a well-trained operator for each vehicle, as well as a designated transport manager at every facility that provides transportation services.

Performance monitoring and costs. To monitor and control effective transport operations, it is essential to define and apply KPIs. For better resource planning, you should also include a complete set of indicators in the collection of all operational costs. Depending on available resources and the size and complexity of the distribution network, the TMS can be ledger-based, a manual process, a computerized software tool, or a combination of systems.

8.3 OUTSOURCING

The term outsourcing refers to a situation in which an organization contracts with an external service provider, or third party logistics provider (3PL), to carry out business functions that were previously performed in-house. This practice has become common in industrialized countries because it is often less expensive and more efficient for companies to use outside expertise for non-core activities, like computer maintenance or payroll disbursement. Outsourcing is also gaining greater attention in developing countries, including as a potential solution for improving the transport and warehousing of health commodities.

8.3.1 WHEN SHOULD OUTSOURCING BE CONSIDERED?

It is essential to recognize that outsourcing is not an easy solution that will remedy all logistics concerns and, most certainly, will not relieve an organization of the responsibility for managing its supply chain or transportation management system. A decision to outsource comes from determining when it is more advantageous for an organization to shift from carrying out specific transportation tasks on its own to managing contracts for implementation of those tasks by an outside party. For transportation or warehousing outsourcing to be successful, the organization must maintain constant involvement in transportation or warehouse management, scrupulously monitor KPIs, and possess (or develop) special skills, particularly in contract management. A key initial issue is whether quality outsourcing options are readily available and how reliable they are. Public sector outsourcing of supply chain functions to private sector partners has been successfully deployed in many countries when well-planned and managed, notably in Bangladesh, Ghana, Malawi, Mozambique, Pakistan, among others.

8.3.2 IMPLEMENTING OUTSOURCING

An organization that has made the decision to pursue outsourcing must then seek to contract with a private sector provider and manage the provider in a way that ensures objectives are met. For the purposes of this guide, it is best for readers to consider a few key principles

about contracting and contract management, and then consult more in-depth sources covering these two intricate processes particularly because they can vary widely from environment to environment.

8.4 PERFORMANCE MEASUREMENT

To help improve supply chain operations, many consider implementing supply chain performance indicators or metrics as one of the simplest, least expensive, and least time-consuming ways of doing so. Studies have shown that people behave based on the way they are measured. Personnel responsible for public health warehouses are no different. Unless clear measurable indicators are in place, staff may not completely understand what is expected of them; as a consequence, they may not carry out their tasks as well as they could.

The underlying power of KPIs is found in analyzing their relationships to each other, to benchmarks or objectives, as well as to trends over time. Looking at data over time allows you to spot trends or deviations from a norm. When a change is identified, you can carry out a root cause analysis to understand why the change occurred and what can be done to make any necessary corrections. Accurate KPIs also allow for cost comparisons to help guide cost-effectiveness decisions.

8.4.1 WAREHOUSING KPIS

Basic warehousing KPIs include the following:

- **Inventory Accuracy Rate:** Measures the percentage of warehouse or storage locations that had no inventory discrepancies when stock cards are compared to physical inventory count during a defined period of time. Alternatively can be calculated for a single facility as the percentage of months or quarters with no discrepancies in the review period.
- **Put-Away Accuracy:** The percentage of items placed in the correct location or bin in a warehouse or storage area.
- **Picking Accuracy Rate:** The percentage of items or lines picked accurately from storage based on a request or packing list, and then placed into the appropriate container.
- **The total number of accidents occurring in a warehouse or other storage facility during a defined period of time.**
- **Warehouse Order Processing Time:** The average amount of time (e.g., minutes, hours, days, weeks) from the moment an order is received at the storage facility until the time the order is actually shipped
- **Total Warehousing Cost:** All costs related to warehousing, such as labor costs and warehouse rent; utility bills, equipment, material- and information-handling systems, etc. It also includes costs related to systems, supplies, and any other material with specific use in warehousing.
- **Storage Space Utilization:** The percentage of the total storage space actually being used out of the total storage space available

8.4.2 DISTRIBUTION KPIS

The following are basic transport management KPIs:

- **Distance Traveled**
- **Fuel Consumption:** actual fuel used, usually measured in kilometers per liter, correlated to factors such as loading and type of equipment.
- **Running Cost per Kilometer:** The average transportation cost per kilometer related to a specific driver, type of vehicle, route, region/district/facility, or carrier (if outsourced) during a defined period, including fuel, tires, maintenance, acquiring and staffing a fleet, or, if outsourced, freight bills.
- **Availability:** The condition of the fleet can indicate the success of fleet management. It is a function of how much time a vehicle was broken down or undergoing maintenance, and how much time was it ready for use. Availability is calculated as a percentage of the total possible days in a reporting period.
- **Safety:** Obtained from the crash/incident reports. Accidents may indicate that the vehicle operator needs training. Critical safety defects in vehicles or their equipment also imply training needs for vehicle operators and maintenance personnel. Beyond the risks to life, poor safety affects vehicle availability and the cost of insurance premiums.
- **On-time Delivery:** measures the percentage of shipments arriving on time or within an agreed time window during a defined period of time.
- **Damages**
- **Shipments Arriving in Good Condition:** measures the percentage of shipments arriving without damage to the products during a defined period of time.
- **Nonconformity:** Unexpected events that adversely affect (or could potentially affect) a delivery system, including any aspect of a warehouse or distribution system. All instances of nonconformity should be recorded and investigated.

8.5 HEALTH AND SAFETY

There are many benefits to implementing appropriate safety procedures. Safety procedures are frequently disregarded in a variety of workplaces due to insufficient time, inadequate resources, or a misguided attempt to save money. However, when safety procedures are soundly implemented, there are major benefits, such as higher staff satisfaction as well as increased productivity. By minimizing the risk of injury, fewer workplace disruptions take place, absenteeism associated with injury is reduced, and equipment downtime is also reduced.

Here are a few safety guidelines that supply chain managers can continually reinforce to help keep warehouses safe:

- Ensure safety equipment is used at all times
- Eliminate any potential safety hazards
- Clearly label designated hazardous zones
- Always use safe lifting techniques
- Provide operational and safety training and refresher courses

The observing, implementing, monitoring, and reviewing of health and safety standards by supply chain managers is also critical to achieving safe, effective transport management. The main reason for doing this is to avoid death and injury from traffic accidents.

Traffic crashes are amongst the main causes of death in the developing world, comparable in scale to death from malaria or AIDS. Unlike these other epidemics, the global loss of life from traffic accidents is forecast to increase rapidly. Managing and enforcing basic health and safety measures can help minimize risks to vehicle operators and users, as well as to anyone on or in the proximity of a roadway.

Safety measures improve entire transport management systems and help ensure that a fleet will be subject to fewer repairs and replacements. Health and safety requirements for transport management systems must meet statutory criteria set out in national and local legislation, as well as local or wider organizational policy.

Photo courtesy of A. Makulec, Ethiopia



ANNEX 8-1.

STORAGE GUIDELINES

STORAGE PROCEDURES	WHY THIS PROCEDURE IS IMPORTANT
Clean and disinfect storeroom regularly	Rodents and insects (e.g., termites and roaches) may contaminate health commodities and their packaging. If you clean and disinfect your storeroom (and keep food and drink out), pests are less attracted to storage areas. If possible, a regular schedule for extermination will also help eliminate pests.
Store supplies in a dry, well-lit, well-ventilated storeroom out of direct sunlight	Extreme heat and exposure to direct sunlight can degrade health commodities and essential drugs and dramatically shorten shelf life. If warehouse temperatures rise above 104 degrees F (40°C), latex in condoms, for example, can begin to break down. If exposed to heat for a long time, condoms may expire well before their stated shelf life. Direct sunlight is also a danger as the ultraviolet rays can damage product and packaging in addition to raising the temperature of a product. To avoid this, store products in their original shipping cartons and shade the interior of the storeroom from sunlight. At lower levels, store products in the inner boxes (i.e., those that came inside the cartons) and leave medicines in their dark-colored or opaque bottles.
Secure storeroom from water penetration	Water can destroy supplies and their packaging. Even if a product itself is not damaged by water, damaged packaging makes the product unacceptable to the customer. Repair leaky roofs and windows. To avoid water damage from moisture that seeps through walls and floors, stack supplies off the floor on pallets at least 10 cm (4 in) high and 30 cm (1 ft) away from walls.
Ensure that fire safety equipment is available and accessible and personnel are trained to use it	Stopping a fire before it spreads can save thousands of dollars of supplies and the storage space itself. Have the right equipment available; water douses wood and paper fires but will not work on electrical or chemical fires. Place appropriate, well-maintained fire extinguishers throughout the storage facility (especially near doors) and train your staff in the use of the available fire safety equipment.
Store condoms and other latex products away from electric motors and fluorescent lights	Latex products, such as condoms and gloves, can be damaged if they are directly exposed to fluorescent lights and electric motors. Electric motors and fluorescent lights create a chemical called ozone that can rapidly deteriorate condoms. Condoms and gloves stored in their proper packaging (i.e., boxes and cartons) will not be affected by limited exposure to ozone. Whenever possible, keep condoms and gloves in their paper boxes and cartons. If this is not possible, move them away from lights and motors.

Maintain cold storage, including a cold chain, for commodities that require it	Cold storage, including the cold chain, is essential for maintaining the shelf life of drugs and vaccines that require it. These items are irreparably damaged if the cold chain is broken. If the electricity is unreliable, you may need to use solar-powered equipment.
Keep narcotics and other controlled substances in a locked place.	Narcotics and other controlled substances are dangerous when misused and may be stolen for sale on the black market. For this reason, stock managers should ensure that all stock movement is authorized. Limit access to the storeroom and track the movement of products. To deter thieves, lock the storeroom and limit access to persons other than the storekeeper and assistants. Access must not, however, prevent appropriate distribution. For this reason, always have several sets of keys—one for the warehouse manager, one for the assistant, and a spare set in the office of the medical officer in charge. Additionally, by keeping inventory records up-to-date, managers can ensure that both incoming and outgoing stock matches documentation. Physical inventories should be conducted regularly to verify recorded amounts.
Store flammable products separately from other products. Take appropriate safety precautions.	Some medical procedures use flammable products. Alcohol is used in sterilization; and mineral spirits power Bunsen burners. Store these highly flammable products away from other products and near a fire extinguisher.
Stack cartons at least 10 cm (4 in) off the floor, 30 cm (1 ft) away from the walls and other stacks, and not more than 2.5 m (8 ft) high.	Pallets keep products off the floor so they are less susceptible to pest, water, and dirt damage. By keeping pallets 30 cm (1 ft) away from the walls and from each other, you promote air circulation and facilitate the movement of stock, cleaning, and inspection. If storekeepers can walk around the stacks, they are more likely to be able to follow other good storage practices (sweeping, reading labels, and first-to-expire, first-out [FEFO]). For larger warehouses, pallets are frequently more efficient than shelving for storing products. Pallets reduce the amount of unpacking for storage and repacking for delivery, facilitate shipment in lot sizes, are cheaper to construct, can be stacked using pallet racking, and hold more stock for the space they occupy. Stack cartons not more than 2.5 m (8 ft) high, whether or not you use pallets. This is the highest that products can be stacked without crushing the cartons at the bottom. Stacking products at a stable height of less than 2.5 m reduces the possibility of injury to warehouse personnel. At lower levels, where pallets are inappropriate, shelving is an excellent way to store medicines. Metal shelving is preferred because wood shelving may attract termites.

Store medical supplies away from insecticides, chemicals, old files, office supplies, and other materials	Exposure to insecticides and other chemicals may affect the shelf life of medical supplies. Old files and office supplies, although not a direct hazard, may get in the way and reduce space for medical supplies or make them less accessible. Keep medical supplies in a separate area to make them readily accessible.
Arrange cartons so that arrows point up. Ensure that identification labels, expiry dates, and manufacturing dates are clearly visible.	It is essential that goods that are txdless of when they arrive at the storage facility. If shipping cartons do not show the manufacture or expiration dates, or if this information is difficult to read, use a marker to rewrite the dates on the cartons in large, easy-to-read letters and numbers. Items should always be stored according to the manufacturer's instructions on the carton. This includes paying attention to the direction of the arrows on the boxes; storing cartons upside down, which help to keep commodities from leaking their contents.
Store supplies in a manner accessible for FEFO, counting, and general management	In addition to having visible expiration or manufacture dates, store products so that the first to expire are the easiest to reach. This will ensure that the first product to expire is the first out (FEFO). Unfortunately, some warehouses base shipping on the date they received a product, rather than the manufacture or expiration date, often called first-in, first-out (FIFO). FIFO, a common practice, works well in most cases, but managing by expiration date (FEFO) ensures that the oldest products leave the warehouse first. You should confirm that FEFO is being followed every time you take a physical inventory. At the SDP, old stock should be moved or rotated to the front of the shelf, with new stock placed at the back of the shelf. By rotating stock so that the first stock to expire is the most accessible, staff can ensure that the first stock to be issued is the stock that is accessible. The goal is to get the product to the customer, not to have it expire on the shelves.
Separate and routinely dispose of damaged or expired products	Shipping expired products down the pipeline is a costly mistake. Not only do clinics (or worse, customers) receive unusable products, but also money and resources are wasted in the shipping, storing, and handling of unusable products as well. To avoid this, designate a part of the warehouse for damaged and expired goods. If possible, routinely plan for their disposal. Check policies for destruction. Donors and governments usually have specific guidelines for disposing of damaged or expired products.

ANNEX 8-2.

COMMON PRODUCT QUALITY PROBLEMS

WHAT TO LOOK FOR	WHAT TO DO ABOUT IT
Damage to packaging (tears, perforations, water or oil stains, or other damage) and products (such as broken or crumbled pills or tablets or torn packets of condoms or IUDs)	Discard any damaged items and distribute the remainder as normal.
Cartons unlabeled with the date of manufacture or expiration on outer and inner packaging	Ensure that lot number, manufacturer's name, and product storage requirements are recorded on bin cards and storage labels. If expiration dates are not visible, open outer carton and check dates on inner boxes. If expiration dates are not visible on inner boxes, check individual units. Use a large marker to write the expiration date on unmarked boxes and cartons.
Information on boxes or cartons is illegible	Check inner boxes or products and write on outside of box; distribute normally. If information is illegible due to exposure to water or chemicals, thoroughly inspect product for damage. If you are unsure that no damage has occurred, quarantine supplies for testing or destruction.
Dirty, torn, or otherwise damaged boxes	Check the product visually for mechanical damage. Remove any damaged products and destroy according to established procedures. Distribute the rest as normal.
Missing products or empty boxes	This may indicate pilferage, removal by upper level, or removed by a donor for testing. Notify upper level about missing stock.
Contents not identified on multiple unit cartons	Open box and check contents. If contents all have the same product and the same expiration date (and lot number, if possible), write information on outer box. If contents are mixed, separate and repackage according to product type, brand, expiration date, and lot number. Visually check for damage. Remove any damaged products and destroy according to established procedures. Distribute the rest as normal.
Products found outside the warehouse or clinic	All such products will almost certainly have been affected by the elements. Any product left outside for almost any amount of time will probably be damaged from moisture, rain, direct sunlight, and/or pests and should be destroyed according to established procedures.
Cartons with holes and/or frayed edges	Unlike torn or dirty cartons, holes or frayed edges may be the result, not of handling, but rather of pests. Check boxes for signs of termite damage and rats, which are attracted to pills. Inspect inner boxes and products for mechanical damage, remove any damaged products, and destroy them according to established procedures. Distribute the remainder as normal.

ANNEX 8-3.

COMMON PRODUCT QUALITY PROBLEMS

STEP		WHAT THIS TELLS YOU
1	Begin with the number of units expected in a single shipment OR Begin with the maximum quantity of a product you expect to store if calculating overall storage requirements for the warehouse	Most shipments are expressed in units. You need the number of units expected to tell you the total amount you should place in a stack.
2	Divide the number of unites to be stored by the number of unites in a carton	This tells you the number of cartons. Sometimes, the shipping documents list the number of cartons in the shipment. In such cases, just skip this step.
3	Multiply the number of cartons by the volume of a carton	You need to know the volume per carton. Obtain this information from the supplier or donor. The answer is the total volume of space needed to store the product, but it does not tell you the amount of floor space needed.
4	Divide the total volume by 2.5 m or 8 ft	Whatever the volume of the cartons, you do not want to stack them higher than 2.5 m or 8 ft high. Divide the volume by the maximum height to determine the floor space needed to store the product.
5	Multiple the floor space needed to store the product by two	Double the amount of floor space to allow for handling space, aisles, and other variables. This is the total amount of floor space needed. You can multiple by a number larger than 2 to allow more space in which to create a handling area for new or outgoing shipments. In very small facilities, where smaller quantities of product are kept, you may not need as much handling space, so you would multiply by a number smaller than 2.
6	Calculate the square root to get the dimensions of the total amount of floor space needed. You can also estimate the dimensions using your knowledge of mathematics.	The answer is the dimensions of the needed space, assuming the space is square. Of course, many storerooms are not square, for example, 36 sq. m is a square of 6 m x 6 m. It could also be an area of 9 m x 4 m.
7	Repeat these calculations for all products to determine the total amount of storage space you will need	You can calculate steps 1-6 for each product separately to estimate the floor space needed for each product separately. If you only need to know the total space requirements for the store, follow steps 1-3 above for each product, then total all the column requirements and perform steps 4-6 on this total.