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The Logistics Handbook

A Practical Guide for the Supply Chain Management of Health Commodities

2011

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A Practical Guide for the Supply Chain Management of Health Commodities

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Abstract

The Logistics Handbook: A Practical Guide for the Supply Chain Management of Health Commodities offers practical guidance in managing the supply chain, with an emphasis on health commodities. This handbook will be particularly useful for program managers who design, manage, and assess logistics systems for health programs. In addition, policymakers, system stakeholders, and anyone working in logistics will also find it helpful as a system overview and overall approach.

Key terms and concepts are clearly defined and explained; the document includes detailed information about the design and implementation of logistics management information systems and inventory control systems. Overviews of quantification, procurement processes, as well as storage, transport, and product selection, are also included.

Acknowledgments

The USAID | DELIVER PROJECT would like to express its appreciation to the many people who worked on and contributed to *The Logistics Handbook: A Practical Guide for the Supply Chain Management of Health Commodities.* The original handbook was based on the flagship logistics course taught by the USAID | DELIVER PROJECT staff (then the Family Planning Logistics Management project staff). In 1992, Barbara Felling and Walter Proper developed the course, and offered it to logisticians outside the project for the first time. The project's Performance Improvement team continued to develop the course, providing many iterations and additional material. In 1998, to increase the number of participants for the course, Barry Chovitz, a trainer and course developer since 1992, developed the handbook and led the effort to turn the extensive training curriculum into a textbook. Barbara Felling updated the handbook in 2004 to reflect new project knowledge. In 2010, a team of USAID | DELIVER PROJECT technical advisors and staff solicited input from all technical teams to make the most significant revision and update to the complete handbook since it was first published in 1998. Major contributers included Claudia Allers, Dana Aronovich, Jaya Chimnani, Todd Dickens, Paul Dowling, Barbara Felling, Carolyn Hart, Alexis Heaton, Rich Owens, Leslie Patykewich, Gregory Roche, Eric Takang, and Edward Wilson. The lead review team included Lilia Gerberg, Kelly Hamblin, Erin Hasselberg, Naomi Printz, and Ashley Smith. Gus Osorio designed the graphics and the layout. Pat Shawkey was the editor. The stand-alone handbook is based on a wide range of knowledge and information from staff throughout the project.

Cover photo: During the rainy season an ox cart is the only reliable way to get health commodities across the flooded plains to rural health centers in Zambia's western province. (USAID | DELIVER PROJECT 2010).

USAID | DELIVER PROJECT

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Acronyms

ABC	abstinence, be faithful, use condoms
AIDS	acquired immune deficiency syndrome
ALu	artemether+lumefantrine (antimalarial medicine)
AMC	average monthly consumption
ARI	acute respiratory infection
ART	antiretroviral therapy
ARV	antiretroviral
ATLAS	Assessment Tool for Laboratory Service
CBD	community-based distributor or distribution
CMS	Central Medical Stores
CPR	contraceptive prevalence rate
CSCMP	Council of Supply Chain Management Professionals
CYP	couple-years of protection
DAR	daily activity register
DHS	Demographic and Health Survey
DTTU	delivery truck topping-up (inventory control system)
EML	essential medicines list
EOP	emergency order point
EPI	Expanded Programme on Immunization
FDA	U.S. Food and Drug Administration
FEFO	first-to-expire, first-out
FIFO	first-in, first-out
FPLM	Family Planning Logistics Management
FPTWG	Family Planning Technical Working Group
GFATM	Global Fund to Fight AIDS, Tuberculosis and Malaria
GIS	geographic information system
GMP	good manufacturing practice
GSMF	Ghana Social Marketing Foundation
HCW	health care waste
HCW	health care worker
HIS	health information system
HIV	human immunodeficiency virus
HMIS	health management information system
ICC	inventory control card
ICS	inventory control system
IEC	information, education, and communication
ILS	inventory control system
INN	international non-proprietary name
IPPF	International Planned Parenthood Federation
IRV	issue and receipt voucher
ISO	International Organization for Standardization
IUD	intrauterine device
IV	issue voucher

JSI	John Snow, Inc.
KPI	key performance indicators
LIAT	Logistics Indicator Assessment Tool
LMIS	logistics management information system
LMU	Logistics Management Unit
LSAT	Logistics System Assessment Tool
M&E	monitoring and evaluation
MAPE	mean absolute percent error
MIS	management information system
MOH	Ministry of Health
MOHSW	Ministry of Health and Social Welfare
NDRA	national drug regulatory authority
NGO	nongovernmental organization
OECS	Organization for Eastern Caribbean States
OJT	on-the-job training
ORS	oral rehydration salts
PAHO	Pan American Health Organization
PMTCT	prevention of mother-to-child transmission
PPD	Population, Health, and Nutrition Projects Database
PPS	Pharmaceutical Procurement Services
RHCS	reproductive health commodity security
RHU	rural health unit
RIRV	requisition, issue and receipt voucher
RIV	requisition and issue voucher
SDP	service delivery point
SKU	stock keeping unit
SMART	specific, measurable, attainable, realistic, and timely
SOH	stock on hand
SOP	standard operating procedures
SPARHCS	Strategic Pathway to Reproductive Health Commodity Security
SRA	stringent regulatory authority
STG	standard treatment guidelines
STI	sexually transmitted infection
TB	tuberculosis
TFR	total fertility rate
TMS	transport management system
TOT	training-of-trainers
UNFPA	United Nations Population Fund
USAID	U.S. Agency for International Development
VEN	vital, essential, and nonessential
VMI	vendor managed inventory
VPP	Voluntary Pooled Procurement
WBD	workplace-based distribution
WHO	World Health Organization
WRA	women of reproductive age

Preface

The Logistics Handbook: A Practical Guide for the Supply Chain Management of Health Commodities will be a valuable asset for anyone who manages health commodities—from policymakers and program managers, to service providers, storekeepers, technical assistance providers, and public- and private-sector partners. The technical topics apply to managing a variety of health commodities, including essential drugs, antiretroviral medicines, vaccines, contraceptives, antimalarial medicines, HIV and malaria rapid diagnostic tests, tuberculosis (TB) medicines, essential medicines, and others.

Many of the concepts described in this handbook will help anyone who is responsible for improving, revising, designing, and operating all or part of a logistics system—including the design of data collection forms and inventory control systems. It offers guidance on how to assess the functioning of an entire logistics system and how to continually monitor and improve a system. This handbook is the starting point for anyone interested in learning about and understanding the key principles and concepts of supply chain management for health commodities.

How to Use This Handbook

Supply chain managers and others will learn about a wide range of logistics principles and practices. The objectives listed at the beginning of each chapter will guide you in selecting chapters of particular interest. By reading only the main body text, you will learn the basic principles of logistics management. The handbook highlights each function of the logistics cycle, in detail, as well as describes other necessary logistics system principles, including assessing stock status, inventory control, and system design.

To increase your understanding of the material, note the selected text boxes that provide more in-depth explanation or examples. You will find the following types of text boxes throughout the handbook:

Real-life in-country examples of supply chain management in action

Fact boxes with answers to common questions

New innovations, advances, and technology in the supply chain management of health commodities

Links and references to other resources and tools, and other USAID | DELIVER PROJECT publications

Examples of how general supply chain concepts apply differently to specific health commodities.

As a quick reference, the summary at the end of each chapter reviews the chapter's objectives.

1• Introduction to Logistics

Objectives

In this chapter, you will learn the following:

- a definition of logistics
- why logistics is important for all health programs
- purpose of a logistics system
- different components of a logistics system and how they fit together
- definitions of key logistics terms.

1.1 What Is Logistics?

Over time, the profession of supply chain management has evolved to meet the changing needs of the global supply chain. According to the Council of Supply Chain Management Professionals (CSCMP)—

> "Supply chain management encompasses the planning and management of all activities involved in sourcing and procurement…and all logistics management activities. Importantly, it also includes coordination and collaboration with channel partners, which can be suppliers, intermediaries, third party service providers, and customers. In essence, supply chain management integrates supply and demand management within and across companies."

The CSCMP also defines logistics management as—

> "[The] part of supply chain management that plans, implements, and controls the efficient, effective forward and reverses flow and storage of goods, services and related information between the point of origin and the point of consumption in order to meet customers' requirement… Logistics management is an integrating function, which coordinates and optimizes all logistics activities, as well as integrates logistics activities with other functions including marketing, sales manufacturing, finance, and information technology." (CSCMP 2011)

In other words, you can consider logistics activities as the operational component of supply chain management, including quantification, procurement, inventory management, transportation and fleet management, and data collection and reporting. Supply chain management includes the logistics activities plus the coordination and collaboration of staff, levels, and functions. The supply chain includes global manufacturers and supply and demand dynamics, but logistics tends to focus more on specific tasks within a particular program health system.

This handbook focuses on specific logistics activities that are undertaken within the context of an integrated supply chain model. This model promotes collaboration and seamless linkages between the activities, levels and people responsible for managing the supply chain. Note that throughout the handbook, we use the terms *logistics* and *supply chain* interchangeably.

1.2 Why Logistics Matters

In the past, logistics was considered a custodial activity. Storekeepers were the custodians of supplies stored in small storerooms and large warehouses. Consequently, the science (and art) of logistics, and the people who make the health logistics system work, were not considered an important part of family planning, HIV and AIDS, or vaccination programs—to name only a few. Fortunately, as time passed, more and more program managers have come to understand how important logistics is to a program's success.

The goal of a health logistics system is much larger than simply making sure a product gets where it needs to go. Ultimately, the goal of every public health logistics system is to help ensure that every customer has commodity security. Commodity security exists when every person is able to obtain and use quality essential health supplies whenever he or she needs them. A properly functioning supply chain is a critical part of ensuring commodity security—financing, policies, and commitment are also necessary.

Effective supply chains not only help ensure commodity security, they also help determine the success or failure of any public health program. Both in business and in the public sector, decisionmakers increasingly direct their attention to improving supply chains, because logistics improvements bring important, quantifiable benefits. Well-functioning supply chains benefit public health programs in important ways by—

- increasing program impact
- enhancing quality of care
- improving cost effectiveness and efficiency.

Logistics increases program impact

If a logistics system provides a reliable supply of commodities, more people are likely to use health services. Customers feel more confident about the health program when they have a constant supply of commodities—it motivates them to seek and use services. Figure 1-1 shows the impact of improved product availability. Notice that, as the availability of a mix of contraceptive methods improves, the contraceptive prevalence rate (CPR) for the public sector increases. When a choice of contraceptive methods is available in health facilities, more women use contraception. When more women use contraception, it impacts a number of key public health indicators: maternal mortality, infant mortality, and total fertility rates all decrease.

Health programs cannot succeed unless the supply chain delivers a reliable, continuous supply of health commodities to its customers. No product? No program!

Logistics matters.

Logistics enhances quality of care

Well-supplied health programs can provide superior service, while poorly supplied programs cannot. Likewise, well-supplied health workers can use their training and expertise fully, directly improving the quality of care for clients. Customers are not the only ones who benefit from the consistent availability of commodities. An effective logistics system helps provide adequate, appropriate supplies to health providers, increasing their professional satisfaction, motivation, and morale. Motivated staff are more likely to deliver a higher quality of service.

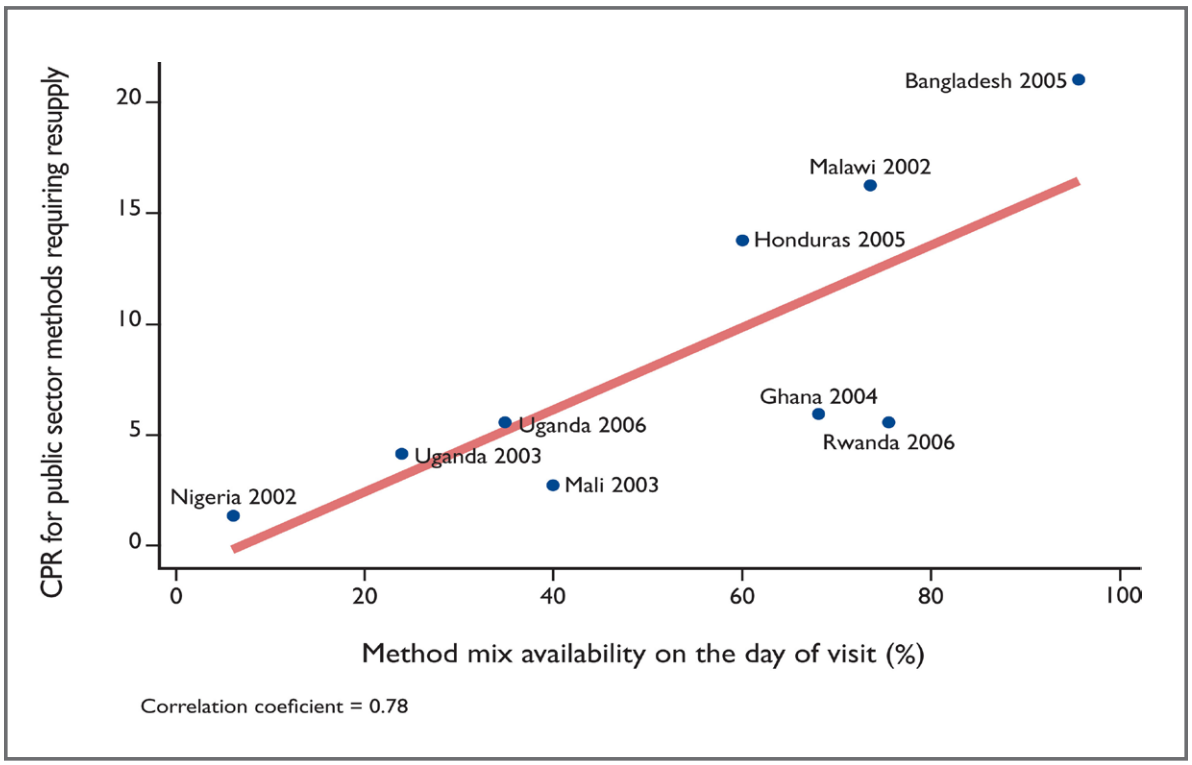
Logistics matters.

Logistics improves cost efficiency and effectiveness

An effective supply chain contributes to improved cost effectiveness in all parts of a program, and it can stretch limited resources. Strengthening and maintaining the logistics system is an investment that pays off in three ways. (1) It reduces losses due to overstock, waste, expiry, damage, pilferage, and inefficiency; (2) it protects other major program investments; and (3) it maximizes the potential for cost recovery.

Logistics matters.

Figure 1-1: Correlation between Contraceptive Prevalence Rate and Product Availability



Source: DELIVER 2007

Logistics should matter to you!
For anyone reading this handbook; and for everyone who works to manage, support, and improve public health logistics systems; logistics is probably important to you already. To ensure that public sector health commodity logistics systems continue to provide commodity security and to improve program impact, quality of care, and cost efficiency, we must convince policymakers and decisionmakers that contributions to strengthening logistics systems will result in increased overall program effectiveness. We must show them that for any public health program to deliver high-quality, comprehensive services; and to ensure commodity security, a robust logistics system for managing health commodities must be in place. We must demonstrate to them that logistics matters.

1.3 Logistics System

During your lifetime, you will encounter hundreds of logistics systems—in restaurants, stores, warehouses, and many other places. This handbook describes logistics systems for health programs; however, if you understand a simple example of a logistics system, you will be able to understand almost any health logistics system.

A restaurant is one example of a simple logistics system.

- The kitchen is a storage facility; the food is held there until it is delivered to the customer.
- Waiters provide the transportation; they carry the food from the kitchen to the customer.
- The tables are the service delivery points, where customers sit to order and eat the food.

For customers, a restaurant is not a logistics system; it is a place to eat. You probably never thought of a restaurant as a logistics system. Your expectations for a restaurant, however, are directly related to logistics.

What expectations do you have when you go out to a restaurant for a meal?

The Six Rights of Logistics

The **RIGHT** goods

in the **RIGHT** quantities

in the **RIGHT** condition

delivered…

to the **RIGHT** place

at the **RIGHT** time

for the **RIGHT** cost.

You may expect that the—

- restaurant will be attractive and pleasing
- server will provide excellent customer service
- food you order will be available
- food will be served promptly
- correct order will be delivered to your table
- food will be of acceptable quality
- food will be of acceptable quantity
- cost of the meal will correspond to the value.

These customer expectations define the purpose of a logistics system—it ensures that the right goods, in the right quantities, in the right condition, are delivered to the right place, at the right time, for the right cost. In logistics, these rights are called the six rights.

Whether the system supplies soft drinks, vehicles, or pens; or manages contraceptives, essential drugs, or other commodities, these six rights always apply.

What is the right cost of a donated good?

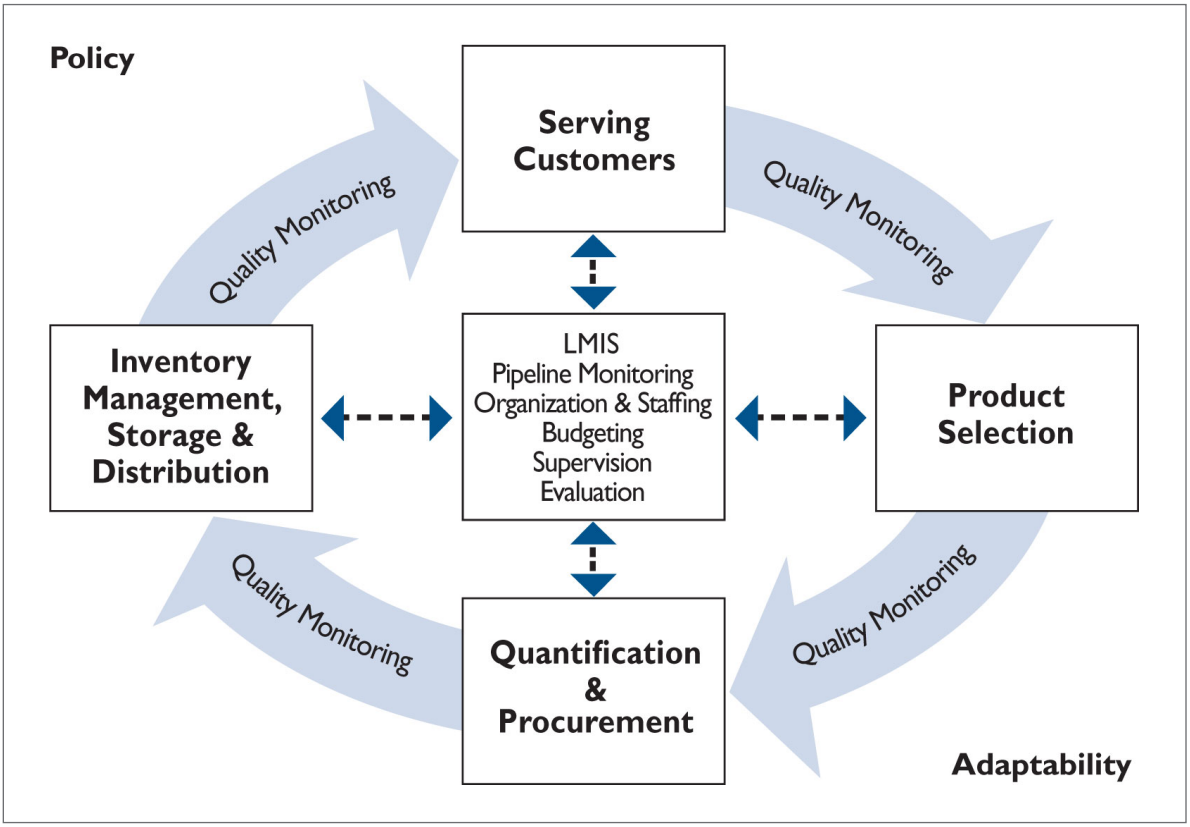
In many health programs, health commodities are donated by international implementing partners or charitable organizations; but, if an item is donated, does the sixth right, at the right cost, still apply?

Yes. Even if the product is donated, the program may still be responsible for paying the other logistics systems costs—the cost of clearing, storing, and transporting the products, as well as collecting data and reporting on how the products are used.

1.4 Logistics Cycle: Organizing Logistics System Activities

Logistics management includes a number of activities that support the six rights. Over the years, logisticians have developed a model to illustrate the relationship between the activities in a logistics system; they call it the logistics cycle (see figure 1-2).

Figure 1-2:The Logistics Cycle



You will first notice that the cycle is circular, which indicates the cyclical or repetitive nature of the various elements in the cycle. Each activity—serving customers, product selection, quantification and procurement, and inventory management—depends on and is affected by the other activities.

For example, product selection is based on serving customers. What would happen if, for a medical reason, we select a product that is not authorized or registered for use in a country program? We would need to rethink our decision and order a product that is authorized and registered for use. This decision would, in turn, affect our procurement and storage, two other activities in the logistics cycle.

The activities in the center of the logistics cycle represent the management support functions that inform and impact the other elements around the logistics cycle.

In the next few sections, you will look briefly at all the elements shown in the logistics cycle, including the—

- major activities in the cycle
- heart of the logistics cycle
- quality monitoring of the activities
- logistics environment—policies and adaptability of the system.

Major activities in the logistics cycle

Let's briefly review the major activities in the logistics cycle:

serving customers. Everyone who works in logistics must remember that they select, procure, store, or distribute products to meet customer needs. Storekeepers do not store drugs just for the purpose of storing; they store products to ensure that commodity security exists for every customer to obtain and use the health commodities when they need them. In addition to serving the needs of the end customer—the customer seeking health services—each person in the process is also serving the needs of more immediate customers. Storekeepers provide customer service when they issue medicines to the health facility, and the central medical stores provide customer service when they issue commodities to the district. The logistics system ensures customer service by fulfilling the six rights. Each activity in the logistics cycle, therefore, contributes to excellent customer service and to ensuring commodity security.

product selection. In any health logistics system, health programs must select products. In a health logistics system, a national formulary and therapeutics committee, pharmaceutical board, board of physicians, or other government-appointed group may be responsible for product selection. Most countries have developed essential medicine lists patterned on the World Health Organization (WHO) Model List. Products selected for use will impact the logistics system, so the logistics requirements must be considered during the product selection.

quantification. After products have been selected, the required quantity and cost of each product must be determined. Quantification is the process of estimating the quantity and cost of the products required for a specific health program (or service), and, to ensure an uninterrupted supply for the program, determining when the products should be procured and distributed. See the suggested reading list at the end of the handbook for sources of additional information about quantification of health commodities.

procurement. After a supply plan has been developed as part of the quantification process, quantities of products must be procured. Health systems or programs can procure from international, regional, or local sources of supply; or they can use a procurement agent for this logistics activity. In any case, procurement should follow a set of specific procedures that ensure an open and transparent process that supports the six rights.

inventory management: storage and distribution. After an item has been procured and received by the health system or program, it must be transported to the service delivery level where the client will receive the products. During this process, the products must be stored until they are sent to the next lower level, or until the customer needs them. Almost all businesses store a quantity of stock for future customer needs.

Heart of the logistics system

Information is the engine that drives the logistics cycle; without information, the logistics system would not run smoothly.

Logistics management information systems

In the beginning of the cycle, managers gather information about each activity in the system and analyze that information to make decisions and coordinate future actions. For example, information about product consumption and inventory levels must be gathered to ensure that a manager knows how much of a product to procure.

Logisticians added the word *logistics* to *management information system* (MIS) to create *logistics management information system* (LMIS). Logisticians want it clear that the collection of data for managing a logistics system is a separate activity from the collection of data for other information systems, including health management information systems (HMISs). An LMIS collects data about commodities; this information is often used for activities, such as filling routine supply orders for health facilities. An HMIS collects information on the total number of patients seen or diagnosed; data from an HMIS is not used as often as LMIS data—i.e., annually—and it is used for different purposes—i.e., for evaluating program impact. Logisticians emphasize the use of logistics data for making decisions about activities within the logistics cycle.

Other activities at the heart of the logistics cycle

Other activities help drive or support the logistics cycle; they are the heart of a well-functioning logistics system. These activities include—

organization and staffing. A logistics system can only work if well-trained, efficient staff monitor stock levels, place orders, and provide products to clients. Health programs assign the appropriate resources to staff (for example, supervision authority and technical knowledge) to complete logistics activities. In fact, some countries have established national logistics management units that analyze logistics data and provide feedback throughout the system. Organization and staffing, therefore, are important parts of the cycle. For a logistics system to work correctly, logistics staff must make the six rights a top priority.

budget. Allocation and management of finances directly affect all parts of the logistics cycle, including the quantities of products that can be procured, the amount of storage space that may be available, the number of vehicles that can be maintained, and the number of staff working in logistics. Mobilizing resources and securing a budget line item for health commodities and logistics activities is extremely important to ensure that products are available and that the logistics system operates effectively. To determine the resources needed to scale up, supply chain managers first need to assess what the expected costs are at different levels of the logistics system. When determining supply chains costs, managers should consider the cost of storage, transportation, and management; and determine what share of these costs each group will cover (i.e., Ministry of Health, donors, nongovernmental organizations [NGOs], etc.).

supervision. Supervising the staff who work within the logistics system keeps it running smoothly and helps to anticipate needed changes. Routine, effective supervision, coupled with on-the-job training in logistics, helps to both prevent and resolve supply problems and human resource constraints.

monitoring and evaluation. Routine monitoring and periodic evaluation of the pipeline and logistics system activities help demonstrate how well the system is performing, the areas that can be improved, as well as the system's impact on service provision.

In Zambia, the National Logistics Management Unit (LMU) sits at the national Medical Stores Limited warehouse in Lusaka. This team of six, all employed by the Medical Stores Limited, work hard every day to enter logistics data into logistics management information databases and to provide monthly feedback reports to the logistics systems for antiretrovirals, HIV test kits, and laboratory commodities.

Quality monitoring

It is important to understand the role of quality monitoring in ensuring an efficient and effective logistics system. In the logistics cycle, notice how *quality monitoring* appears between each activity of the logistics cycle. *Quality monitoring refers not only to the quality of the product, but also to the quality of the work.*

Quality monitoring appears four times in the logistics cycle:

Between Product Selection and Quantification & Procurement. Quality monitoring plays an important role in quantifying and procuring the right products, based on the appropriate product selection and use. Products that are quantified should be on the national essential medicines list (EML), be approved and registered for use in the country, and be included in appropriate standard treatment guidelines (STGs). Also, service providers must be trained to correctly use the products before they are procured and distributed to facilities.

Between Quantification & Procurement and Inventory Management. Procurement decisions should be based on the supply plan that is developed during quantification. To ensure product quality, procurement documents must include detailed product and packaging specifications, and the expectations for quality at the time of receipt. After procurement, program managers must check the quality of health commodities before they enter the distribution system. Products that are procured should be quickly cleared through customs, or other inspections, before being distributed to facilities.

Between Inventory Management and Serving Customers. While products are received, stored, and distributed (and when customers receive them), it is important to monitor their quality. Furthermore, the quality of the storage conditions and transportation mechanisms should be monitored. The inventory control system must be designed so that, if followed, customers will receive the products they need, at the time they need them.

Between Serving Customers and Product Selection. Even after customers receive the products, the program must continue to monitor the quality. Programs must determine if customers are satisfied with the quality of the products and whether the customers are satisfied with the service they received. Health workers must adhere to standard treatment guidelines when serving clients; they must also conduct pharmacovigilance. Quality monitoring of both the product and the service is critical to the success of efforts to promote the appropriate use of products. Customers should correctly use the products they receive and be satisfied with them and with the service they received. The results of monitoring customer satisfaction can be used to inform decisionmakers about changes in product selection and use for the next procurement cycle. Remember, serving customers is at the top of the logistics cycle and that means getting the right goods to those customers.

Quality monitoring is discussed in more detail throughout this handbook. To satisfy the six rights and ensure you receive the right goods—in the right condition—to customers, you need to institute quality assurance mechanisms throughout the supply chain.

Policy and adaptability

In addition to the elements in the logistics cycle, two additional factors—policy and adaptability—directly relate to the logistics system.

policy. Government regulations and procedures affect all elements of the logistics system. Many country governments have established policies on the selection of medical products (usually based on essential medicine lists), how items are procured (for example, international competitive bidding or using prequalified manufacturers); when items are distributed; where and how items are stored; and the quantities customers receive (often called *dispensing protocols*). Fiscal and budget policies are often some of the most influential policies affecting a logistics system, whether related to securing funding for product procurement; or to pay for critical infrastructure, such as storerooms and transportation. Health program managers and other personnel dedicated to logistics can influence these policies, but they may face great challenges when trying to implement or change them. These managers and personnel should stay up-to-date on current policies and complete them, as specified.

adaptability. Adaptability is a characteristic of all successful logistics systems. Logistics systems must be designed to be flexible and adapt to constantly changing circumstances, such as changes in demand for a product, or changes in funding policies for logistics activities. You cannot redesign the logistics system every time a new product is introduced, or when consumption increases. In one sense, adaptability speaks to the logistics system's ability to successfully obtain the resources that are necessary to address changes in demand. For example, as demand increases, the logistics system needs to be flexible enough to respond to the increase in the quantities of products that will move through the system. This may mean building more warehouses and purchasing more vehicles, or increasing the frequency of resupply to avoid the need for larger storage facilities. The system's ability to meet these needs—its adaptability—will impact commodity availability. As governments continue to propose ways to reform the entire health sector—such as decentralization, integration, or cost recovery—the logistics system must continue to function when reforms are implemented. To function, a logistics system must be adaptable.

1.5 Key Logistics Terms

Many of the terms in this handbook have a specific meaning for logistics; definitions in a dictionary may not be the same as the definitions we use. The key logistics terms used throughout the handbook are defined below and in the glossary at the back of this handbook.

supplies, commodities, goods, materials, products, and stock. These items flow through a logistics system. The terms are used interchangeably throughout this handbook.

users, clients, patients, and customers. The people who receive or use supplies. The terms are used interchangeably throughout this handbook.

> ***Users*** is familiar to anyone who collects information about *new* or *continuing* users, such as in family planning programs. *Users* can also refer to people who use a product that is not given to a client or patient but is used for them, such as an HIV test kit or a laboratory reagent. In those examples, the counselor or the lab technician is the *user* of the product.
>
> ***Clients*** usually refers to someone who receives a treatment or service. For example, they could be a family planning client and receive contraceptives; or they could be a client and receive a service, such as a test for malaria or TB.
>
> ***Patients*** is a term often associated with clinic patients receiving treatment for an illness, such as those in an antiretroviral therapy (ART) program.
>
> ***Customers*** is a term typically used by the private sector; it helps reinforce the concept of *customer service*. In public health programs, all users, clients, and patients are considered to be *customers* in the same way a commercial business thinks of its customers: the service provider, health center, and laboratory are there to serve the customer. The concept of customer service can also be applied between levels of a logistics system—the regional or provincial warehouse is the customer of the central warehouse.

consumption, dispensed, dispensed to user, usage data. Data on the quantity of goods given to or used by customers**.** The terms are used interchangeably throughout this handbook.

service delivery point. Any facility where users receive supplies related to health services. Service delivery points (SDPs) are usually hospitals and health centers, but may also include mobile units, community-based distributors, laboratories, and health posts. These facilities are called SDPs because services are provided and products are used or dispensed at these locations.

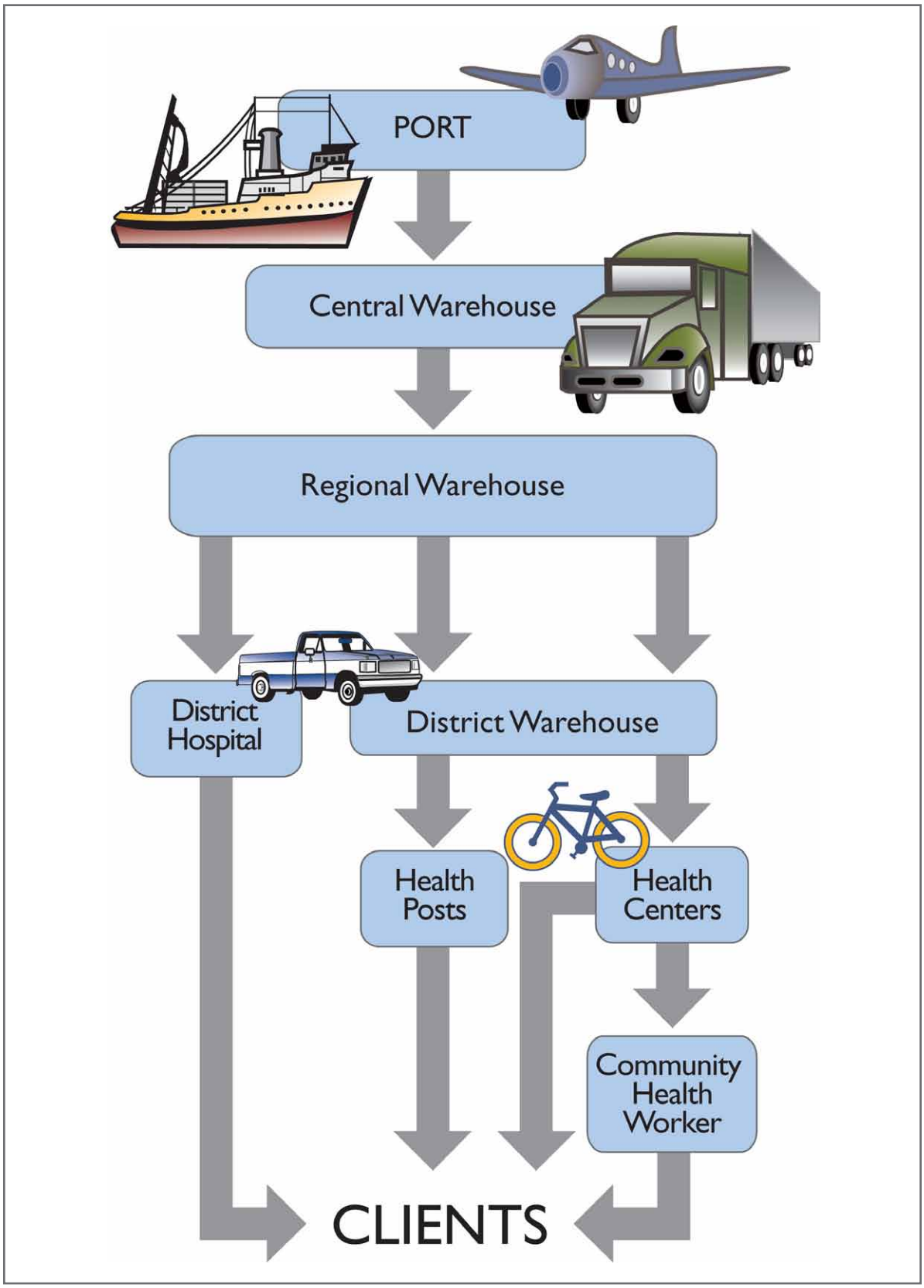
pipeline. The entire chain of physical storage facilities and transportation links through which supplies move from the manufacturer to the user, including port facilities, central warehouse, regional warehouses, district warehouses, all SDPs, and transport vehicles, including community-based distribution networks. See figure 1-3.

> Like a water pipeline, the logistics system has ***tanks*** and ***physical pipes*** (the warehouses and means of transportation) that store and move ***water*** (the product) to the ***home*** (the SDP).
>
> Unlike a water pipeline, which is usually continuous, a health logistics pipeline requires transportation to move supplies periodically from one warehouse to another. In geographically diverse countries, supplies are moved in various ways, including small boats, buses, and even bicycles.

lead time. The time between when new stock is ordered and when it is received and available for use. When logistics managers evaluate how well a logistics system is meeting the six rights, they measure the lead time and try to reduce it. Goods should be available to customers at *the right time*—before the customer asks for the product. Lead time can be calculated within the entire in-country system, from arrival in port to the end user, between specific levels of the system, or even the procurement lead time from when a product is ordered with the manufacturer until it arrives in port.

When you calculate lead time, it is especially important to include all the time up to when the stock is *available for use*. Stock that has been received, but not inspected, recorded, and put on the shelf, is not ready to be issued and is not available to be used. To satisfy the client's need, stock must be available for the customer when they request or need it.

Figure 1-3: Typical Public Sector In-Country Supply Pipeline



What is in-country lead time?

The in-country lead time includes the following activities:

1. The ordering facility (lower-level) manager determines that more stock is needed.
2. An order form is completed and sent to the upper level.
3. The upper level receives the order and a manager approves the order (usually by signing the form).
4. The manager sends the form to the storekeeper.
5. The storekeeper picks and packs the order and gives it to a driver.
6. The driver takes the order and transports it to the ordering facility.
7. The ordering facility receives the order, conducts a visual inspection, places the order on the shelf, and records the receipt on a stock card.

The product is then ready for distribution, or to be dispensed to users, and the lead time clock stops.

Lead time can be a few hours or several months, depending on the particular logistics system. It also varies with the speed of deliveries, availability of transport, communications environment, and, sometimes, weather. No matter what factors affect your system, remember to consider them when calculating lead time.

1.6 More Logistics Terms

Several common logistics terms can be defined by comparing them to an opposing term—*allocation* and *requisition* resupply, *dispensed* and *issues* data, and *vertical* and *integrated* systems. The following sections compare each of these paired terms. Although we could define many more concepts, these basic comparisons are fundamental and we refer to them throughout the handbook.

Allocation (push) versus requisition (pull)?

Placing orders is a routine activity in logistics. In most logistics systems, an order is placed for new supplies every month, or every quarter, from an SDP to a higher level. In some logistics systems, the quantity to be resupplied is calculated by the person *placing* the order. This is called a *requisition (*or *pull)* system. In other systems, the quantity to be resupplied is determined by the person who *fulfills* the order. This is called an *allocation* (or *push)* system.

- In a *requisition* system, the person who *receive*s the supplies calculates the quantities of supplies required.
- In an *allocation* system, the person who *issues* the supplies calculates the quantities of supplies required.

Push and pull in the commercial world

You will notice that, in this handbook, we refer to allocation (push) and requisition (pull). We included the terms push and pull in parentheses because different sectors or organizations may use different terminology when referring to similar concepts.

In the private sector's push-based supply chain, products may be pushed from the production side to the retailer, with the manufacturer determining production levels based on historical data and forecasted demand. In a pull-based system, consumers pull the products they decide they want or need; therefore production, procurement, and distribution are determined by actual—rather than forecasted—demand.

In public health logistics, we tend to think in terms of allocation (push) and requisition (pull). In an allocation system, the higher-level facility decides what commodities to push down the chain and when to move them. In a requisition system, the lower-level facility orders commodities as they need them, pulling supplies through the chain. The difference between allocation and requisition relates to who (i.e., what level) is making the decision about resupply, not what data are used—ideally, that data should be the same across levels.

Returning to our restaurant example, at an all-you-can-eat buffet, customers select the types of food to put on their plate and how much to take; they decide how hungry they are and select their meals, accordingly. The server does not tell the customer what to eat—the customer decides. These restaurants use a *requisition* system. In contrast, at home, the cook usually decides what and how much to serve, based on the family's taste and the available ingredients—this is *an allocation* system.

The advantages and disadvantages of allocation and requisition systems are shown in table 1-1.

Note that table 1-1 reflects the context in which most of us work, one that uses manual calculations and one in which there are time lags in sharing information and challenges with data completeness and accuracy. The table is based on the assumption that the receiving facility has access to more current data than the issuing facility. However, if information systems work efficiently and are automated (in many parts of the private sector, for example); and different levels can access the same information, at the same time, and have the capacity to conduct calculations, then the differences between the allocation and the requisition systems fade. The main issues to consider are data visibility (i.e., what data is available where and when), human resource requirements (i.e., can existing personnel do the mathematical calculations?), and level of budget authority (i.e., does the individual health facility control its own funds so it can operate in a requisition system, or does the district control commodity funding, making an allocation system necessary?).

Table 1-1: Advantages and Disadvantages of Allocation and Requisition Systems

SYSTEM ACTIVITIES	ALLOCATION (PUSH) SYSTEM	REQUISITION (PULL) SYSTEM
Computing calculations	Advantage: The higher level is confident of its own calculations and the quantities it issues. Disadvantage: The higher level must calculate all orders.	Disadvantage: The lower level must be able to do calculations, and the upper level may still need to verify them.
Using information	Disadvantage: The information that the higher level uses to make calculations may not be as current.	Advantage: In a manual system, the lower level has the most current information.
	Note: Neither system works when information is not available to decision makers. Ideally, all levels should use the same data for decisionmaking; however, the most current data is not always simultaneously visible to different levels.	
System responsiveness	Disadvantage: The higher level may not be able to respond as quickly to changes.	Advantage: The lower level has the most up-to-date information and may be able to anticipate upcoming needs.
Training needs	Advantage: Fewer people need to be trained to calculate resupply quantities.	Disadvantage: Lower levels may not have the skills needed to calculate resupply quantities.
Staff sense of ownership	Advantage: Managers feel they have more control over the system.	Advantage: Lower level owns its decisions about orders and, therefore, assumes that it has more control over the system.
Staff workload	Disadvantage: In large systems, the higher level may need to make large numbers of calculations; it must calculate all the orders for lower-level facilities.	Disadvantage: The lower level must allocate time to make calculations, instead of serving customers.

Both allocation and requisition approaches can be used in one system; however, it is usually inefficient to combine the two among facilities at the same level. For example, a requisition system can be used from the central level to the regional level, and an allocation system from the regional level to the SDP. But, only one system should be used within each level. Imagine the frustration and confusion at the regional warehouse

if some health facilities are requisitioning supplies while others need supplies allocated to them. For the pipeline to work, the proper quantities must be ordered and shipped in the shortest time possible. Using two systems at one level only adds to confusion and delays.

It is also important that, when a logistics system is designed, the lower level and the higher level understand who decides what quantities are to be ordered. If staff at the higher level think it is an allocation system, and staff at the lower level think it is a requisition system, lower-level staff may become confused when the quantity they receive is not the same as the quantity they ordered. If this happens often enough, lower-level staff may assume that they will never receive what they order and stop ordering.

Rationing versus allocation

Often, we operate in an environment where there are not enough health commodities available to meet everyone's needs. In this case, we say that commodities are not in full supply in a particular country. What should we do in such a situation? Both allocation and requisition system operate as they are designed when commodities are in full supply. When commodities are not in full supply, the higher level must determine how to fairly distribute what is available. This is called rationing.

However, if a requisition system is already designed and is operating when the supply chain has stock shortages, the personnel calculating the quantities required may find that they do not have the quantities they requested. This can be a problem, because if facilities do not receive what they are requesting, they may lose confidence in the system. Therefore, the levels should clearly communicate to each other if there are any discrepancies between quantities requested and quantities delivered. If stock shortages are expected to continue, the system may need to be redesigned.

Consumed versus issued?

Consumption data provide information about the quantity of goods actually given to or used by customers.

Logistics systems fulfill the six rights for the customer; therefore, all decisions in logistics should be based on information about the products that the customer is given or uses. Logistics systems need to track information about the quantities of a product actually put in the hands of the customers. After a customer receives a product, we say that it is consumed; even if it is wasted or discarded, the logistics system will still need to resupply the item, regardless of its ultimate use. (Outside the field of logistics, of course, knowing how customers use or discard the supplies they receive is of great interest.)

Information about the quantity of products given to customers is called *dispensed-to-user data*, often abbreviated as *dispensed data* or *consumption data*. Because an SDP is the only place where supplies are given directly to customers, this is the only level where we can collect dispensed-to-user data. *Usage data* is another term with a meaning similar to dispensed to user, except that it is used by the consumer but is not dispensed directly to them (i.e., laboratory reagents, HIV test kits, etc.). For these products, consumption (usage) data must come from the facility or level where the products are used (the laboratory, the testing site, etc.).

The supply pipeline includes all intermediate storage facilities. The term for information on the movement of products between any two storage facilities is *issues data.* For example, when the regional level distributes supplies to the district level, the data on the quantity of product moved is issues data. Or, when a hospital pharmacy store gives supplies to other departments or wards in the hospital, or to the dispensary, this is also issues data.

Whenever possible, logistics decisions for planning should be based on consumption data. If the regional warehouse issued 50,000 condoms to the district warehouse last quarter, should it issue the same number this quarter? The answer is *not necessarily*, because condoms may be piling up in the district warehouse. The issue quantity will be more accurate if information is available on the quantity of condoms that were dispensed to users during that time period. Throughout this handbook, we emphasize the importance of using consumption data for decisionmaking.

In systems that do not have consumption data, issues data can be used as a substitute. When you use issues data, however, always use issues data from the lowest level possible. For example, issues data from districts to health facilities are preferred to data from the central warehouse to districts; because district issues should better reflect customer demand. Even better, issues data from the facility store to the dispensary will be a closer estimate of actual consumption. Because the relationship between issues data and customer demand is not exact, particularly at the higher the level of the issues data, collecting the actual dispensed-to-user data should be a priority for logistics systems that do not have dispensed-to-user data available.

Issues data provide information about the quantity of goods moved from one level of the system to another, or from department to another in the same facility.

Product integration

Many countries have several parallel logistics systems for selecting, procuring, and distributing different types of supplies to clients. Often health programs—family planning, maternal and child health, malaria control, TB control, or HIV and AIDS—each manage and distribute supplies for their programs. These programs are called disease-specific programs (sometimes called *vertical* programs); because, historically, they often have separate standard operating procedures and distribution channels and may be managed by separate management units at the central level.

Recently, however, many countries have moved toward product integration, i.e., combining the management of some or all logistics functions for different commodity categories (i.e., family planning, HIV, malaria, and TB) into a shared supply chain. For example, a system that manages contraceptives for the family planning program might also manage oral rehydration salts (ORS), vitamin A, and other products for the maternal and child health program.

Within a given country, some logistics functions may remain separate, where others are combined. For example, contraceptives, nevirapine for preventing mother-to-child transmission (PMTCT), and HIV test kits may be procured by separate programs, but they may also, subsequently, be stored and transported together. Procurement, in this example, is said to be separate (or vertical), where the storage and transport functions are integrated.

When you determine which logistics functions to combine, you need to consider and make trade-offs between the handling requirements of particular products (i.e., cold chain, short shelf life), and the cost of the functions, and customer service (i.e., ensuring that merging the distribution of different products will not disrupt service). You may read more about the logistics system design considerations for product integration in chapter 10; also, see the suggested reading list at the end of the book for information about how product integration can affect logistics.

Supply chain integration

This handbook distinguishes between product integration (described above) and supply chain integration. By *supply chain integration,* we mean a performance-improving approach that develops seamless linkages between the various actors, levels, and functions within a given supply chain to maximize customer service. The objectives of supply chain integration are to improve efficiency and reduce redundancy, thus improving product availability and, often, reducing costs. Performance-enhancing measures can take many forms: logistics management units, joint strategic plans, information sharing mechanisms, and technical working groups. In Rwanda, for example, the Family Planning Technical Working Group (FPTWG) was formed to improve coordination and minimize duplication of effort. Through regular meetings and sharing information, the group has fostered trust among partners; which has, in turn, contributed to improvements in commodity security: forecasts and procurements are executed in a reasonable time, stockouts are minimized, and more providers are trained and facilities are upgraded throughout the country. The end result of the group's efforts is improved efficiency and better customer service. This handbook focuses on the logistics of the supply chain and how the integration of particular functions within that chain can create a higher level of service.

Vertical versus integrated distribution functions

Like many other countries, Malawi maintains a vertical logistics system dedicated to the antiretroviral (ARV) therapy program. ARVs are stored and distributed separately from essential medicines because the central medical stores system currently cannot carry out these functions for the ART program.

In Nicaragua, however, contraceptives and essential medicines are stored and distributed jointly. As in Tanzania, more than 150 health commodities are stored, distributed, and also ordered/reported on jointly via the national integrated logistics system. The integration of these logistics functions has reduced transportation and management costs.

In the supply chain industry, other sectors and organizations have different ways of considering integration; therefore, you may see different language or definitions. In the public health arena, however, the focus is on streamlining the supply chains of disease-specific programs. Therefore, this handbook illustrates how you can create functions that work well together, how to build or strengthen the connections between those functions, and how these activities can support a reliable supply of quality products.

Customer service

No matter where you work in the logistics system, you serve various types of customers. Usually people think of customers as the end users—the clients who enter a health facility to get a product they need.

When you work at a district or regional health facility, do you have customers? Yes—your customers are the people who receive products from you. In this case, they are referred to as internal customers, in contrast to external customers, the end users.

The district warehouse expects good customer service from the regional warehouse. The district warehouse expects to receive the right quantity of the right good, at the right place (its warehouse), at the right time, in the right condition, and at the right cost. The six rights apply to both internal and external customers. Everyone working in logistics should remember that they are serving customers, whether internal or external. And, everyone should remember that they are also a customer—of the level above.

Look at the logistics cycle in section 1.4 and note the position of the label, Serving Customers. Serving customers is placed at the top of the cycle to emphasize the importance of our ultimate goal—getting products to end users. Everyone working in logistics should keep this in mind. The customer is the most important reason for our work.

Chapter Summary

In this chapter, you learned the following:

1. Why logistics is important to all health programs—No Product? No Program!
2. The purpose of a logistics system—
3. To supply the right goods, in the right quantities, in the right condition, to the right place, at the right time, and at the right cost; and to provide good customer service.
4. How the different components of a logistics system fit together in the logistics cycle.
5. Definitions of key logistics terms—
   - ***supplies, commodities, goods, products, and stock.*** All items that flow through the logistics system.
   - ***users, patients, clients, and customers.*** The people who receive or use supplies.
   - ***consumption, dispensed, dispensed-to-user, usage data.*** Data on the quantity of goods actually given to or used by customers.
   - ***service delivery point.*** Any facility where clients receive supplies.
   - ***pipeline.*** The entire chain of physical storage facilities and transportation links through which supplies move from the manufacturer to the user, including port facilities, central warehouse, regional warehouses, district warehouses, all SDPs, and transport vehicles.
   - ***lead time.*** Time between when products are ordered and when they are received and available for use.
   - ***requisition system.*** In a requisition (pull) system, the personnel who receive the supplies calculate the quantities of supplies required.
   - ***allocation system.*** In an allocation (push) system, the personnel who issue the supplies calculate the quantities of supplies required.
   - ***issues data.*** Information about the quantity of goods moved from one storage facility to another (either between levels or within a facility).
   - ***product integration.*** Combining the management of some or all logistics functions for different commodity categories.
   - ***supply chain integration.*** A performance-improving approach that develops seamless linkages between the various staff, levels, and functions within a given supply chain in order to optimize customer service.

To continue your introduction to logistics learning, go to Session 1: Introduction to Logistics of the online training Lessons in Logistics Management for Health Commodities at the following website: http://deliver.jsi.com/dhome/topics/organizational/distancelearning

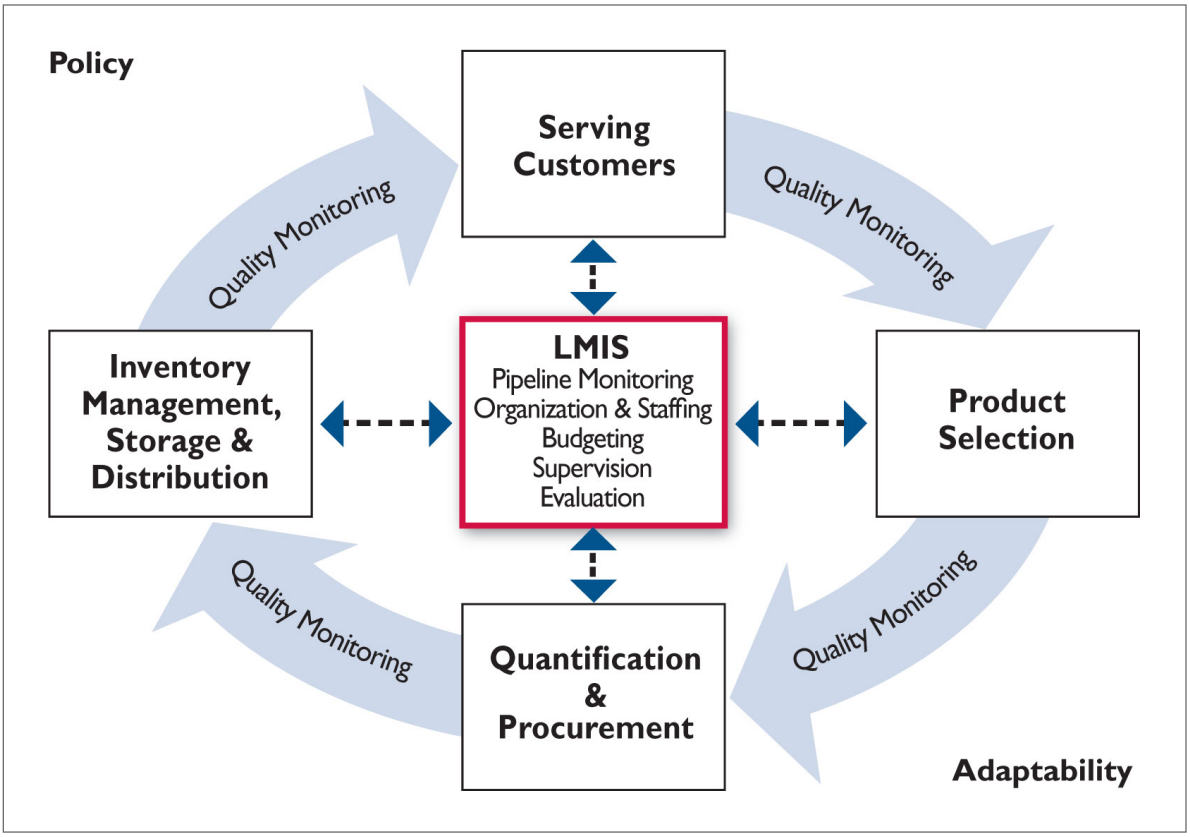
2 • Logistics Management Information Systems

Objectives

In this chapter, you will learn the following:

- purpose of a logistics management information system
- essential data needed for logistics management
- purpose of the three types of logistics records and the data they must contain
- purpose of reporting
- types of logistics reports and the data they must contain
- purpose of logistics feedback reports.

Figure 2-1: The Logistics Cycle



2.1 Logistics Management Information Systems

As you learned in chapter 1, information is the engine that drives the entire logistics cycle. We collect information to make decisions; the better information we have, the better decisions we can make. A logistics management information system (LMIS) is the system of records and reports that you use to collect, organize, and present logistics data gathered across all levels of the system. Most important, an LMIS enables logisticians to collect the data needed to make informed decisions that will ultimately improve customer service. See figure 2-1.

A logistics management information system collects, organizes, and reports data that enables people to make logistics system decisions.

If you are not going to use information and data to make decisions, do not collect it in the LMIS. Collecting data for managing a logistics system is a separate activity from collecting data about patients and health services, which is what a health management information system (HMIS) collects. An HMIS and an LMIS have a few key differences.

What are the differences between a health management information system (HMIS) and a logistics management information system (LMIS)?

	HMIS	LMIS
What data is collected?	Data about patients' health conditions or health services rendered.	Data about commodities, i.e., quantities issued, dispensed, used, received, lost/stolen/damaged, ordered, etc.
How frequently is data collected?	Data is collected and recorded daily, and usually compiled and reported monthly or quarterly.	Data is collected and recorded daily, and usually compiled and reported monthly or quarterly.
How frequently is data used to make decisions?	Data collected may be analyzed monthly or quarterly to determine disease patterns; data may be used annually, or every few years, to track disease patterns or health service usage.	Data are analyzed daily to assess stock status; data are analyzed and used monthly or quarterly to determine resupply or order quantities; data are used annually to conduct quantification exercises.

2.2 Essential Data for Decisionmaking

If data are to be collected for decisionmaking, you need to know what data to collect and how frequently to collect it. To decide what data to collect, look at the decisions you will need to make. Think about the questions logistics managers might ask. What information would they need to answer those questions and make informed decisions?

The questions might include the following:

- How long will current supplies last? When do we need to order more supplies?
- Where are our supplies in the pipeline? Do we need to move supplies from higher to lower levels?
- Where is consumption the highest? Do those facilities need more resources?
- Are we losing products from the system that require us to take action?
- Are supplies flowing smoothly through the pipeline? Do we need to adjust our pipeline to account for bottlenecks in the distribution system?
- Are any products about to expire? Should we take them out of the pipeline? Can we redistribute them; can they be used before they expire?

To make logistics decisions, a logistics manager needs three essential data items: (1) stock on hand, (2) consumption, and (3) losses and adjustments. Although we may make good use of other data in logistics, these three data items are *absolutely required* to manage a logistics system; you must use an LMIS to record and report them. (See table 2-1.)

Table 2-1: Three Essential Logistics Data Items

DATA ITEM	DEFINITION	EXAMPLE
Stock on hand	The quantities of usable stock available. (Items that are unusable are not considered part of stock on hand; they are considered losses to the system.)	The health center has 300 bottles of paracetamol in the store on the last day of the month. At a national level, 780,000 bottles of paracetamol are on hand, based on stock-on-hand data from the health centers, districts, and national warehouse.
Consumption	The quantity of stock dispensed to users or used during a particular time period.	In the last month, the health center used 120 Determine HIV tests. In the last month, the health center dispensed 1,045 condoms to clients.
Losses and adjustments	Losses are the quantity of stock removed from the pipeline for any reason other than consumption by clients or use at the service delivery point (due to expiration, theft, damage, etc.). Adjustments are the quantities of stock issued to or received from other facilities at the same level of the pipeline. Also, adjustments may be administrative corrections made to stockkeeping records—for example, when you count stock and find a different amount from the quantity listed on the bin cards. For this reason, adjustments may involve either positive or negative changes to stock.	In the past month, the district hospital had— • 30 male condoms expire (loss) • 4 IUDs stolen (loss) • Loaned another health facility 12 packages of oral rehydration salts (negative adjustment). • Received 20 treated malaria nets from another health facility (positive adjustment).

2.3 Three Types of Logistics Records

From a logistics point of view, only three things can happen to supplies in a pipeline—they can be stored, moved (in transit), or consumed (used). Because we want to monitor products at all times in the pipeline, we need three types of logistics records to track the products. Each record type has a distinct form and use.

- *Stockkeeping records.* Holds information about products in storage.
- *Transaction records.* Holds information about products being moved.
- *Consumption records.* Holds information about products being consumed or used.

Stockkeeping records

What is the most important reason for having stockkeeping records?

They are used to record information about products in storage.

What essential data items do stockkeeping records contain?

They must contain the quantity of stock on hand; the quantity of losses; and the quantity of adjustments, by individual product.

What about the third essential data item, consumption?

Usually, products are not distributed (dispensed) directly from the storeroom to the customer; therefore, actual consumption data is not collected on a stockkeeping record. Issues data recorded at the lowest-level stockkeeping record can be a substitute for consumption data, if those data are not available (for example, from a facility store to the dispensary).

Who completes the stockkeeping record?

It is completed by anyone who receives or issues stock from storage, and by anyone who takes a physical inventory of the stock, including the warehouse manager and other warehouse staff, and service delivery point (SDP) staff. Pharmacies store stock; the staff should also use stockkeeping records. The pharmacist and other pharmacy staff are responsible for completing these stockkeeping records.

When are entries made to stockkeeping records?

They are recorded on the stockkeeping record whenever products are received or issued. Entries are also recorded when stock is counted during a physical inventory, or as soon as a loss is noticed. When the stockkeeping record is full, a new record is started, using the ending balance from the previous record.

How are the data on a stockkeeping record organized?

They are organized by date and transaction reference (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, and the balance on hand. They also record the results of physical inventories (when items are counted to verify the quantity in storage).

What are some examples of formats of stockkeeping records?

The most common formats for stockkeeping records are individual stock cards and stores ledgers. Types of stockkeeping records include stock cards, inventory control cards, and bin cards.

What is a bin card?

It is an individual stockkeeping record that holds information about a single product by lot number or batch number (see figure 2-2). Every item in that lot will have the same expiration date. For example, one bin card would hold information about a single lot of paracetamol at a storage facility. The card should note the stock on hand of paracetamol for that lot only, as well as any losses and adjustments for that lot. Bin cards are usually displayed at the bins (or shelf or pallet position) where the lot is found.

Figure 2-2: Bin Card

BIN CARD								
Commodity Lot/ Batch No.:				Proct Name & Description:				
Unit:				Expiry Date :				
Date	Transaction Reference	Received from/Issued to	Quantity Received	Quantity Issued	Losses	Adjustments	Quantity on Hand	Initials

What is an inventory control card?

It is an individual stockkeeping record that holds information about *all* the lots of a single product. You should keep one inventory control card for each product. The inventory control card may be a summary of many bin cards for a particular product. For example, one inventory control card could hold information about all the paracetamol in a storage facility. It should note the total stock on hand of paracetamol in the warehouse, as well as the total losses and adjustments, without regard to lot number or where the product is located in the warehouse. See figure 2-3 for an example of an inventory control card. To ensure that each lot is managed correctly in larger warehouses, which may have many lots of each product stored in different places, it is usually advisable to maintain both inventory control cards and bin cards. In smaller storerooms, you can keep a single stockkeeping record, such as a stock card or inventory control card.

Figure 2-3: Inventory Control Card

INVENTORY CONTROL CARD								
Product Name:								
Unit:				**Product Code :**				
Date	**Transaction Reference**	**Received from/Issued to**	**Quantity Received**	**Quantity Issued**	**Losses**	**Adjustments**	**Quantity on Hand**	**Initials**

What is a stores ledger?

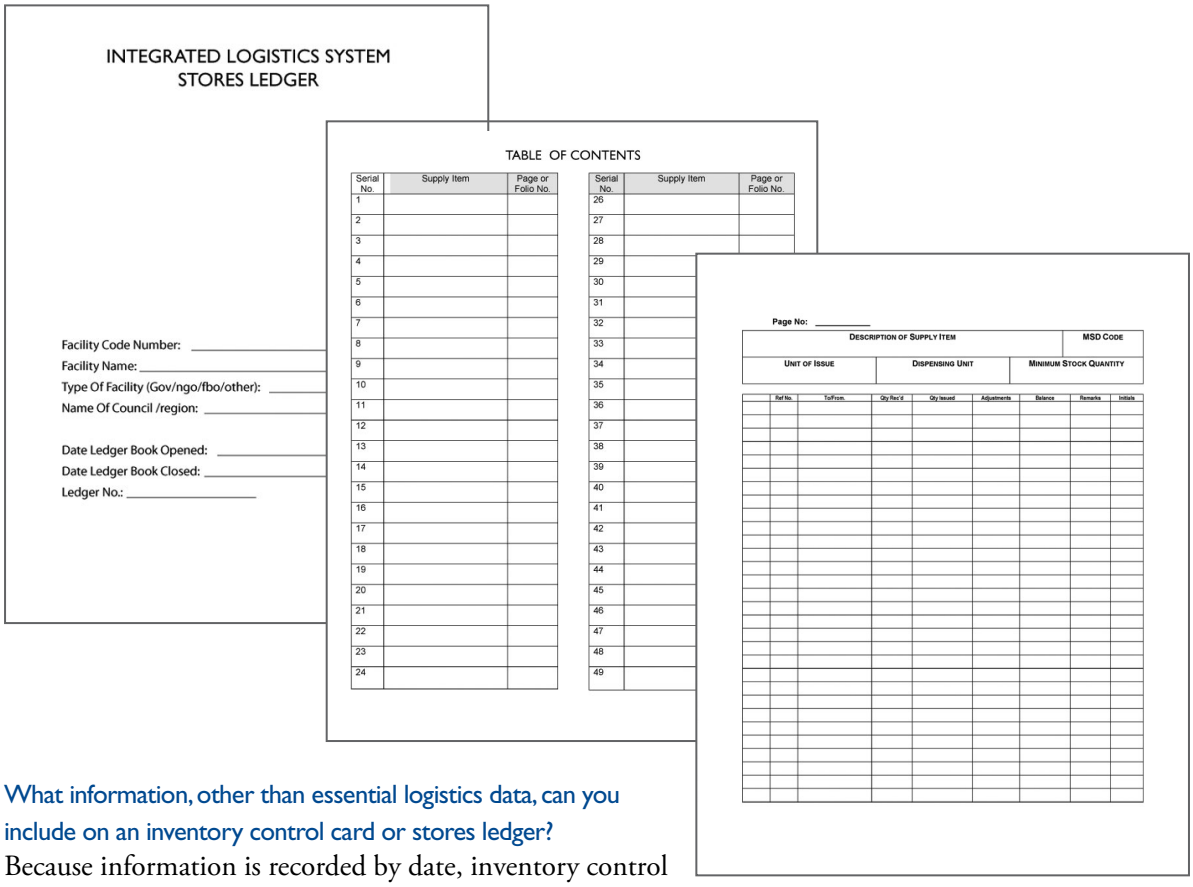
It is a stockkeeping record that contains the same information as the inventory control card described above. Unlike inventory control cards, a stores ledger is bound like a book; it is used instead of the individual card format. Government policy in some countries requires the use of stores ledgers. (Managers may think that binding the pages increases accountability, because missing pages are obvious.) However, the ledger format is less desirable than individual cards, because it is easy to run out of space for an individual product. It is also hard to add new products—you can alphabetize a set of individual inventory control cards as new cards are added, but you cannot alphabetize pages within a bound book. In many countries, the format of stockkeeping records is determined by the Ministry of Finance and is used by all government units because commodities are considered assets of the government and should be accounted for carefully. (See figure 2-4.)

Should losses be tracked separately from adjustments?

As a best practice, you should track and report losses separately from adjustments. Because the causes of losses (i.e., expiry or theft) are different from the reasons for adjustments (i.e., administrative movement of stock), it is useful to track losses separately and use that data as an indicator of system performance. For example, to measure the effect of a system improvement initiative, such as more robust security protocols, you should measure a change in the loss rate.

However, it can be a challenge to collect losses and adjustment data, let alone segregated in two separate columns on a stock card. However, at a minimum, losses should be tracked. Thus, this decision should be made by a system designer upon assessment of the capacity of the staff and resources to collect this level of data.

Figure 2-4: Stores Ledger (cover, table of contents, product page)



What information, other than essential logistics data, can you include on an inventory control card or stores ledger?

Because information is recorded by date, inventory control cards or stores ledgers include information about when shipments are received and when issues are made, including the shipment quantity. For tracking the movement of stock, inventory control cards or stores ledgers should also include a reference number for the shipment or shipping document.

Automation of stockkeeping records

In Bangladesh, the Department of Livestock Services (DLS) central warehouse uses an automated warehouse inventory management system to keep track of receipts, and issues and balance of avian influenza control commodities. This automated system not only saves the central warehouse staff time; it also improves accuracy and the ability of the DLS to coordinate emergency responses to outbreaks.

To record the reason for a loss or adjustment, the stockkeeping record should also include a column for remarks or notes.

In facilities with more than one storekeeper, a column for the initials of the person receiving, issuing, or counting stock is helpful for tracking these activities. In addition, inventory control cards or stores ledgers should contain product description information (strength, formulations, brand names, and identification codes) and stock location information.

How and where do stockkeeping records move?

Stockkeeping records *do not* usually move; they stay where products are stored (e.g., the warehouse, pharmacy, or storeroom).

Transaction records

What is the primary purpose of a transaction record?

Transaction records are used to record information about the movement of stock from one storage facility to another. In addition, transaction records are proof of requisition, issue, and/or delivery.

What essential logistics data items are included on a transaction record?

Although transaction records are essential in recording the movement of stock, they do not need to include any of the essential data items mentioned earlier. Sometimes, a transaction record will be combined with a type of report and will include data like current stock on hand and, depending on the system design, losses and consumption data.

Who completes the transaction records?

Warehouse personnel at both issuing and receiving facilities complete transaction records. In pharmacies or SDPs, storekeepers, pharmacy personnel, or nurses may complete the transaction records.

When are transaction records completed?

They are started any time a facility requests or issues supplies. They are filled in at any point in the order, issue, and receipt process when custody of the product being moved changes. They are completed when the receiving facility confirms receipt of the items shipped.

How are the data on a transaction record organized?

They are usually organized by date and by transaction number, which helps identify the transaction. Extra copies of transaction records can be a reminder that a request was made and not yet received, or that an item was issued, but confirmation of receipt is still pending. Ideally, transaction records should include a reference number that identifies each transaction. Data on the transaction record are organized by the product requested or issued. One transaction record is usually used to request or issue any number of products. On paper transaction records, the product names may be preprinted or written by hand.

What are some examples of formats for transaction records?

The most common formats are bills of lading; receiving records; issue vouchers; receipt vouchers; and combined requisition, issue, and receipt vouchers. The content of the transaction record will depend on how many transactions and which parts of the transaction are tracked on the record. The format of the transaction record may also depend on whether the system is pull or push. In all cases, a preprinted voucher number on each transaction record helps track individual shipments.

What is an issue and receipt voucher (IRV)?

An IRV lists the items and quantity issued to a facility. It also includes a separate column for the quantities received in case any items are lots or damaged en route. IRVs are used in a push system; the issuing facility determines the quantity to be sent and issues the supplies to the receiving facility. See figure 2-5 for a sample IRV. An IRV is should be completed in triplicate (three copies). See figure 2-6 for a visual representation of how an IRV flows between facilities.

1. The issuing facility completes the date and quantities issued, signs the voucher, and sends the top two copies (1 and 2) to the receiving facility, with the supplies. The bottom copy (3) is often called the reminder copy because the issuing facility keeps the bottom copy of the issue voucher as a reminder that it is waiting for verification that the supplies were received.
2. The receiving facility verifies the quantity received, signs the form, and returns the top copy (1), and keeps the middle copy (2) for its files.
3. The top copy (1) arrives at the issuing facility, which then disposes of the reminder copy (3) and keeps the top copy for its files.

Each of the facilities will have a completed copy of the IRV for its permanent file. All copies of the IRV are labeled with the same transaction number so there is no confusion when either facility manager needs to talk to the other manager about a problem with the shipment.

Figure 2-5: Issue and Receipt Voucher

ISSUE AND RECEIPT VOUCHER

Issue Voucher No.: _____

Date: _____ Ship to: _____

_____

_____

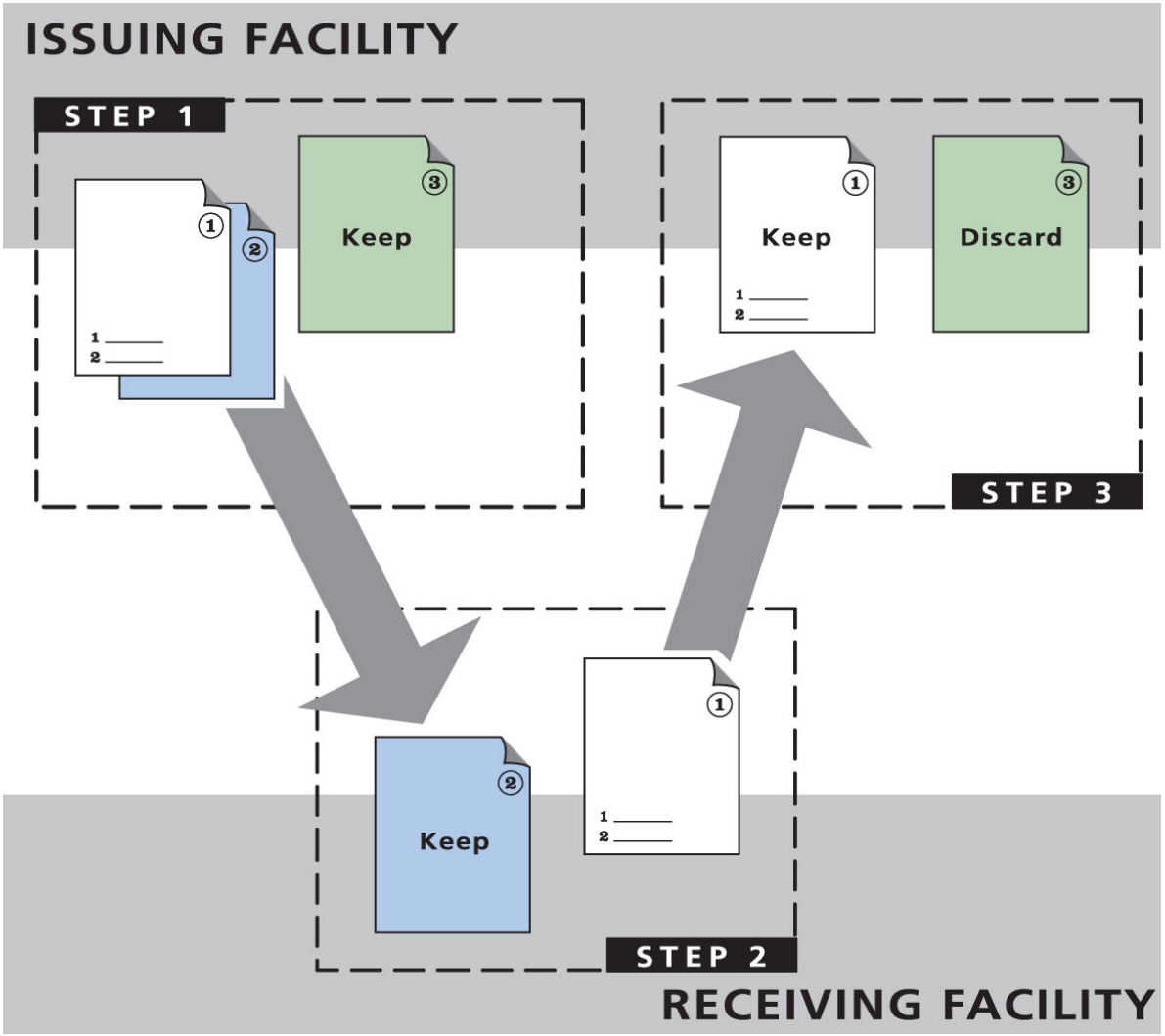
	ARTICLE	Quantity		REMARKS
		Issued	Received	
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				
11				
12				

Approved by: _____ Date: _____

Shipped by: _____ Date: _____

Received by: _____ Date: _____

Figure 2-6: Issue and Receipt Voucher Flow



What is a requisition, issue and receipt voucher?

A requisition, issue and receipt voucher (RIRV) is similar to an IRV, except that the RIRV is used only in a pull system (if it is completed by facility staff) (see figure 2-7). An RIRV lists the items and quantities requested by a facility. It also includes a column for the quantity actually issued. This is important in situations when it is impossible to supply the full amount requested. Like an IRV, the RIRV includes a column for the quantity received, which helps to account for any losses or damage en route.

Figure 2-7: Requisition, Issue, and Receipt Voucher

REQUISITION, ISSUE, AND RECEIPT VOUCHER

Issue Voucher No.: _____

Date: _____ Ship to: _____

_____

_____

	ARTICLE	Quantity			REMARKS
		Requested	Issued	Received	
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					

Approved by: _____ Date: _____

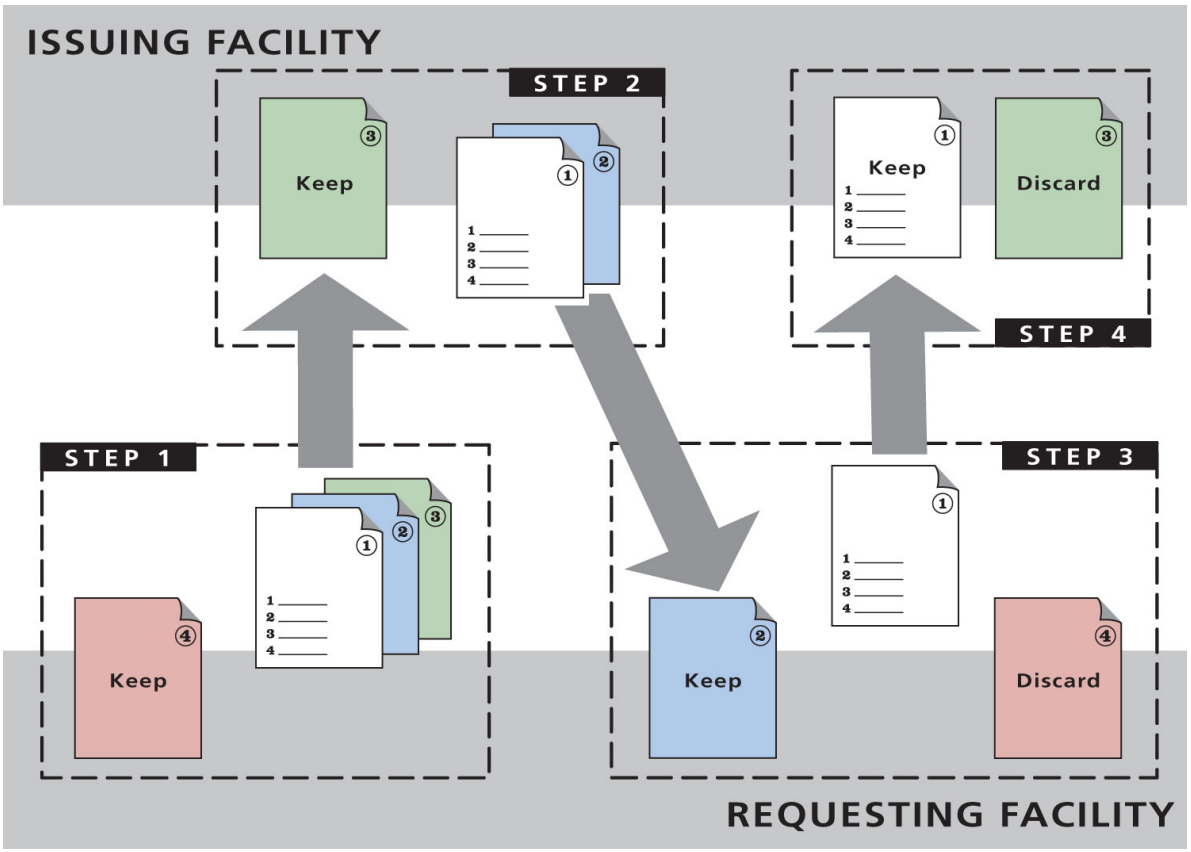
Shipped by: _____ Date: _____

Received by: _____ Date: _____

Between two levels, RIRVs should be completed in quadruplicate (four copies) for requisition (pull) systems. See figure 2-8 for the diagram of the flow of an RIRV between facilities.

1. The requesting facility completes the date and quantities requested for each item, signs the record, and sends the top three copies (1, 2, and 3) to the issuing facility; they keep the bottom copy (4) as a reminder that it has placed an order and is awaiting its arrival.
2. The issuing facility fills the order, signs the form, and sends the top two copies (1 and 2) to the receiving facility, with the supplies; they keep the bottom copy (3) as a reminder.
3. The receiving facility signs the form, verifies the quantity received, and returns the top copy (1). The receiving facility keeps the second copy (2) for its files and disposes of the reminder copy (4).
4. The top copy (1) arrives at the issuing facility, which disposes of the reminder copy (3) and keeps the top copy for its files. Each of the facilities will have a completed copy of the RIRV for its permanent file. Because the transaction has only one RIRV number at both facilities, there should not be confusion when referring to the shipment.

Figure 2-8: Requisition, Issue and Receipt Voucher Flow



What information, other than the essential logistics data items, can you include on a transaction record?

In addition to the item description and quantity of each item being moved, all transaction records should include dates, signatures, and a space for comments. The signatures indicate responsibility for and authorization of a transaction (by, for example, an accounting department or program manager). Limit the number of required signatures on a transaction record, if possible, to reduce the administrative burden and time spent collecting signatures. A space for comments should be available for recording any reason why the quantities shipped are different from the quantities received.

Consumption records

What is the primary purpose of a consumption record?

They are used to record the quantity of each product used by or dispensed to end users, or used at an SDP when services are provided.

Which of the essential data items do consumption records contain?

As the name of the record implies, they contain consumption data; more specifically, the quantity of any specific product consumed in a specific period of time.

What about the other essential logistics data items—stock on hand and losses and adjustments?

They do not usually record stock on hand, or losses and adjustments.

Who completes consumption records?

Service providers who dispense products to clients or use products at SDPs.

When are consumption records filled out?

Whenever supplies are dispensed to clients or used by service providers during service provision. The total quantity of each product used or dispensed is totaled at the end of the reporting period.

How are the data on a consumption record organized?

Usually by the date of the visit, or date of dispensing or usage. They record the quantity of a specific product either dispensed to users or used by the end user.

How are consumption records organized?

Consumption records are usually bound in a book or are printed on oversized paper. One record (perhaps consisting of several pages) is usually used per month; however, in a bound book, a new page is started each month.

What are some examples of formats of consumptions records?

Common formats include daily activity registers (DARs), pharmacy dispensing registers, daily usage registers or logs, and tick sheets.

What are some of the different ways to capture consumption?

Although this section focuses on consumption records that capture the quantity of products actually dispensed, there are alternative ways to collect information on consumption.

In certain circumstances, system designers may choose to calculate consumption based on stock on hand, using information from a stock card rather than a consumption record. In Zimbabwe, for example, the Delivery Truck Topping Up system was designed to calculate consumption by conducting physical inventories. The delivery team arrives at a facility, conducts a physical inventory, and compares the results to the previous physical inventory to calculate their consumption. The delivery team calculates resupply quantities based on this consumption, and top up facilities to the maximum stock level.

Alternatively, consumption can be estimated by using lowest level issues data. For example, a facility store often issues products to the dispensary or wards. Using this type of issues data can be a proxy for consumption.

What is a daily activity register (DAR)?

Record the quantity of each product received by a customer (by name or client number) and by date (see figure 2-9). They work best when the brands (for family planning programs) or the names/strength/formulation of each product (for medicines) are preprinted on the form. At the bottom of the DAR, the total quantity dispensed or used is calculated for each product and then used for reporting purposes. Another name or example of a DAR is a Daily Dispensing Register.

Figure 2-9: Daily Activity Register

MINISTRY OF HEALTH

ART DAILY ACTIVITY REGISTER

Facility: ________________

District: ________________

Quantities Dispensed

Fixed Dose Combinations

Date	Patient Name/Number	Stavudine/Lamivudine/Nevirapine 30/150/200mg Tabs Bottle of 60 Tabs	Stavudine/Lamivudine/Nevirapine 40/150/200mg Tabs Bottle of 60 Tabs	Stavudine/Lamivudine 30/150mg Tabs Bottle of 60 Tabs	Stavudine/Lamivudine 40/150mg Tabs Bottle of 60 Tabs	Tenofovir/Emitrictabine 300/200mg tablets Bottle of 30 tablets	Zidovudine/Lamivudine 300/150mg Tabs Bottle of 60Tabs		
Total Quantity Dispensed									
Quantity Dispensed for Month (running total):									

Single Drug Formulations

Date	Patient Name/Number	Abacavir 300mg Tabs Bottle of 60 Tabs	Efavirenz 200mg Caps Bottle of 90 Caps	Efavirenz 50mg Caps Bottle of 30 Caps	Efavirenz 600mg Tabs Bottle of 30 Tabs	Didanosine 100mg Tabs Bottle of 30 Tabs	Didanosine 25mg Tabs Bottle of 60 Tabs	Didanosine 50mg Tabs Bottle of 60 Tabs	Lamivudine 150mg Tabs Bottle of 60 Tabs	Lopinavir/ritonavir 133.3/33.3mg Bottle of 180 Caps	Nevirapine 200mg Tabs Bottle of 60 Tabs	Stavudine 15mg Caps Bottle of 60 Caps	Stavudine 20mg Caps Bottle of 56 Caps (or 60)	Stavudine 30mg Caps Bottle of 56 Caps (or 60)	Stavudine 40mg Caps Bottle of 56 Caps (or 60)	Tenofovir 300mg Tabs Bottle of 30 Tabs	Zidovudine 100mg Caps Bottle of 60 Caps	Zidovudine 300mg Tabs Bottle of 60 Tabs			
Total Quantity Dispensed																					
Quantity Dispensed for Month (running total):																					

Liquid/Powder Formulations

Date	Patient Name/Number	Abacavir oral solution 20mg/ml 240ml Bottle	Lamivudine oral solution 10mg/ml 100ml Bottle	Lamivudine oral solution 10mg/ml 240ml Bottle	Lopinavir/ritonavir 20mg/80mg/ml 60ml bottle	Nevirapine oral suspension 10mg/ml 100ml Bottle	Nevirapine oral suspension 10mg/ml 240ml Bottle	Nevirapine oral suspension 10mg/ml (PMTCT) 25ml Bottle	Nelfinavir powder for suspension 50mg/g 144g Bottle	Stavudine powder for suspension 1mg/ml 200mg Bottle	Zidovudine Oral Solution 10mg/ml 240ml Bottle	Zidovudine Oral Solution 10mg/ml 100ml Bottle				Dispenser's Initials
Total Quantity Dispensed																
Quantity Dispensed for Month (running total):																

What is a daily usage log or register?

Used to record the quantities of a product, usually related to the laboratory, that facility personnel use on a particular date; for example, the number of HIV tests used in the HIV counseling and testing department on a particular day, or the number of vacutainers used in the lab on particular day. These usage logs also work best when the products are pre-printed, by brand, on the form. (See figure 2-10.)

Figure 2-10: Daily Usage Log

Date	ClientName/Number	Determine	Unigold	Bionor		
		(place tick below)				
Page total						
Running monthly total						

What is a tick sheet?

It is used to record the quantity of each product dispensed to users (see figure 2-11). A *tick* or mark (often an X) indicates one unit dispensed. In some cases, each box represents a client, and the number of each item dispensed is written in the box. A tick sheet does not record this information by day or by client. In some cases, a tick sheet can be made from an ordinary spiral-bound notebook. Tick sheets work well at small health facilities that do not collect general patient data; they also work well for community-based distributors.

Figure 2-11: Tick Sheet

MINISTRY OF HEALTH

Client Contraceptive and HIV Testing Tally Sheet

FACILITY NAME:		MONTH:		YEAR:	

METHOD	NEW CLIENTS		RETURNING CLIENTS		RESTARTING CLIENTS		CLIENTS CHANGING METHOD		SUMMARY OF METHODS			
Lo-Femenal	OOOOO	OOOOO	OOOOO	OOOOO	OOOOO	OOOOO	OOOOO	OOOOO	One tick stands for one packet			
	OOOOO	OOOOO	OOOOO	OOOOO	OOOOO	OOOOO	OOOOO	OOOOO	OOOOO	OOOOO	OOOOO	OOOOO
Condom - Male	OOOOO	OOOOO	OOOOO	OOOOO	OOOOO	OOOOO	OOOOO	OOOOO	One tick stands for 20 condoms			
	OOOOO	OOOOO	OOOOO	OOOOO	OOOOO	OOOOO	OOOOO	OOOOO	OOOOO	OOOOO	OOOOO	OOOOO
	OOOOO	OOOOO	OOOOO	OOOOO	OOOOO	OOOOO	OOOOO	OOOOO	OOOOO	OOOOO	OOOOO	OOOOO
Depo Provera	OOOOO	OOOOO	OOOOO	OOOOO	OOOOO	OOOOO	OOOOO	OOOOO	One tick stands for one bottle			
	OOOOO	OOOOO	OOOOO	OOOOO	OOOOO	OOOOO	OOOOO	OOOOO	OOOOO	OOOOO	OOOOO	OOOOO
	OOOOO	OOOOO	OOOOO	OOOOO	OOOOO	OOOOO	OOOOO	OOOOO	OOOOO	OOOOO	OOOOO	OOOOO
	OOOOO	OOOOO	OOOOO	OOOOO	OOOOO	OOOOO	OOOOO	OOOOO	OOOOO	OOOOO	OOOOO	OOOOO

HIV COUNSELLING AND TESTING												
TEST	18 MONTHS - 14 YRS		15 YRS - 24 YRS			25 YRS –OLDER			NUMBER OF TESTS USED			
	M	F	M	F-NP	F-P	M	F-NP	F-P				
DETERMINE	OOOOO	OOOOO	OOOOO	OOOOO	OOOOO	OOOOO	OOOOO	OOOOO	OOOOO	OOOOO	OOOOO	OOOOO
	OOOOO	OOOOO	OOOOO	OOOOO	OOOOO	OOOOO	OOOOO	OOOOO	OOOOO	OOOOO	OOOOO	OOOOO
	OOOOO	OOOOO	OOOOO	OOOOO	OOOOO	OOOOO	OOOOO	OOOOO	OOOOO	OOOOO	OOOOO	OOOOO
UNIGOLD	OOOOO	OOOOO	OOOOO	OOOOO	OOOOO	OOOOO	OOOOO	OOOOO	OOOOO	OOOOO	OOOOO	OOOOO
BIOLINE	OOOOO	OOOOO	OOOOO	OOOOO	OOOOO	OOOOO	OOOOO	OOOOO	OOOOO	OOOOO	OOOOO	OOOOO
TOTALS +VE												
TOTALS -VE												

HIV TESTING REFERRALS												
	18 MONTHS - 14 YRS		15 YRS - 24 YRS			25 YRS –OLDER			EFFECTIVE REFERRALS			
ART	OOOOO	OOOOO	OOOOO	OOOOO	OOOOO	OOOOO	OOOOO	OOOOO	OOOOO	OOOOO	OOOOO	OOOOO
PMTCT	OOOOO	OOOOO	OOOOO	OOOOO	OOOOO	OOOOO	OOOOO	OOOOO	OOOOO	OOOOO	OOOOO	OOOOO
SUPPORT GROUPS	OOOOO	OOOOO	OOOOO	OOOOO	OOOOO	OOOOO	OOOOO	OOOOO	OOOOO	OOOOO	OOOOO	OOOOO
TOTALS												

What information, other than the essential logistics data items, can be included on a consumption record?

Other data can be included on a consumption record; however, you should not use it to collect data that will not be useful for logistics management decisionmaking, because it would create a burden on the health care personnel who implement the system. Overloading forms and staff with additional data fields increases the risk of slowing reporting and preventing data from being transmitted in a reasonable time to make decisions. However, if collecting a limited amount of service data with the logistics data would actually reduce some of the reporting burden for service providers, then it may be appropriate to include some service data reporting on a consumption record. Most important, relevant data must be collected at appropriate locations in the logistics system; the forms and reports used to collect and transmit the data must be clear and easy to use.

How and where do consumption records move?

Consumption records *do not* usually move. Most often, they remain at the service delivery facility.

Relationships among data found in records

In a well-functioning LMIS, the relationships among data found in records are clear. For example, at the SDP, the consumption data recorded on the DAR should be close to the issue quantities recorded on the inventory control card (ICC). Also, the transaction numbers on an RIRV or IRV should match the numbers recorded on the ICC. Periodically, logistics managers should verify the quality of the data.

Maintaining accurate records is crucial to good supply chain management. At any level of the system, managers should be able to quickly and easily report the stock on hand for any item. In a small warehouse, this may mean walking to the storage area and reading the numbers from a conveniently located stock card. In a large warehouse, this may mean being able to find the ICC file quickly, or to look it up data in a database. The entire transaction should be clear—who placed the order and when, when the order was filled and shipped, and when the order was received. If questions arise, you should be able to trace a transaction by using the reference number from the stockkeeping records to locate the transaction records.

Software tool: Supply Chain Manager

Supply Chain Manager is a computerized logistics management information system (LMIS) that allows logistics managers to monitor stock levels throughout the supply chain. For more information about the software, email askdeliver@jsi.com.

2.4 Reporting Systems and Summary Reports

Stockkeeping, *transaction*, and *consumption records* record data. To make the collected data useful, the records must be available to managers in a form useful for decisionmaking. In this section, we discuss how information moves on reports.

Six rights for LMIS data

If customers expect to find the right goods, in the right quantity, at the right place, at the right time, in the right condition, and for the right cost (see section 1.3 on the six rights), is it reasonable for logistics managers to expect the same to be true for the information they need?

We think the answer is definitely yes! The six rights also apply to data. We need the right data (the essential data items), at the right time (in time to take action), at the right place (the place where the decisions are made), and in the right quantity (having all essential data from all facilities). The data must be of the right quality (we have to believe that the data are complete and accurate) and at the right cost (we should not spend more to collect information than we spend on supplies).

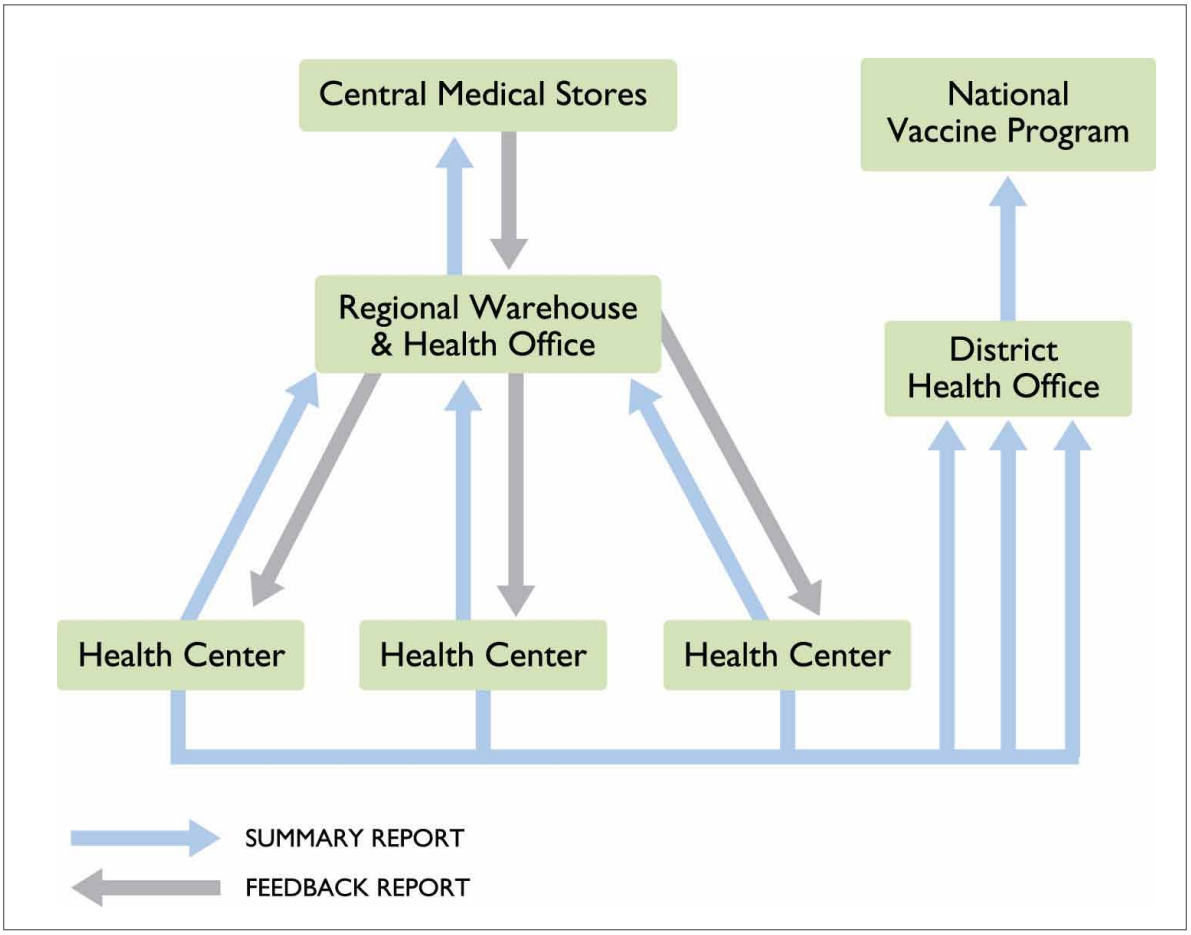
How do data get to decisionmakers? As you already learned, stockkeeping records and consumption records are kept at storage and service delivery facilities, yet they contain all the essential data needed to make decisions. And, although transaction records move from one facility to another, they do not usually contain essential logistics data. Data must be given to decisionmakers who can make informed decisions. Therefore, reports are used to move the essential data to decisionmakers.

Reporting systems

Reports move information up and down through a logistics system and provide decisionmakers at various levels the right information, at the right time, in the right place, in the right quantity, of the right quality, and the right cost. A reporting system must be in place to ensure that this information flows correctly and consistently. A reporting system in a supply chain may include levels outside storage and distribution points. For example, a District Health Office might not hold stock or be involved in the distribution of products, but this office still needs to receive LMIS reports to ensure that facilities are stocked appropriately to determine if the District Health Office needs to invest additional funding and/or resources into training, staffing, commodity quantities, etc.

Figure 2-12 is an example of a reporting system that includes both summary reports and feedback reports. It also highlights how the different levels that are involved in budget and supervision decisions—but not necessarily in direct stock management and distribution—also need logistics information to make decisions.

Figure 2-12: Sample Logistics Reporting System: National Vaccine Program



Summary reports

What is the primary purpose of a summary report?

It is used to move all essential logistics data items for products, for a specific facility, and for a specific time period (such as monthly, bimonthly, or quarterly) to the decisionmakers.

What essential logistics data items do summary reports contain?

They must contain all three essential logistics data items—stock on hand, consumption, and losses. Adjustments may also be reported, if useful for decisionmaking, but reported separately from losses.

Who completes the summary report?

The manager responsible for collecting the three essential logistics data items usually completes the summary report. One summary report is usually prepared and submitted for or by each facility required to report, for a specific period.

When are summary reports completed?

Summary reports are completed at the end of the reporting period (usually monthly, bimonthly, or quarterly). Lower-level facilities are usually given a reporting deadline, and each successive level is given another deadline for reporting to the next level. For example, health facilities may be given until the 10th day of the following month to report to districts, districts may have until the 20th day to report to the region, and the region may have until the last day of the month to report to the central level.

Some countries stagger their reporting schedules. For example, in a staggered, bimonthly reporting system, half the lower-level facilities would report one month and the other half would report the next month. This has the advantage of decreasing the reporting burden at the lower-level facilities, because they only need to report every other month. The burden of work at the next level is also half, as they only need to review half the number of reports in a given month. Staggering bimonthly reporting evens out the work load over the year.

Staggering reporting, however, has implications in terms of aggregation of data, supervision schedules, and delivery management. For aggregating data, you may have to wait for an extra month before total consumption data is available. Consider a system where half the facilities (Group A) report at the end of February (for January and February) and half the facilities (Group B) report at the end of March (for February and March). To determine February's national consumption data, you must wait for Group B's facility reports.

How are the data on a summary report organized?

Summary reports are usually organized by date—monthly, bimonthly, or quarterly, depending on the reporting cycle. Most often, they report the beginning stock on hand, receipts, the quantity issued or dispensed, losses and adjustments, and the end stock on hand for a specific time period.

In what format are summary reports printed?

The most common formats include simple facility reports, aggregate facility reports, and combined report and request forms.

Why Use Self-Balancing Reports?

Some reports are self-balancing, which means that by adding and subtracting the data on the report, as appropriate, the reviewer can determine whether the report is mathematically correct.

Consider the following report of a district warehouse reporting to a regional warehouse:

Opening Balance + Receipts – Issues – Loss ± Adjustments = Closing Balance

100 + 35 – 65 – 0 ± 0 = 70

In this example, the supervisor at the regional warehouse can clearly see that the calculations are correct.

It is important that the lower-level facility conduct a physical inventory at the beginning or end of every month; self-balancing reports can help supervisors verify the accuracy of the supply on hand, determined by the physical count. If districts complete the report without comparing the closing balance with the actual quantity on hand, self-balancing reports may not reflect actual quantities on hand. Thus, opening balances should equal the closing balance of the previous report, and the reported closing balance must equal the actual stock on hand (not a calculated stock on hand), so the quantity to be ordered is determined directly by the actual stock on hand and not by a calculated number.

If a physical inventory reveals a discrepancy in the beginning or ending stock on hand, the discrepancy should be reported as a loss or adjustment for the reporting period.

What is an aggregate summary report?

One of the most important decisions logistics managers face in collecting data on summary reports is determining when and at what level data can be aggregated. What data should be aggregated, and at what level, depend on many factors. First, how *visible* does the facility-level data need to be higher up in the system (i.e., does the central level need to know exactly what each health facility distributed and has on hand?)? Second, what decisions need to be made at what levels (budgetary, supervision, stock distribution, etc.) and what detail of data is needed? Third, what are the current tasks and work responsibilities of staff that will be required to compile the aggregated data? Will aggregating data be too much of a burden? Which levels have tools (computers) and staff that can more easily aggregate data?

Consider a pipeline of three regions, each with two districts, and each district with four health centers. The health centers forward their reports monthly to the district. The district then reports to the region in one of three ways:

1. Include information for the district storeroom only on the report, and then include a copy of each health center's report separately.
2. Include information for the district storeroom only on the report, and then add all the health center data together on a second report.
3. Add data for the district and health center together, but, under the column *issued/dispensed*, report only the aggregate dispensed-to-user data from the clinics (without including the issues data from the district to the health centers).

With any of these three methods, the regional level will receive all the essential logistics data items for the district. Each method has advantages and disadvantages. These are described in more detail in chapter 3, Assessing Stock Status.

Errors in Aggregation

When aggregating data, you can easily report the wrong information, unless the procedures for aggregation are clear. It is important that staff at all levels understand which stock on hand should be reported—that of the reporting facility only, that of the reporting facility and all lower-level facilities, or the aggregation of the lower levels only. If the wrong data are reported (such as issues instead of dispensed to user), the decisions made based on that data will also be incorrect.

What is a combined report and request form?

This is a summary report that presents the data to the next higher level and requests new supplies. The advantage of this report is that the higher level can verify the need, and the lower level sends up only one form that includes both its reporting data and its order. A report and request form (or Report and Requisition) is sometimes combined with an Issue and Receipt Voucher and is useful for other steps in the transaction (see figure 2-13).

Another advantage of linking reporting to ordering is that reporting rates often improve because when a report is tied to an order, it usually encourages timely submission of reports. Facilities are more likely to submit their reports when they receive something (resupply) in return. If reports and orders are linked, it is important to consider that the frequency of reporting dictates the frequency of distribution (i.e., if reporting is monthly, then distribution must be monthly). The issuing facility must have the infrastructure and capacity to distribute products as often as it receives reports.

Figure 2-13: Monthly Report and Request for ARVs (last page of a four-page form)

REPORT AND REQUISITION FOR ANTIRETROVIRAL DRUGS

Explanation for Losses/Adjustments: _____

Reporting Period: From _____ (dd/mm/yyyy) to _____ (dd/mm/yyyy) Province: _____ Maximum Stock Level: 3 Months

Facility: _____ District: _____ Emergency Order Point: 0.5 Months

Drug Product	Unit	Beginning Balance of Store room + Dispensary	Total Quantity Received during the month	Total Quantity Dispensed for the month	Losses and Adjustments	Physical Count of Store Room + Dispensary at the end of the month	AMC = (E + previous 2 months consumption) ÷ 3	Maximum Quantity	Order Quantity
A	B	C	D	E	F	G	H	I = (H X 3)	J = (I–G)
Liquid/Powder Formulations									
Abacavir oral solution 20mg/ml	240ml Bottle								
Lamivudine oral solution 10mg/ml	100ml Bottle								
Lamivudine oral solution 10mg/ml	240ml Bottle								
Lopinavir/ritonavir 20mg/80mg/ml	60ml bottle								
Nevirapine oral suspension 10mg/ml	100ml Bottle								
Nevirapine oral suspension 10mg/ml	240ml Bottle								
Nevirapine oral solution 10mg/ml (PMTCT)	25 ml Bottle								
Stavudine powder for suspension 1mg/ml	100ml bottle								
Zidovudine oral solution 10mg/ml	240ml Bottle								
Zidovudine oral solution 10mg/ml	100ml Bottle								
Co-trimoxazole for Prophylaxis of Bacterial Infections									
Co-trimoxazole 120mg tablets	Bottle of 100 tablets								
Co-trimoxazole 80+400mg Tablet	Container of 1000 tablets								
Co-trimoxazole 240mg/5ml suspension	100ml Bottle								
Co-trimoxazole 240mg/5ml suspension	60ml Bottle								

Remarks: _____

Completed by:	*Authorized by:*	*Ordered by:*	*Authorized by:*
Signature:	*Signature:*	*Signature:*	*Signature:*
Date:	*Date:*	*Date:*	*Date:*

What is the link between summary reports and transaction records?

The common data element between these two is often order quantity/quantity requested. For example, Order Quantity (column J on the report and request form) should equal Quantity Requested on the Requisition, Issue and Receipt Voucher (see figure 2-7).

One way to streamline information is to combine all data elements on one form so that logistics data—as well as proof of delivery—are all on one piece of to paper. However, warehouses often have their own transaction records. Furthermore, combining all data elements on one form would require that the form travel back and forth multiple times between levels; and it may be challenging to make self-carbonized, due to the number of copies required.

What information, other than the essential logistics data items, can be included in a summary report?

Information in a summary report can also include limited service data. Summary reports should always include a place for comments, particularly explanations for any losses and adjustments. The person completing the report must sign and date the report. At higher levels in the system, the summary report could also indicate the completeness of the report. For example, the report may indicate that 100 reports were expected, but only 92 were received. Knowing this, a manager at the next higher level can determine how well facilities are reporting and then make mathematical adjustments for the missing data.

How do summary reports move?

They move up the pipeline from the SDPs to the central level. Depending on where reports are aggregated, reports from SDPs may move all the way to the central level or may be kept at the level at which they were aggregated. Summary reports that are also tied to requisitions (order) may bypass reporting to intermediate levels and report directly to higher levels, usually from where supplies are issued—like a district store or central warehouse. This has the effect of shortening the *lead time* for reporting. However, other levels may still need to see the summary report for supervision, pipeline monitoring, and budgeting purposes. In addition, reporting lead time can be shortened significantly if reports are transmitted electronically—either through email, mobile phone, or a website/LMIS database. Electronic reporting also decreases the possibility of a report being lost during transit.

Feedback reports

As we mentioned, program and logistics managers collect data to make decisions. When they receive data they know are incorrect, they need to communicate with the facility that sent the data. Managers can also use data they receive to congratulate facilities for moving toward program goals. To do this, managers can use feedback reports (see figure 2-14); these reports are important for facilities and managers, as well as for stakeholders at other levels of the supply chain, especially the central level.

Feedback reports aggregate and analyze the data contained on the routine LMIS reports submitted by facilities. These central-level reports often contain information on trends in consumption, national stock status, percentage of facilities reporting, and percentage of facilities experiencing a stockout. Use feedback reports to identify overall logistics system weaknesses or issues to inform overall program planning and management, and areas for logistics system improvement.

Preparing feedback reports is easiest when the LMIS is automated. Computers quickly identify mathematical errors and highlight missed deadlines; list the percentage of expected reports received; and search for data averages, highs, and lows. Feedback reports are essential for manual systems too, but processing and preparing reports by hand may require a great deal of time and effort. All logistics systems should be designed with feedback mechanisms.

Feedback for facilities

Feedback reports inform lower levels about their performance; improve capacity; give recognition; and, in some cases, provide information about reporting from other facilities. Feedback reports also inform managers at higher levels about how the system is functioning.

Feedback reports may help solve many problems. For example, when summary reports are self-balancing, it is easy to pinpoint errors in the individual reports. Feedback reports can include information about these errors and how to correct them. In addition, feedback reports let the person sending the report know their work has been received (and when it was received). Also, feedback reports can be used to motivate lower levels to turn in complete, error-free reports, on time, by reporting which sites are producing quality reports and which are not.

Feedback for decisionmakers throughout the supply chain

Managers can use feedback reports to gauge how well the system is functioning. For example, a feedback report might list facilities that are stocked out or overstocked; percentages of those facilities reporting at each level; or quantities of losses and adjustments, by level. Feedback reports can also address a single facility or product.

In addition to providing feedback to facilities, the feedback reports are used to present data for decisionmaking throughout the supply chain. The decisionmakers might be divisions within the public sector, such as Ministry of Health, government procurement units, warehouses (such as the Central Medical Stores [CMS], or distributors [if third party logistics are being used]). Other donors, funding agents, implementing partners, and nongovernmental organizations (NGOs) can also be decisionmakers within a system and can benefit from using feedback reports. A key element of feedback reports, whether they are sent to a facility or the CMS, is that they increase visibility of information by communicating logistics data to all levels of the system.

Feedback reports in Zambia

In addition to gathering and analyzing logistics data, the Logistics Management Unit (LMU) at the Medical Stores Limited in Zambia provides monthly feedback reports to facilities. These feedback reports include information on facility reporting accuracy and current stock status of supplies at the central level.

What should you do if all your facilities do not report on-time?

One of the most difficult problems logistics managers face is deciding what to do when facilities do not report. Should you send the report in late? Should you send in your report with only the available data? Should you substitute other data for the missing/incomplete information? Any of these responses may be appropriate. Each program may have a different procedure for handling missing data. Most important, all managers must know what procedure to follow, and they should follow the same procedure consistently. Well-designed summary reports include the number of expected reports and the number of reports received, enabling higher-level managers to calculate the percentage reporting. All managers should, of course, encourage the reporting facilities to report all data on time. The supervisor should contact any facility that does not comply as soon as possible and offer assistance.

See chapter 3 for more information about adjusting data for incomplete reporting.

Figure 2-14: Feedback Report

Ministry of Health & Populatio
RHLMIS Database

Stock Imbalances

Report Period: February, 2003
All Facility Types

Run Date: 09-Mar-04
Run Time: 12:50 PM
Page: 1 of 40

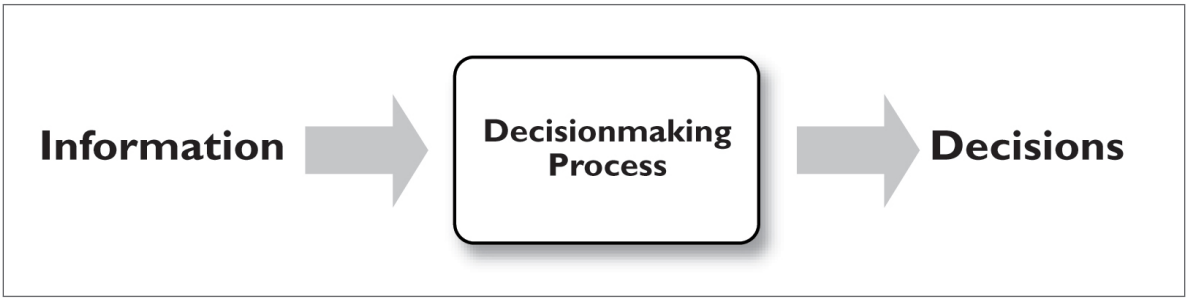
Supplying Facility / Facility	Product	Closing Balance	AMC	Months of Stock	Quantity Needed	Status
Balaka DHO						
Balaka Hospital Clinic	Metronodazole	0	18,667	0.0	37334	Stocked Out
	Doxycycline	0	17,667	0.0	35334	Stocked Out
	Erythromycin	0	14,334	0.0	28668	Stocked Out
	Gentamycin	0	767	0.0	1534	Stocked Out
	Benzathine Penicilli	0	80	0.0	160	Stocked Out
	Norplant	0	1	0.0	2	Stocked Out
Kalembo	GV Paint	0	667	0.0	1334	Stocked Out
	Metronodazole	0	334	0.0	668	Stocked Out
	Doxycycline	0	334	0.0	668	Stocked Out
	Spermicide	0	87	0.0	174	Stocked Out
	Syringes	0	34	0.0	68	Stocked Out
	Benzathine Penicilli	0	7	0.0	14	Stocked Out
Balaka Hospital Clinic	Condom	3,243	4,884	0.7	6525	Below Minimum
	DepoProvera	300	642	0.5	984	Below Minimum
	Depo Syringes	300	642	0.5	984	Below Minimum
	GV Paint	300	310	1.0	320	Below Minimum
Kalembo	Condom	944	2,086	0.5	3228	Below Minimum
	DepoProvera	370	373	1.0	376	Below Minimum
	Depo Syringes	370	373	1.0	376	Below Minimum
Mbela	Condom	731	1,090	0.7	1449	Below Minimum
	Nystatin	19	101	0.2	183	Below Minimum
Balaka Hospital Clinic	Spermicide	420	34	12.4	-352	Overstocked
	Ovrette	60	25	2.4	-10	Overstocked
Kalembo	Lofemenal	434	115	3.8	-204	Overstocked
	Ovrette	285	39	7.3	-207	Overstocked
	Nystatin	100	34	2.9	-32	Overstocked
Mbela	Metronodazole	3,500	327	10.7	-2846	Overstocked
	Doxycycline	3,068	292	10.5	-2484	Overstocked
	Erythromycin	5,593	291	19.2	-5011	Overstocked
	DepoProvera	488	154	3.2	-180	Overstocked
	Depo Syringes	488	106	4.6	-276	Overstocked
	Lofemenal	520	39	13.3	-442	Overstocked
	Ovrette	400	10	40.0	-380	Overstocked
	Benzathine Penicilli	121	7	17.3	-107	Overstocked
Namanolo Health Centre	Metronodazole	670	165	4.1	-340	Overstocked
	Doxycycline	790	105	7.5	-580	Overstocked
	Condom	908	50	18.2	-808	Overstocked
	Depo Syringes	351	24	14.6	-303	Overstocked
	DepoProvera	351	24	14.6	-303	Overstocked
	Lofemenal	40	4	10.0	-32	Overstocked
	Benzathine Penicilli	14	3	4.7	-8	Overstocked
Phimbi	Doxycycline	860	214	4.0	-432	Overstocked
	Depo Syringes	531	107	5.0	-317	Overstocked
	DepoProvera	531	107	5.0	-317	Overstocked
	Metronodazole	880	90	9.8	-700	Overstocked
	Condom	5,796	74	78.3	-5648	Overstocked
	Lofemenal	192	20	9.6	-152	Overstocked

2.5 Using an LMIS for Decisionmaking

At the most fundamental level, the decisionmaking process can be viewed as a *black box* into which information flows and out of which decisions emerge. Although simplistic, figure 2-15 shows what logistics managers actually do; it illustrates some important points that are frequently overlooked in LMIS development.

- If you are interested in decisions of any type, you must understand the decisionmaking process.
- To improve decisions, you could (1) improve the information flowing into the box, or (2) improve the process within the box. These are two different types of activities; in most cases, to have any effect on decisions, the two must be done simultaneously.
- It is not possible to define better information without understanding both the decisions being made and the decisionmaking process. This is the most important principle of LMIS development: to design a relevant, useful system, you must first consider what decisions are being made and, second, how they are being made. Only with this understanding can you say what information is needed and how to collect it. Information systems fail most frequently because the information they collect is not useful in decisionmaking.

Figure 2-15: Decisionmaking Process



Quality monitoring of the logistics management information system

This chapter focuses on the essential data needed for logistics management. Because these data are used to make informed decisions that will improve customer service, quality is critical; in fact, data quality is one of the six rights for LMIS data. Although data quality is often a challenge, there are specific steps that can be taken to improve the quality of LMIS data:

Data collection: All staff responsible for maintaining logistics records—whether stockkeeping, transaction or consumption—should be appropriately trained and have adequate time to carry out this responsibility. The forms should be clear and simple, with sufficient writing space. On-the-job training (OJT) and supportive supervision should be undertaken to ensure the forms are being completed correctly.

Data reporting: Data should be reported regularly and logistics managers should review the reports to verify the quality of the data. Feedback reports and incentives can be used to motivate lower levels to turn in complete, error-free reports. Linking reporting with ordering also encourages timely reporting.

Data monitoring, aggregation, and analysis: The data should be validated by comparing different reports to ensure that data are accurately and consistently entered, aggregated, and reported. It is important to ensure optimal quality of the raw data that is subsequently analyzed, so that reports are reliable for decisionmaking.

Automated LMIS: An automated LMIS—using computers, handheld devices, mobile phones, or the Internet—can help improve data quality. It can help reduce mathematical errors; highlight missing information; and facilitate data capture, analysis, reporting, and feedback. However, computerized LMISs are expensive and require significant inputs (i.e., hardware, programming, electricity, training etc.); therefore, the quality improvement benefits must be weighed carefully against the costs.

Chapter Summary

In this chapter, you learned the following:

1. The purpose of a logistics management information system is to collect, organize, and report data that enable people to make logistics system decisions.
2. The essential data needed for logistics management are—
   - ***stock on hand.*** These quantities of usable stock are available at any, or all, levels of the system. Do not count unusable items, but consider them losses to the system.
   - ***consumption.*** The quantity of a particular item dispensed to users or used by service providers during a specific time period.
   - ***losses and adjustments.*** Losses are the quantity of stock removed from the pipeline for any reason other than consumption by clients (e.g., losses, expiration, theft, damage, etc.) or for use when services are provided. Adjustments include quantities transferred between facilities or levels. Adjustments may also include administrative changes, such as a mathematical correction after a physical count when a different amount from the quantity listed on the stock cards was discovered. Remember: Adjustments can be either positive or negative changes to stock.
3. The three types of logistics records and the data they must contain are—
   - ***stockkeeping records.*** These are used to record information about items in storage. At a minimum, stockkeeping records must contain the quantity of stock on hand and the quantity of losses and adjustments.
   - ***transaction records.*** These are used to record information about the movement of stock from one storage facility to another. Transaction records do not need to include any essential data items.
   - ***consumption or usage records.*** These are used to record the quantity of each item dispensed to clients or used at a facility.
4. Reporting moves the essential data to decisionmakers for decisionmaking.
5. Summary reports must contain all essential data items—stock on hand, consumption, and losses and adjustments. Report types include simple reports, aggregate reports, and combined report and request forms.
6. Feedback reports inform lower levels about their performance and, sometimes, provide additional information about reporting from other facilities. Feedback reports also inform higher-level managers about how well the system is functioning.

To continue learning about LMISs, consult Session 2: Logistics Management Information Systems of the online training, Lessons in Logistics Management for Health Commodities, at this website: http://deliver.jsi.com/dhome/topics/organizational/distancelearning

Objectives

In this chapter, you will learn the following:

- purpose for assessing stock status
- data needed to assess stock status
- general formula for assessing stock status
- instructions for analyzing consumption data for trends
- process for determining the months of stock available at any level, if stock-on-hand and dispensed-to-user data is available.

3.1 Assessing Stock Status

You may not know it, but you may already understand the principles of assessing stock status. A simple example from daily life will show you how you regularly assess stock status.

How often have you decided to prepare rice and then looked at the rice container to see how much rice you have? When you determine that you have enough rice, too little rice, or more rice than you need, you have assessed the stock status.

Suppose you were asked to assess the stock status of a supply of aspirin in a health facility. For example, you found 100 aspirin tablets. With this information, could you tell if the clinic has too much aspirin? Too little? Just enough?

You do not want to know, "How much aspirin does the clinic have?" but, "How long will the clinic's supply of aspirin last?" When you answer this question, you are assessing your stock status.

The purpose of assessing stock status is to determine how long supplies will last.

If you know that the clinic dispenses about 25 aspirin tablets every month, you can use the following simple formula to determine that the aspirin supply will last about four months—

$$\frac{\textbf{How much we have of a certain product}}{\textbf{How much we use during a given period}} = \textbf{How long that product will last (in number of periods)}$$

…or, in this case—

$$\frac{\textbf{100 tablets on hand}}{\textbf{25 tablets used per month}} = \textbf{4-months supply of tablets}$$

You have just assessed the stock status of the aspirin in the clinic.

Assessing stock status is a management function; you use this information wherever you assess stock status. Stock status assessments are usually not written in reports at the facility level, nor are the number of months of stock on hand recorded on a stock card. Stock status is primarily assessed to make decisions related to

resupply. Depending on your inventory control system, based on your stock status assessment, you may place an order or, in some cases, place an emergency order. If from the assessment you see that you do not need to place an order, you can return to your other duties confident that your supplies will last until your next order.

3.2 How to Assess Stock Status

Our formula for assessing stock status can be expressed in terms familiar to logisticians. The *amount we have* is the same as *stock on hand*. The *amount we use* is the same as *rate of consumption*. Because stock assessment is measured in terms of *months of stock* (a convenient measure because data are often collected monthly at the service delivery point [SDP] level), the AMC more accurately describes the rate of consumption.

THIS…	IS THE SAME AS…
Amount we have	Stock on hand
Amount we use	Rate of consumption/ average monthly consumption
How long it lasts	Months of stock

By substituting logistics terms, the equation becomes—

$$\frac{\text{Stock on hand}}{\text{Average monthly consumption}} = \text{Months of stock on hand}$$

Stock on hand and average monthly consumption, therefore, are the data items we need to assess stock status.

Why is assessing stock status important?

When you assess stock status, time is an essential factor. In the aspirin example above, it would have been an entirely different situation if the clinic had dispensed 100 aspirin tablets per week and would not have been resupplied for another month. You may think that 100 aspirin tablets are more than enough for a clinic or hospital. On the other hand, if you work with or in a large warehouse, 100 aspirin tablets may not be a lot, making the supply drastically understocked. It is important, therefore, to ask how long supplies will last.

In logistics management, your job is to turn data and numbers into information that can be used to make decisions. In this case, you need to use data to determine if you have enough stock to last until the next order is received and available for dispensing or issuing.

Stock on hand

To calculate the months of stock-on-hand, you first need to know the quantity of stock on hand. You can find stock on hand data in your stockkeeping records (inventory control card, bin card, stores ledger; or, perhaps, your computerized system). The most accurate source is a physical inventory.

A physical inventory is the process of counting, by hand, the total number of units of each commodity in your store or health facility, at any given time.

Physical inventories are discussed in detail in chapter 8.

Average monthly consumption

In addition to knowing the stock on hand, you also need to know the AMC. The average of the quantities of product dispensed to users or patients in the most recent three months, as appropriate.

Average monthly consumption is the average of the quantities of product dispensed to users or patients in the most recent three months, as appropriate.

You can use consumption data to determine the AMC; you can find actual consumption data in only one place—consumption records (daily activity registers, daily usage logs, or tick sheets). Because consumption fluctuates—sometimes by a great deal—over time, you should not use data from one month only. To calculate the AMC, first calculate a simple average by finding the sum of a set of monthly consumption numbers and divide the total by the number of months used.

When you determine the AMC, in general, you should analyze data for the most recent three months. For example, if during the last three months, the number of blisters of artemether+lumefantrine (ALu) 1×6 dispensed, each month, in a hospital was—

April	1,250
May	1,364
June	1,255
Total	**3,869**

Decimal dilemma: Average month consumption (AMC)

When you calculate the AMC, the answer will probably have a decimal. Because you cannot distribute a portion of a product, always round up the AMC to the nearest whole number.

The average monthly consumption is—

3,869 (total number of blisters) ÷ 3 (3 months of data) = 1,289.6 or 1,290 blisters per month (AMC)

What about seasonality?

When deciding how many months of stock to use to calculate the average monthly cosumption (AMC), you should consider special characteristics for different programs. Some programs have cyclical trends; for example, during the rainy season, demand and use of malaria medicines, tests, and other commodities may increase. Therefore, in this program, because of the seasonal nature of malaria, using only three months of data may underestimate annual demand if it is calculated at the beginning of the malaria season and overestimate it if calculated toward the end of the season. It may be more accurate to use six months instead, if data is available, or analyze the previous year's trend and compare it to the current year trend. For most health programs, however, three months of data is appropriate for calculating AMC.

Putting the formula to use

Using the data above, if the stock on hand for ALu 1×6 is 3,000, and we calculated the AMC to be 1,290 blisters a month, we have the data to assess stock status. Our formula is—

Stock on hand ÷ AMC = months of stock on hand

…and the calculation is—

3,000 blisters ÷ 1,290 blisters/month = 2.32 or 2.3 months of stock on hand

The answer you obtained means that, based on recent usage, the current stock on hand of ALu 1×6 will last for 2.3 months. If you think back to why we assess stock status, you will remember why this calculation is important. If you received a report stating that 3,000 blisters were in a warehouse, you might assume that this quantity is more than enough for several months. The reality is that, given the current rate of consumption, the stock will only last for 2.3 months. If new stock is not received before 2.3 months have passed, the facility is at risk of a stockout and, ultimately, customers will not be served.

Decimal dilemma: Months of stock

When you calculate months of stock, your calculation will usually have a decimal. If one month is 1.0, 0.25 months is equal to approximately one week. Depending on the lead time, a one-week difference could be crucial to obtaining supplies and avoiding a potential stockout. Therefore, do not round to the nearest whole month; we want to include one-tenth of a month. When assessing stock status, follow normal rounding rules: round up to the nearest decimal place if the digit in the 100's place is 5 and above; round down for 4 and below.

For example, 3.36 months becomes 3.4 months and 6.74 months becomes 6.7 months.

3.3 When to Assess Stock Status

You should regularly assess the stock status of each product in your storeroom. We recommend that you consider assessing the stock status monthly for all products that you store. Even if you only report or order quarterly, you should assess stock status more often to ensure that you are not at risk of a stockout. Stock status should also always be assessed during quantification exercises. See chapter 6 for more information.

If the number of products you store is large, you may not be able to assess the stock status for each product every month. In such cases, consider a vital, essential, non-essential (VEN) analysis, which categorizes products by public health priority; and/or an ABC analysis, which categorizes products by cost, and count a subset of products monthly, based on their importance and cost. These techniques are described in chapter 8.

Frequent assessments of stock status are the best way to ensure that you are aware of the potential for stockouts. Simply looking up at a shelf and making a decision without considering consumption data could lead to stockouts and, consequently, poor quality of care and customer service.

3.4 Stock Status Assessment at Any Level in the System

As a logistics or health program manager, you probably work in the capital city or a regional center, with provincial, district, and/or health facility storerooms and warehouses scattered across the country. Despite the distances to these outlying facilities, it is important that you are able to assess the stock status for any level of your system.

Importance of stock status at different levels

Assessing stock status at any level, or even all levels, can give you more than just a glimpse of stock status in your own warehouse. You could also know whether—

- The levels you supervise are overstocked.
- The levels you supervise are understocked; additional shipments are needed.
- Any products will expire in storage before they can be dispensed to users.
- Some facilities have too much stock and others not enough.
- Supplies are reaching customers instead of sitting in warehouses.

If you know the stock status at various levels of your pipeline, you can prevent these problems.

You should assess stock status at different levels as often as you receive reports on dispensed-to-user data. Typically, all reports do not come in at once. A district level may report monthly, but the central level may only have new data quarterly. No matter when new dispensed-to-user data arrives, this new data should be used to assess stock status.

How to avoid product expiry

One advantage of assessing stock status is your ability to anticipate if products will expire in storage in order to take action before this occurs. For example, if a regional manager calculates that one facility has more stock on hand than they will be able to dispense before the expiry date, and the manager knows another facility is running low on stock, then they can arrange a transfer to avoid stock expiring in storage at the first facility. Similarly, if the central medical store assesses that it has more stock on hand than it will be able to dispense nationally, it can arrange a transfer to another country in order to avoid expiry.

Assessing stock status at higher levels

When assessing stock on hand at the level above the SDP—for example, at the district level—you can use stock-on-hand data from one or more of the following three sources:

- district warehouse stock on hand
- aggregate (sum) of the stock on hand at all SDPs reporting to the district
- aggregate of the stock on hand for the district warehouse plus the SDPs reporting to the district.

The source you use depends on the question you want to answer:

Do you only want to know the stock status of the district warehouse?

The stock on hand for only the district warehouse will not tell you anything about the SDP level, but it does indicate how long the district warehouse will be able to supply the SDPs; this is important in determining if the district should be resupplied.

Do you only want to know the stock status of the service delivery points?

If you only use the SDP data, you will know how long stocks will last at the entire service delivery level, but you will not have information about the district warehouse, or about individual SDP stock levels.

Do you want to know the stock status of the entire district?

If you aggregate the stock on hand for both SDPs and the district warehouse, you will assess the stock status of the entire district, but you will not be able to distinguish between stock in the district warehouse and stock in the SDPs.

Some countries do special studies to assess stock status for every facility in the system at approximately the same time. Such a study produces a *snapshot* of stock status that can inform decisionmakers of changes that may need to be planned for the upcoming year. It is important to note that each time you aggregate data, you lose some visibility in the system. For example, if, at the central level, you want to know stock status of individual facilities, then you cannot aggregate any of the data. If the central level only needs regional-level stock status, then district and facility data will be aggregated and the central level will not have *visibility* of the true stock situations at the district level or facilities.

Regardless of how often you assess stock status or what data sources you use, be sure that you document how you calculated the months of stock. This may be important when you review your decisions.

Use stock-on-hand data to assess stock at higher levels

The following example shows four methods for assessing stock status at higher levels. Imagine that you are the district warehouse manager; you have two health facilities reporting to you. At the end of the month, you conduct a physical inventory of your warehouse and receive reports from both health facilities. You find—

LEVEL	STOCK ON HAND	AVERAGE MONTHLY CONSUMPTION	MONTHS OF STOCK
Facility 1	100	200	0.5
Facility 2	600	300	2.0
District	3,000	700 (issued)	4.3 (based on issues)

Method 1: Use only district warehouse stock on hand

Because the district has dispensed-to-user data, it can assess its stock status best by using the AMC data from both facilities. The calculation would be—

LEVEL	STOCK ON HAND	AVERAGE MONTHLY CONSUMPTION (FROM FACILITIES)	MONTHS OF STOCK
District	3,000	500	6.0

If the regional supervisors assess stock status using only these data, they would miss the potential stockout at facility 1. The region would feel confident knowing that the district warehouse had enough stock to supply its facilities for another six months.

Method 2: Use only health facility stock on hand

If the district reports only the aggregated clinic stock on hand to the region, the calculation would be—

LEVEL	STOCK ON HAND	AVERAGE MONTHLY CONSUMPTION	MONTHS OF STOCK
Both facilities	700	500	1.4

If the regional supervisors assess stock status using only these data, they would identify a serious emergency. This assessment reveals that the facilities need to be restocked immediately. However, this assessment does not show us that the situation can be resolved fairly quickly because the district has enough stock on hand to easily resupply the health facilities. Ideally, the regional supervisor would have this data, as well as the data in method 1; and the supervisor would be able to make a well-informed decision.

Method 3: Aggregate the district and facility stock on hand

If the district reports all data aggregated, the calculation would be—

LEVEL	STOCK ON HAND	AVERAGE MONTHLY CONSUMPTION	MONTHS OF SUPPLY
All	3,700	500	7.4

If the regional supervisors assess stock status using only this data, they would miss the potential stockout at facility 1. The region would know that there were sufficient supplies in the entire district, but they would not be able to tell how they were distributed between the district and facility levels.

Method 4: Disaggregate data

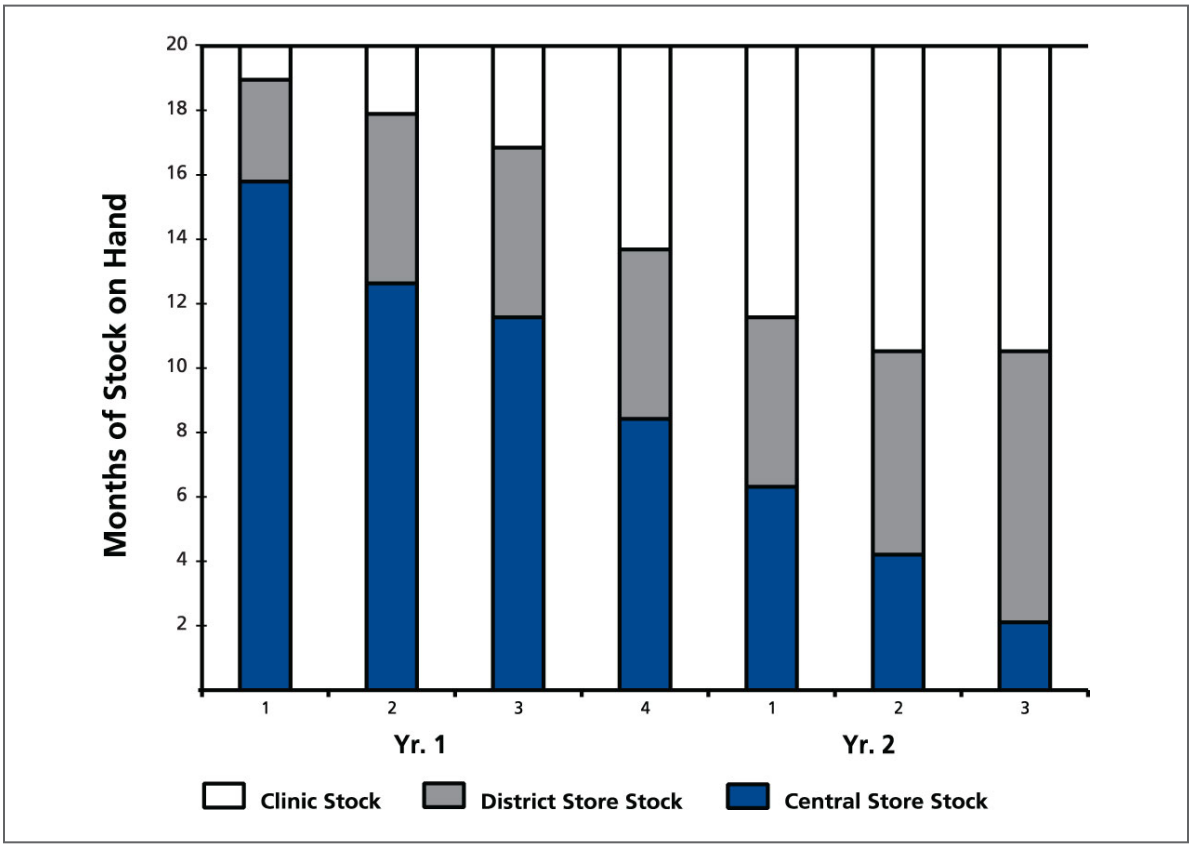
In an ideal setting, the regional supervisor would receive all the data for all the facilities. This information could be used to pinpoint problems at all facilities, at all levels. It may, however, be difficult to process the numerous monthly reports needed for so many facilities. Managers must understand what each method tells them and the strengths and weaknesses of each, and then choose the method most appropriate to their program.

Understanding your assessment of stock status at higher levels

Figure 3.1 illustrates why it is important to assess stock status at higher levels. Stock on hand nationwide (the total months of supply at all levels) appears to be relatively steady and high. However, if you assess the supply status of the central warehouse only, you might believe the stocks are rapidly depleting and that more stock is urgently needed. The graph shows that this is not true; rather, stock is gradually being redistributed to lower levels in the pipeline.

However, the graph also shows that product is being redistributed in very large quantities—your clinics have 12 months of stock and may actually be overstocked! Understanding stock status at all levels, therefore, is important when you manage a supply pipeline.

Figure 3-1: Stock Status Assessment



Adjusting consumption data

When you assess stock status at the lower levels in the pipeline from the higher levels, you should base AMC on actual dispensed-to-user data from the dispensing level (consumption data). These data can only come from SDPs. However, you may encounter problems with consumption data: incomplete data because of a missing time period, or incomplete reporting or stockouts. When complete dispensed-to-user data for the last 3 months are not available, use one of the following techniques:

- Use the dispensed-to-user data from previous complete reports (older than three months).
- Adjust incomplete data to estimate complete reporting.
- Adjust for stockouts.
- For dispensed data, substitute issues data from the lowest possible level.

Adjusting data for incomplete reporting

At higher levels, collecting 100 percent of reports from SDPs (which include consumption data) may be challenging. Many systems experience these challenges because it is unusual to have all SDPs reporting on time. When this is the case and you want to assess stock status, you can use the consumption data that are available and adjust them to account for the missing data.

To adjust the data, divide the quantity reported by the percentage reporting, using the following formula—

$$\frac{\text{Sum of all consumption reported}}{\text{Percentage of reports received}} = \text{Estimated total consumption}$$

For example, if you receive 8 of 10 reports, you have 80 percent of the expected reports. If the sum of the consumption from those reports equals 100 units consumed, the estimated total consumption would be—

100 ÷ 0.80 = 125 estimated units consumed

As in any stock status assessment, divide the estimated total consumption by the number of months of data used (following the guidelines discussed in section 3.2). This will give you an estimated AMC to use in the general formula for assessing stock status.

If you use this technique to estimate consumption, remember the following:

- Document how you made your adjustment.
- If reporting is very low, (for example, below 70 percent), substitute issues data for consumption data (discussed below).
- Not all SDPs are equal in terms of number of client visits or quantity of product dispensed. The basic technique described here assumes that consumption rates for the missing SDPs are approximately the same as the SDPs that have reported. However, if SDPs that have not reported are very different from those that have reported (i.e., they are known to dispense much larger or much smaller quantities to users), you can substitute issues data for consumption data, or you can adjust reported consumption data to reflect the percentage of total consumption that the reporting facilities represent. To adjust for incomplete reporting when the non-reporting sites are not similar in size to those reporting, use the following formula—

$$\frac{\text{Sum of all consumption reported}}{\text{Percentage of consumption represented by those reporting}} = \text{Estimated consumption during period}$$

Adjusting data for stockouts

In gathering your stock on hand, or consumption data, you may discover that a stockout has occurred. In some cases, you may find that facilities have been rationing supplies to avoid a stockout or have been hoarding supplies (gathering large quantities) to avoid future problems. For established programs, if you know that a stockout, hoarding and rationing, or incorrect data reporting occurred in a particular month, you should disregard the data for that month and include data from earlier months when these events did not occur, until you have 3 months of data without such problems. You can use the following formula to determine an average of the (n) other periods and use that as the data for the stocked out period—

$$\frac{\text{Sum of consumption in other n periods}}{\text{Number of periods (n)}} = \text{Estimated consumption during period in which stockout occurs}$$

For new or expanding programs, or those with seasonal considerations, you may need to adjust the consumption data for *what would have been* if the stock had been available and dispensed normally. In these cases, you may not have a sufficient number of months of historical data or, due to programmatic changes, data from past months may not be reflective of current or future program realities. Therefore, supervisors could analyze trends, targets, and data from non-stocked out facilities to develop assumptions about the missing rates of consumption.

These adjustments and calculations should not be done at the facility level. Facility-level staff time should be focused on providing services and serving customers, not doing sophisticated calculations, like the ones described here. These adjustments are made primarily for two reasons: (1) if it has been decided that resupply quantities should account for days out of stock, and (2) when estimating consumption for an entire program or country, in order to assess national stock status.

Regardless of which approach you take, document how you adjusted the data and keep detailed notes on how you made your calculations. It is important to be able to repeat your stock status assessment and to calculate the same answers if you are called on to demonstrate your decision-making process.

Using issues data instead of consumption data

You can substitute issues data for dispensed-to-user data when you assess stock status at higher levels, but this can be problematic. Issues data may overestimate consumption if excessive quantities of product are being sent from one level of the system to another. Similarly, issues data could also underestimate consumption if products are being rationed. To minimize over- or under-estimates of consumption, if issues data must be substituted for consumption data, it is best to collect issues data from the lowest level possible. For example, this could be the issues data from the facility store to the dispensary.

Adjusting stock-on-hand data

Similar to the situation described when adjusting consumption data, you may be in a situation when not all reports are received. When complete stock-on-hand (SOH) data for all facilities are not available, the stock-on-hand data must be adjusted for incomplete reports. This can be done in two ways, exactly as described when you adjust consumption data.

Adjusting stock on hand by percentage reporting

To do this calculation, divide the quantity of stock on hand reported by the percentage of the reports received.

$$\frac{\text{Sum of all SOH reported}}{\text{Percentage of reports received}} = \text{Estimated SOH at end of the period}$$

However, not all SDPs are the same size. The calculation above can be used if you think that the facilities that reported are representative of all facilities. If they are not, then you may need to do a slightly different calculation.

Adjust stock on hand by percentage represented

To do this calculation, divide the quantity of stock on hand reported by the percentage of stock on hand the reporting facilities represents.

$$\frac{\text{Sum of all SOH reported}}{\text{Percentage of stock on hand represented by those reporting}} = \text{Estimated SOH at end of the period}$$

Just as you did for the consumption data, document all of the assumptions and calculations that you did, including the rationale for the adjustment method chosen. Again, this calculation should not be at the facility level; instead, central level managers (or intermediate level, in some cases) should do this when they want to assess national stock status for a product.

Data for decisionmaking

Assessing stock status is one example of using data for decisionmaking: an assessment is made and appropriate action is taken. At higher levels, assessing stock status tells managers how stocks are moving through the system; bottlenecks in the system are more readily identified, and action can be taken. Managers can also review stock status to see how well storekeepers are complying with keeping their appropriate levels of inventory.

Stock status assessment is also a good example of looking at data using a systems approach—that is, looking at how all elements of the logistics cycle work together. The quantity and quality of your data tell you how your logistics management information system (LMIS) is functioning. The stock balance at each level tells you where stock is in the pipeline and can identify potential expiration problems. The stock level tells you whether facilities are keeping the appropriate quantities on hand. Problems with stock levels may also indicate transportation problems, management problems due to hoarding or rationing practices, and a variety of other logistics difficulties. Thus, stock status assessment can give you a quick view of how your system is functioning.

Chapter Summary

In this chapter, you learned the following:

1. The purpose of assessing stock status is to determine how long supplies will last.
2. Specific data—that is, stock on hand and rate of consumption—are needed to assess stock status.
3. The general formula for assessing stock status:

Stock on hand ÷ average monthly consumption = months of stock

To calculate months of stock, follow these four key steps:

1. Organize monthly consumption data for the product in chronological sequence.
2. Calculate your AMC:
   - add the most recent 3 months of data
   - divide the sum by 3 months
   - round this figure up to the nearest whole unit.
3. Collect your current stock-on-hand data.
4. Calculate your months of stock on hand:
   - divide stock on hand by the AMC
   - round this figure up to the nearest tenth decimal.

To determine the months of stock available at any level, given inventory and dispensed-to-user data, do the following:

1. Apply the general formula using the stock on hand for the level you want to assess.
2. For the AMC, use actual consumption data when possible and use the lowest level of issues data available when consumption data are not available.
3. Adjust reported data to account for incomplete reporting.

   To adjust consumption data, you can—
   - use consumption data from past reports
   - adjust incomplete data to estimate complete reporting (either by the percentage reporting or the percentage representative)
   - adjust for stockouts
   - substitute issues data from the lowest level possible
   - consider seasonality, if applicable; and adjust, if needed.

To continue learning about how to assess stock status at the local and national level, see session 3: Assessing Stock Status of the online training Lessons in Logistics Management for Health Commodities, at the following website: http://deliver.jsi.com/dhome/topics/organizational/distancelearning

4 • Maximum-Minimum Inventory Control Systems

Objectives

In this chapter, you will learn the following:

- purpose of an inventory control system
- key terms in inventory control
- details of three types of max-min inventory control systems and the rules for storekeepers for each system
- how to determine order/issue quantities
- how to set max and min stock levels
- the advantages of using a max-min inventory control system
- how to select the type of max-min inventory control system to implement.

4.1 Purpose of an Inventory Control System

Your home probably has a number of inventory control systems; for example, the milk in your kitchen. Think about the following questions:

- How much fresh milk do you keep in your house?
- How often do you buy milk?
- What is the lowest quantity of milk you want to have before you buy more?
- How much milk do you want to have at any one time?
- Do you consume milk regularly, or does your use fluctuate?
- How many people in your house consume milk? Does this ever change?
- Do you have any financial or other constraints when you purchase milk, such as limited supply or transport?

Although you can use any other household item in this example, milk is a good one to compare with health products. Like milk, health products are staple goods—you do not want to run out of them, and each may have many uses. For example, you can use milk at breakfast with coffee and throughout the day when you cook and bake. Likewise, antibiotics are used in a variety of treatments. Using milk as an example also demonstrates that simply having a large quantity of an item does not ensure that you will always have supplies; both milk and antibiotics may spoil (or expire) over time. Although you may not need to have a formal inventory control system for milk, when you drive, you need a more formal system for ensuring the car has fuel—in this case, a fuel gauge (see figure 4-1). The worst—and most preventable—thing is for your car to run out of fuel. Similarly, the worst thing that can happen in a health facility is to have a *stockout* (i.e., you run out of stock). The best way to ensure that you do not stock out in a health facility is to establish an inventory control system.

An inventory control system informs the storekeeper when to order or issue, how much to order or issue, and how to maintain an appropriate stock level of all products to avoid shortages and oversupply.

A vehicle's fuel gauge helps you maintain your stock level.

Figure 4-1: Fuel Gauge

While driving, you monitor your fuel consumption from time to time and decide when to purchase more gas. By assessing the supply status of the tank, you can calculate when to refuel and how much, depending on your destination (and perhaps your budget). Drivers often use the red warning area as an indicator of when to buy more fuel. In other cases, drivers replenish the tank on a specific day of the week, regardless of the level, adding enough fuel to reach *full*. In deciding on an approach, drivers are choosing a form of inventory control.

4.2 Key Inventory Control Terms

As we discuss inventory control systems, the following key terms are important:

max-min inventory control system. A max-min inventory control system is designed to ensure that the quantities in stock fall within an established range. Throughout this handbook, we use the term *max-min system* as an abbreviation for maximum-minimum inventory control system. Most successful inventory control systems used for managing health commodities are max-min systems of one type or another.

max stock level/max quantity. The max stock level is the level of stock above which inventory levels should not rise, under normal conditions. *The max stock level is set as a number of months of stock* (for example, the max level may be set at four months of stock). It indicates how long supplies will last.

The max stock level can be converted to the max quantity (for example, the max quantity could be 120,000 units). The max stock level is fixed, whereas the max stock quantity varies as consumption changes. The max quantity is calculated by multiplying the average monthly consumption (which can change) by the max level (number of months). For example, 100 bed nets (AMC) × 6 months = 600 bed nets—the max quantity.

min stock level/min quantity. This is the level of stock at which actions to replenish inventory should occur under normal conditions. As with the max, the *min stock level should be expressed in months of stock* (for example, the *min level* is one month of stock); it can then be converted to a quantity (for example, the *min quantity* is 30,000 units). The min stock level is fixed, whereas the quantity varies as consumption changes. Depending on the design of the max-min system, reaching the min may be the trigger for placing an order (often called the reorder level or reorder point). In some systems, reaching the min may be an indicator to monitor stocks carefully until the next order is placed, or the emergency order point is reached (as defined below).

review period/review period stock. This is the *routine interval of time between assessments of stock levels to determine if additional stock is needed***.** This term is also called the *order interval* or *resupply interval*, but review period is preferred because in some max-min systems, a review does not always result in an order being placed. Review period stock is the quantity of stock dispensed during the review period.

safety stock level. This is the additional buffer, cushion, or reserve stock kept on hand to protect against stockouts caused by delayed deliveries, markedly increased demand, or other unexpected events. The safety stock is expressed in number of months of supply, which can also be converted into a quantity.

lead time stock level. This is the level of stock used between the time new stock is ordered and when it is received and available for use. The lead time stock level is expressed in number of months of supply, or as a quantity.

emergency order point (EOP). This is the level of stock that triggers an emergency order; it can be reached at any point during the review period. The EOP must be lower than the min.

4.3 Three Types of Max-Min Inventory Control Systems

Three types of a max-min inventory control system are applicable to health commodity logistics systems: forced-ordering, continuous review, and standard.

As discussed earlier, an inventory control system is used to determine how much to order or issue and when to order or issue. For each of the systems, the same formula is used to determine how much to order or issue. The basic difference between the systems is the trigger for ordering or issuing, i.e., when the order should be placed or an issue made.

1. In a *forced-ordering system*, the trigger for ordering is the end of the review period.
2. In a *continuous review system*, the trigger for ordering is when the facility reaches the minimum level.
3. In a *standard system*, the trigger for ordering is the end of the review period for the commodities that are at the minimum level.

In the following sections we will review how to calculate order or issue quantities, when the order/issue should be made, and the design formulas for each of the three systems.

In this section, we will use the verb *set* when referring to the design of a max-min system, and *calculate* when referring to the routine implementation of the system. System designers *set* levels in a max-min system, and storekeepers *calculate* the quantities to order or issue.

4.4 Determining How Much to Order or Issue

No matter which inventory control system is used, the formula for calculating the order, or issue quantity, is the same. This is true whether the system is an allocation (push) system or a requisition (pull) system. In an allocation (push) system, the quantity to issue is calculated; in a requisition (pull) system, the quantity to order is calculated.

To calculate the order or issue quantity, storekeepers must be able to convert established stock levels (max and min stock *levels*) into the actual *quantities* of product needed. A storekeeper cannot, for example, send an order to the central warehouse for two months of stock of an item. The central warehouse would not know what two months of stock means.

The storekeeper should use the following formula to calculate the quantity to order or issue for each product—

Calculating Order or Issue Quantities
Max stock quantity − stock on hand = order/issue quantity

Where…

- max stock quantity = average monthly consumption × max stock level
- average monthly consumption = average of the quantities of product dispensed to users or patients in the most recent three months, as appropriate.

Note: See chapter 3 for a discussion of AMC.

Should quantities on order be included when calculating order quantities?

With a well-designed and well-functioning system, the facility should receive resupply before placing the next order, or before the next stock is issued. However, if a facility, for some reason, has not received the previous order or issue, but is positive that stock will arrive, they should subtract the quantities expected from the next resupply quantity. In this case, the formula for ordering should be:

Max stock quantity − stock on hand − quantity on order = order quantity.

Order calculation example (forced-ordering)

Imagine a health center where the storekeeper knows that his max level is three months and his emergency order point is one month. His review period is monthly, and it is the end of the month—time to order!

He calculates that his average monthly consumption (AMC) is 100 condoms/month. He then calculates his max quantity:

100 condoms (AMC) * 3 months (max level) = 300 condoms (max stock quantity)

At the end of the month, he has 200 condoms on hand. With this information he calculates his order quantity:

300 (max quantity) – 200 (stock on hand) = 100 condoms

Based on his calculations, he needs to order 100 condoms this month.

4.5 Determining When to Place an Order or Issue

The difference between the three inventory control systems is the trigger for placing an order or issuing resupply. This section reviews the rules for the three types of max-min inventory control system: forced-ordering, continuous review, and standard.

Forced-ordering max-min system

Even though this max-min inventory control system is called *forced-ordering*, this type of max-min system can be used in either a pull (requisition) or a push (allocation) system. In either a system, the forced-ordering max-min system action is done at the end of each and every review period—either a requisition is made by the facility, or a facility sends a report with data to help their supply source determine how much to allocate to that facility.

Storekeeper decision rule

In a forced-ordering system, the facility is resupplied based on the following decision rule:

Forced-ordering max-min system storekeeper decision rule

At the end of each review period, review all stock levels and order or issue enough stock to bring the levels up to the max.

Place an emergency order if the stock level for any item falls below the emergency order point before the end of the review period.

In a forced-ordering max-min system, storekeepers do not use the min, because they always take action at the end of the review period. The review period, then, is the trigger for ordering.

Storekeepers must be careful not to run out of stock. Therefore, in addition to applying the decision rule for ordering, they are given an EOP. Storekeepers will know that they have reached the EOP if they frequently assess stock. This is why, in systems that place orders quarterly, stock status should be assessed more frequently. The results of a stock status assessment alert the storekeeper to the need to place an emergency order for any item that has reached the EOP.

Advantages and disadvantages of forced-ordering max-min system

A forced-ordering system has both advantages and disadvantages:

- The storekeeper's decision rule is simple: order/issue every item at the end of the period.
- Because orders are placed at regular intervals (i.e., the end of each review period), transportation can be scheduled for specific times, making it easier to ensure the availability of transport resources.
- Every facility orders or is resupplied at the end of every review period.
- Because all items are ordered/issued at the end of every review period, storekeepers do not need to constantly assess stock status, unless they think a potential stockout is possible.
- One disadvantage of a forced-ordering system is that orders for some items may be for small quantities; because all items are ordered, regardless of the stock on hand.

Forced-ordering max-min system in Nepal

In 2002, Nepal's Ministry of Health decided to integrate the logistics system for more than 200 health products. This meant that different types of products would be ordered on the same order form and delivered at the same time.

In designing an appropriate max-min inventory system for the integrated logistics system, the MOH considered the reality of distribution in Nepal. Because some facilities are extremely difficult to reach (some require walking for 14 days), unpredictable timing of orders, as required by a continuous system, was not practical. Thus, the MOH chose a forced-ordering system with a quarterly review period. Under this system, facilities must order up to their max every quarter, but emergency ordering is possible if the stock level falls below the emergency order point at any time.

Because of the reduction in delivery frequency, lower levels needed to hold more stock on hand. To address this change in storage space requirements, the MOH is rebuilding the country's 75 district stores.

Forced-ordering variation: delivery truck system

One variation of a forced-ordering max-min system is the delivery truck system, sometimes called a *topping up* or *bread truck system*. It can also be called Vendor Managed Inventory (VMI) system. The rules for the storekeeper and the considerations for the designer are the same as for a regular forced-ordering system.

The difference between a regular forced-ordering system and a delivery truck system is the way the deliveries are made. In a delivery truck system, a truck is loaded with supplies at the end of the review period. The truck and a delivery team travel to each facility, assess the stock, and leave (top up) an amount of each product that is sufficient to bring stock levels up to the max at that location.

Delivery Truck Topping Up (DTTU) in Zimbabwe

The Zimbabwe National Family Planning Council uses a DTTU system to supply health facilities with condoms, contraceptives, nevirapine, and HIV rapid test kits. Under this forced-ordering delivery truck inventory control system, facilities do not place orders. Instead, delivery trucks, pre-loaded with estimated product requirements, visit 1,400 facilities quarterly to do stock accounting and reporting tasks, as well as to top up facilities to their max level. The DTTU system in Zimbabwe has significantly increased the availability of products at facilities; it has improved reporting rates while reducing the reporting burden on health workers.

Delivery truck systems can be either pull or push systems. In the former, the truck arrives, and the storekeeper completes the report/transaction record and orders from the truck. In the latter, the supervisor on the truck calculates the quantity to be issued and issues it from the truck. The supervisor may or may not complete the facility's report. In some cases, the supervisor and storekeeper complete the order form together. The difference for the designer is determining *who* should be trained to complete the order form—multiple storekeepers or just a few supervisors/delivery team members.

Advantages and disadvantages of the forced-ordering delivery truck system

The delivery truck system has several advantages over regular forced-ordering:

- The order is filled on the spot, so the facility does not have to hold quantities of stock while waiting for the next delivery. The lead time is zero, which lowers the lead time stock to zero. This lowers the min and, consequently, the max stock levels.
- Damaged or expired products can be put back on the truck for disposal (if this is the procedure for handling these products), taking advantage of space on the truck.
- The truck can be sent out with a full load of supplies, eliminating multiple small orders.
- The LMIS report can be completed and collected at the time of delivery. This is especially advantageous when reporting is delayed because of poor mail service, or when reporting is spotty because facilities lack postage funds.
- The training requirements are significantly less; only delivery team leaders need training, rather than all the facility staff.
- If a supervisor goes on the truck for deliveries, he or she can provide on-the-job training and supervision at the various stops. This is helpful when transport for supervision alone is difficult and higher-level managers want to ensure routine supervision.

The delivery truck system can also have certain disadvantages:

- All types of max-min systems rely on their delivery trucks. However, the delivery truck system is particularly vulnerable to breakdowns. If the truck breaks down, the whole system breaks down. Alternate transport for emergency orders must be available.

- A sufficient number of staff must be available in the office to complete logistics management and other duties while team leaders are away making deliveries.
- The system may require larger trucks, as trucks always carry more stock then they will actually deliver.

Automating data collection in delivery truck systems

Delivery truck forced-ordering systems can relatively easily accommodate technology that can help improve the speed and accuracy of stock calculations. Instead of using a piece of paper, pencil, and calculators, delivery team leaders travel with laptops, cell phones, or other handheld devices where they enter stock-on-hand data and max stock quantities, and reorder the calculated quantities. Automating data collection on the delivery truck also greatly facilitates the data entry process at the central level. Data can be transferred directly to a database to produce national level stock status reports.

Continuous review max-min system

Of the three types of inventory control, continuous review max-min inventory control is probably the *least* appropriate for most health programs; but when it is appropriate, it can be very effective. Comparing continuous review with forced-ordering max-min systems shows how small variations in design can change the way an entire system functions.

Storekeeper decision rule

In a continuous review system, the storekeeper is told when to order and how much to order based on the following decision rule—

Continuous review max-min system storekeeper decision rule

Review the stock level of each item every time you make an issue. If the stock level is at the min, or has fallen below the min, order enough stock to bring the level up to the max.

In a continuous review system—

- The review period is not fixed; a decision about whether to order is made each time a product is issued.
- The storekeeper must know both the max and min stock levels.
- The storekeeper does not need an emergency order point, because an order can be placed any time stock is needed.
- The storekeeper must assess stock status each time an issue is made. In a system with many items, this means that the storekeeper's workload increases; in a forced-ordering system, the storekeeper needs to assess stock status only when levels appear low enough to warrant an emergency order.
- The storekeeper must be able to order (pull) stock from the higher level, because the storekeeper is the only one who can determine whether the min stock level has been reached. A continuous review system must be a pull system.

Advantages and disadvantages of continuous review max-min system

Continuous review inventory control has both advantages and disadvantages.

Advantages include—

- The storekeeper's decision rule is simple.
- The system is more responsive and flexible because orders can be placed at any time.
- Small orders are eliminated because stock levels are at the min when an order is placed.

Disadvantages of a continuous review system include—

- Transportation resources are harder to schedule because orders can be placed at any time; a single facility can order pills one day, condoms the next, and HIV test kits the following week.
- In facilities with a large number of products, or a great deal of activity, the storekeeper's job is harder because the stock status must be assessed every time stock is issued.

Continuous review system variation: two bin

One variation of continuous review max-min systems is the two bin system. In this case, the rules for the storekeeper and considerations for the designer are the same as for any other continuous review system.

The difference between a regular continuous review system and a two bin system is the way the storekeeper determines when the min has been reached. In the two bin system, the storekeeper has two equal-sized bins (containers, boxes, cartons, sacks, or other receptacles) of each individual product (i.e., not a kit of products). When the first bin is empty, the min has been reached. An order is placed for another bin (i.e., a bin's worth of stock), and the storekeeper begins issuing from the remaining bin. The arrival of a new bin brings the stock level up to the max. The two bin system is designed to be extremely simple for the provider. The provider does not need to make calculations and paperwork is minimal. In an even simpler version of the two bin system, an order form is included at the bottom of each bin; the provider only needs to sign and date the form before posting it.

A two bin system designer's most challenging task is to choose an appropriate bin size. The min is equal to one bin, and the max is equal to two bins; but because the bin size is fixed, bins may need to be replaced more frequently, if demand increases. The bins must allow for some expansion in the program without risking product expiration.

If the stock level for any item falls below the emergency order point before the end of the review period, place an emergency order.

Two bin continuous review for community-based distribution (CBDs)

Two-bin systems have enormous potential for use in CBD programs. Many health programs train local community members (often volunteers) to be CBD agents. Historically, CBD agents only supplied family planning products such as condoms and pills, referring customers to local clinics for injectables, IUDs, and sterilization. This made the two-bin system ideal because the family planning programs try not to overburden counseling and promotion activities with complicated forms and calculations. Two-bin continuous review systems, in these scenarios, can be appropriate for CBD programs.

However, as CBD agents begin to distribute more and more products, including injectables, antimalarials, rapid diagnostic tests, etc., the two bin system may not be as appropriate. Remember—where transport is limited or products are numerous, two-bin continuous review systems generally are not used! When designing an inventory control system, remember that CBD agents usually have limited access to resupply.

Advantages and disadvantages of continuous review two bin max-min system

Advantages:

A two bin-system require less training than a normal pull systems because the only trigger to order is an empty bin. No calculations are required and paperwork is minimal.

Disadvantages:

If consumption for products is not stable, the bin size must be continually reviewed to ensure that CBDs are not overstocked or understocked on commodities.

Standard max-min system

Theoretically, the standard version of the max-min system is the most effective because it combines the decision rules of both forced-ordering and continuous review and, therefore, shares the advantages of both. However, it also has disadvantages. Under some circumstances, the standard version may be the only choice. To understand why, we need to discuss both the implementation and design of standard max-min systems.

Storekeeper decision rule

In a standard system, the storekeeper is instructed when to order. or when supplies should be issued and how much to order/issue, based on the following decision rules—

Review all stock levels at the end of each review period. For products that are at or have fallen below the min, order/issue stock quantities up to their max levels.

In a standard system—

- When to make an order or issue new stock is based on the min stock level and the review period. This means that the storekeeper must know the min, max, and review period.
- The storekeeper will need an emergency order point to ensure that a stockout does not occur between review periods.
- The storekeeper must assess the stock status at the end of each review period and at any time levels appear to be low enough to warrant an emergency order.

Advantages and disadvantages of standard max-min system

A standard system has advantages and disadvantages.

Advantages:

- Small orders are eliminated because an order is placed only when stock levels are at or below the min.
- In programs with many products, standard systems eliminate the need to assess stock status continually (as in continuous review) and to reduce the number of calculations that must be made because fewer products will be ordered or issued than in forced-ordering.
- Because orders are placed at regular intervals (i.e., at the end of each review period), transportation can be scheduled for specific times, making it easier to ensure the availability of transport resources.

Disadvantages:

- The primary disadvantage of a standard system is that the min stock level is higher, increasing the likelihood of expiry and requiring more storage capacity, both of which mean increased costs.
- Storekeepers must learn the max, min, and EOP; know how to assess stock status; and be able to calculate the order or issue quantity. More training for the storekeepers may be required because their decision rules are more complex.

4.6 Setting Max-Min Levels

For any max-min system, you should set the max and min levels high enough to avoid stockouts, yet low enough so you do not increase the risk of expiration or damage. It is possible, and actually likely, that the stock balance will, at times, go below the min; but, ideally, it should never go below the emergency point. To achieve this, you must set a min level high enough to ensure that the facility never completely runs out of stock. At the same time, you must still set the max low enough to ensure that space in the storeroom is adequate and that the stock does not expire before it can be used.

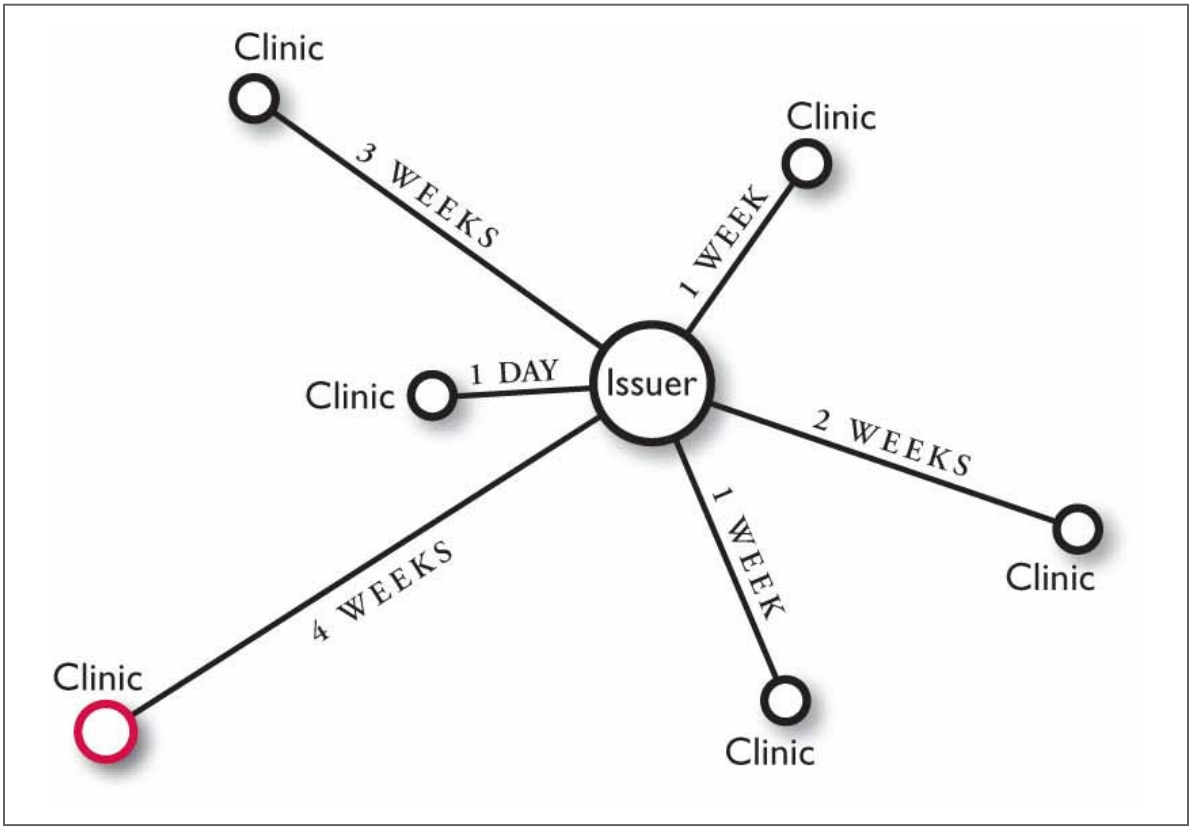
The goal is to avoid stockouts of essential health products. Moreover, the system should ensure that emergency orders are rarely placed, because such orders are time-consuming and, generally, expensive to fill.

You begin the process by setting your min stock level. To set your min, you must determine three key components: lead time, review period, and safety stock.

Step 1. Determine your lead time

Lead time is one of the most important determinations for a system designer to calculate; it is the time between when stock is ordered or issued and when it is delivered and available for use. The lead time stock level, therefore, is the number of months of stock used after an order is placed, or an issue determined, and before you receive the new order. The min clearly must include the lead time stock level, because you will need stock to distribute after you place an order, or send a report that will be used to calculate an issue, and are waiting for it to come in. If it takes a month from the time you place an order until you receive and unpack your new stock, the min must be at least one month. (see figure 4-2.)

Figure 4-2: Lead Times



Because lead times are variable, accurately calculating the lead time stock level can be difficult. As a designer, you could calculate the lead time stock level to equal the average of the lead time levels for the past two or three review periods, for the average facility. Determining the average can be tricky. If you used the lead time for urban health facilities last month, for example, to set the lead time stock level for district-to-facility deliveries, the level may not be appropriate for rural facilities. Instead, you should use an average for all facilities at the same level, if lead times are not substantially different among facilities. When in doubt, assume your lead time is longer. Lead times should be determined for each level in the pipeline.

Consider, however, a system for which transport is not routinely available, or where weather conditions (e.g., a rainy season) make selected roads impassable. In such situations, the designer must use the longest lead time observed between the two least-reliable facilities, or some facilities will stockout. This will ensure that, under almost every conceivable situation, a stockout will not occur. But, increasing the lead time stock level increases the min and, ultimately, the length of the pipeline.

Step 2. Set the review period

This handbook defines a review period as the routine interval of time between assessments of stock levels to determine if an order should be placed or an issue of resupply made.

In some programs, the system designer cannot set the review period. It may be based on existing government review periods, or it may coincide with the reporting period, usually monthly or quarterly. Gathering data for a routine report is usually an excellent opportunity to assess the status of supplies and order or issue supplies.

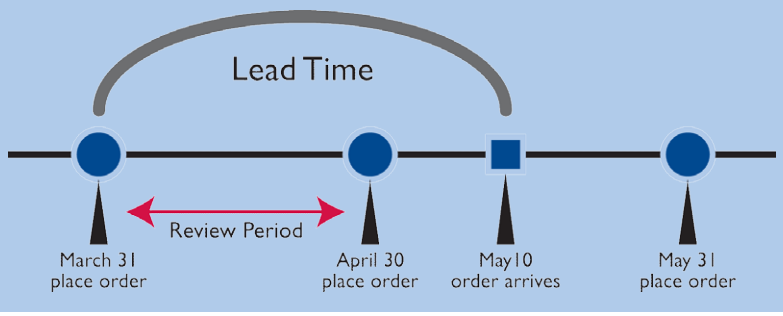
Reporting periods may be more frequent than review periods. For example, a clinic may send reports in monthly, but only place orders quarterly. This is the case when it is difficult to resupply clinics more often—for example, when transportation and road condition difficulties occur.

In designing a max-min system, it is recommended that you use reporting periods as the review periods. By linking reporting and ordering, logistics managers are more likely to receive the information needed for central-level decisionmaking. SDPs are more likely to send in their reports when they get something in return (i.e., resupply commodities). The value for reporting is seen when commodities are supplied.

Remember, in a continuous review system, the trigger for ordering is when products reach their min stock level (not the end of the review period). So, even though from the storekeeper's point of view, there is no fixed review period; as a system designer, you want to set a review period about as often as you would like to have orders processed. For example, orders should not be placed as often as weekly, nor as infrequently as once a year. As the designer, you should choose a desired review period to factor into the min. The desired review period is also used to help set the safety stock, if no better information is available.

Always set the lead time as shorter than the review period

We recommend that you set the lead time shorter than the review period. Consider a system in which health facilities order monthly, but supplies are not available for use until five weeks after they are ordered. The result is that you place your next order before the first order arrives.



Step 3. Set the safety stock

Safety stock helps protect against any unplanned situations, such as delays in deliveries, increased consumption, or product losses, including theft or expiry. Other terms for safety stock include *security stock* or *buffer stock*. The safety stock level is one of the most important decisions the system designer must make. How should the safety stock level be set?

Safety stock is the buffer, cushion, or reserve stock kept on hand to protect against stockouts that are caused by delay in deliveries, increased consumption, or product losses.

As a general guideline, the safety stock level should equal at least half of the review period.

Safety stock ≥ ½ review period

How high should the safety stock be? Only the designer and personnel in the system assessing confidence in the system can determine this. Personnel must believe that the safety stock is sufficient to prevent a stockout, or they may begin to order more stock than they actually need. When demand is stable, and the logistics system functions well, the safety stock can be lower because there is less uncertainty. When demand is unstable, or the logistics system does not function well, the safety stock level should be set higher. In a new system, the designer should set the safety stock higher, monitor the system's performance, and lower the safety stock, if possible, as data on actual fluctuations in demand and supply become available. Remember, however, that setting a higher safety stock increases the quantities kept in stock, which, in small warehouses, may result in expired or damaged products. Having higher safety stock also means that more financial resources are being held in inventory.

Step 4. Set the minimum

After determining the lead time, setting the review period, and setting the safety stock, you can now set the min stock level. Remember, the min stock level should approximately equal the stock level you want the facility to have at the end of a *normal* review period. Set the min high enough to account for the normal lead time needed to replenish stock and to cover unexpected delays and uncertainties in the logistics system. Take into account the following factors:

- Lead time may be variable.
- Consumption may be higher than expected, therefore you may need additional stock.
- Deliveries may be late.

The formula for setting the min stock level for forced-ordering and continuous review is the same. There is a special consideration for standard systems, which is discussed below.

For forced-ordering and continuous review max-min systems, the formula for setting the min stock level is as follows:

Min level formula (forced ordering and continuous review)

Min stock level = lead time stock level + safety stock level

For a standard system, the formula for setting the min is a little different. In the standard system, orders are placed at the end of the review period, but only for products that have reached the min. If a store is just above min, you would not place an order at the end of the review period, and you would not have another chance to order until the end of the following review period. Consequently, the min must be set higher. For the standard system, the formula for setting the min stock level is as follows:

Min Level Formula (standard)
Min stock level = lead time stock level + safety stock level + review period stock level

Do storekeepers need to know the min? To answer this, think about the triggers for ordering/issuing in each of the systems.

- In a forced-ordering system, storekeepers do not need to know the min, nor are they concerned about what it is. They only need to bring the stock level up to the max at the end of the review period. Why, then, establish a min in a forced-ordering system? First, you, as the designer, determine the max based on the min, as described below. Also, the min is the stock level you would like the facility to have on hand at the end of a normal review period—that is, a review period when nothing unexpected has occurred. It must be high enough to prevent stockouts when unexpected consumption or other events occur.
- In a continuous review system, the trigger for ordering is when products hit the min stock level, so the storekeeper definitely needs to know the min.
- Similarly, in a standard system, the trigger for ordering or issuing is at the end of the review period, but only for the products that have reached min. Therefore, the storekeeper must know the min.

Step 5. Set the maximum

After the min has been set, setting the max is relatively easy. The formula for setting the max is—

Max Level Formula
Max stock level ≥ min stock level + review period stock level

Emergency Orders

An emergency order should be just that—an order placed only when a realistic possibility of stocking out exists. Emergency situations are not normal; rather, they are the exception. When a max-min system experiences frequent emergency orders, the system design and stock levels should be reviewed and probably reset.

A small number of emergency orders may occur, particularly in places where disease patterns vary widely, or when the onset of an epidemic cannot be predicted. A lack of communication between program managers and storekeepers can also result in emergency ordering. For example, scheduling a condom promotion campaign without notifying the storekeeper could trigger an emergency order because of the additional supplies.

When an emergency order is placed, storekeepers should order the quantity required to reach the max level, not just enough to last until the next review period. This may not be possible in some situations. For example, if the emergency order is delivered by motorcycle, the quantity cannot be as large as for a regular delivery by truck.

You set your min previously, and your review period is fixed (probably monthly, bimonthly, or quarterly). Simply add the two to find the max. The *greater than or equal to* symbol (≥) indicates that you may want to set the max level higher than the sum of the min and review period stock level, when it is logically and economically sensible to store a larger quantity at a specific level in the system.

Step 6. Set the emergency order point

As a system designer, you should set max and min levels high enough to avoid stockouts yet low enough that you do not increase the risk of expiration or damage (if the warehouse is too full, the risk of damage increases). On rare occasions, however, a facility may find itself very low on stock before it is time to place a routine order. When stocks reach the emergency order point (EOP), the storekeeper should place an emergency order.

The EOP should not be set to equal the min, because the min includes the buffer stock. The EOP could be as high as the lead time stock level if urgent orders take as long to process as a routine order. In most cases, however, it should be possible to issue stock faster than normal in urgent or emergency situations. This is called the *emergency lead time*.

The EOP is defined as—

Emergency order point ≥ longest emergency lead time

To avoid a mistake in timing the delivery of an emergency order, the designer should set the EOP equal to or greater than the longest emergency lead time.

Imagine that you are designing a max-min inventory control system in a hypothetical country. You first determine what the lead time is and then tabulate the time of each of the steps in the process for a facility submitting an order up to the time they receive the resupply. You determine that—

Lead time = 1 month

After determining that lead time is one month, you know that the review period must be greater than the lead time, as facilities must be able to receive their resupply before submitting the next order. Knowing this you decide that—

Review period = 2 months

No other information is available to guide you into setting the safety stock level, so you decide to set the safety stock at one-half the review period stock or one month.

Safety stock = 1 month

After setting the lead time, the review period, and the safety stock, you are now ready to set the min and max stock levels for the facility.

Decimal dilemma: Safety stock and lead time

When setting the lead time or safety stock, your answer may include half, or some other portion, of a month. For example, when review periods are quarterly (every three months), the safety stock level is set to at least one and a half months of stock. Therefore, if the lead time is one month, the min will be two and one-half months. It is difficult to work with partial months, however, and difficult to teach storekeepers decision rules based on partial months.

The best solution is to add lead time and safety stock and then round up to the next full month.

For example:

If the average lead time is three weeks, and the safety stock level is four weeks, the min = 1.75 months. For ease of use, round this number up to two months. It is unlikely that the additional stock will to be enough to affect the overall system.

4.7 Two Design Issues for Inventory Control Systems

Two questions arise when designers set up an inventory control system.

1. How long should you allow the pipeline to be?

   …and…

2. Should you establish different max-min systems within the same level?

Analyzing the overall pipeline length

Setting max-min stock levels for each level of the system may result in a lengthy pipeline. For example, consider a situation in which the max-min levels are as depicted in table 4-1.

Table 4-1: Sample Max-Min Levels

LEVEL	MINIMUM	MAX
Central	6	12
Regional	5	9
District	3	6
SDP	2	3
Total	**16**	**30**

This analysis suggests that it may take as long as 30 months (two and one-half years) for a product to reach a customer after it has entered the country. Add to this the time from the manufacturer until the product has cleared the port and is placed in the central warehouse ready for distribution. The product could easily be more than three years old by the time the customer receives it.

Depending on the product, this could be the maximum time a product can be kept in storage. For essential medicines, a 30-month in-country pipeline is unacceptable, because some products have a shelf life as short as six months.

Pipeline length and shelf life

Some malaria rapid diagnostic tests (RDTs) have a 12-month shelf life. As a result, the in-country pipeline for RDTs must be relatively short to ensure that the tests reach the customer in the right condition.

Solutions to this dilemma include—

- *Shorten the review periods at one or more levels.* This will reduce the pipeline length by reducing the max. (Remember that max ≥ min + review period.) Shorter review periods, however, mean that resupply happens more frequently, increasing the frequency of delivery and, perhaps, requiring additional transportation. Calculating order or issue quantities will also require additional labor. The review period can only be shortened if the designer can be certain that the shortened review period is still longer than the lead time, and that personnel can manage the increased workload.
- *Reduce the lead time at one or more levels.* Lead time is often extended by administrative requirements, such as obtaining signatures and approvals. Reducing the lead time reduces the min and max levels. System designers cannot, on their own, arbitrarily shorten the lead time from six weeks to four. To reduce the lead time, you must change the processes.

- *Improve reliability in the system to reduce safety stock levels*. Safety stocks are kept primarily because of uncertainty about the system's ability to provide routine service (i.e., uncertainty about either supply, or demand, or both). If you can reduce the uncertainty, you will be able to reduce both min and max levels. This is more easily said than done, however.
- *Eliminate an entire level from the supply chain*. This will result in a large resource savings and is probably the single most effective method to reduce the pipeline. For example, eliminating the regional level in this example immediately reduces the total pipeline length by nine months. An additional burden is placed on transportation from the central level to the districts, however, and the supervision burden of the central level may be increased. When a level is eliminated from the pipeline, it does not necessarily stop playing a role in the management of the system. Politically, it may be a difficult to eliminate a level in the system. Government units, such as regions, may hesitate to yield control over valuable commodities; yet, where the pipeline is too long, eliminating a level may be the only appropriate solution.

Eliminating a system level in Kenya

To reduce the pipeline for contraceptives and essential medicines, Kenya's MOH eliminated the management function of the regional level. All eight regions continue to hold supplies, but the central level, which uses the regional depots as satellites for its delivery-truck system, manages these supplies. By eliminating the administrative steps at the regional level, lead times are reduced significantly.

Mixing max-min systems and levels

Max-min systems could be implemented in a variety of ways by doing the following:

- Recommend using different types of max-min systems at different levels—for example, standard for central to district and forced-ordering for district to clinics.
- Recommend using different max-min levels for different facilities at the same level—for example, a six-month max for rural clinics and a three-month max for urban clinics.
- Recommend using different max-min levels for different products within a facility—for example, a three-month max for ARV medicines and a six-month max for contraceptives.

Such strategies, however, have consequences that the system designers must be aware of and comfortable with—

- Managers at the next level up (e.g., district level) may find it extremely difficult to manage facilities with different rules, systems, and levels.
- In pull systems, training for lower-level facilities is more complicated if the max levels are different for each facility.
- Ordering forms work best when the formula for ordering can be printed on the form. With different max-min levels, this can be challenging. For example, if some facilities establish their max quantity as AMC × 4 months and others as AMC × 3 months, you would not be able to write both of those options in one column heading of a form. Likewise, writing AMC × max stock level may not give the facility enough information to complete the calculation.
- You could set the safety stock level for rural clinics higher than that for urban clinics, resulting in higher min and max levels for rural clinics. This means that more financial resources are tied up in inventory, and more storage space is needed. Higher minimums and maximums may increase the potential for products to expire.

An important exception to mixing systems is CBD programs, for which a two bin continuous review system is sometimes recommended, because it is a relatively simple system and does not complicate inventory control procedures elsewhere in the system.

It can be recommended that some levels be push and others pull—for example, pull from central to district, and push from district to facilities. In chapter 1, we suggested that facilities at the *same* level—for example, facilities—should not be both push and pull; however, *between* levels, different push and pull systems can be recommended when appropriate. Some logistics systems are designed as pull systems from the central level to the level above the delivery point, where the system then changes to a push system. This allows service delivery staff to focus on serving customers, while staff at higher levels are responsible for determining what quantity to issue.

4.8 Selecting an Appropriate Max-Min System

To implement a max-min inventory control system, you must select from five choices, including—

1. forced-ordering
2. forced-ordering/delivery truck
3. continuous review
4. two bin continuous review
5. standard.

Your selection is critical to the success of the logistics system. In addition to selecting a system, you need to set the max and min levels and determine whether each level should be a push or pull system.

The following factors should influence your decision on the appropriate max-min system—

The number of items managed by your program

More than any other factor, the number of items managed will influence your choice of an inventory control system.

- For a system that manages only a few items (one or two), and if the consumption of those items is relatively stable (i.e., it is not a new or rapidly expanding program) two bin continuous review may be appropriate.
- For a system that manages a large number of items (more than 100), however, a continuous review system would be difficult to manage without making transport impossible. A standard system works better, because the number of orders placed will be lower than for any other system, and the timing of the orders will be fixed. A forced-ordering system is usually impractical for a large number of items; many items would be ordered, and many of those orders would be for small quantities.
- For a system that manages a small number of items (perhaps 1–20 items), a forced-ordering system is probably the most appropriate, because it is not difficult to calculate 20 order quantities. There is usually no particular advantage to using a standard system for a small number of items, and as you have seen, stock levels are much higher in a standard system. A continuous review system would work for a small number of items, but only where reliable transportation is available and inexpensive.
- For a program managing many items (between 20 and 100), your selection depends on many factors, such as the quantity and quality of transport and storage, who is best equipped to make calculations, how well supervision is carried out, and other factors discussed below.

The type of products managed

Designers must consider the types of products managed by the program. Going through a segmentation process might be helpful for certain designers. *Segmentation* is a process of reviewing and analyzing product and customer characteristics to identify commonalities and then organizing the supply chain into segments to best respond to customer needs or product requirements. Not all products are the same and not all customers are the same; supply chains managers need to take this into account. Certain product characteristics can influence the type of max-min system selected.

- **Seasonality of disease or unpredictability of demand.** For products with seasonal consumption, a continuous review system may work best to ensure that products are not always ordered unless they are at the min level.
- **Bulkiness of a product.** For products that are particularly bulky, for example insecticide-treated bed nets, a standard system may not be the most appropriate. These products need higher min and max stock levels, which require more storage space.
- **Shelf life of a product.** For products with an extremely short shelf life—for example, laboratory reagents with a shelf life of three months—a standard system may not be the best, as the min and max stock levels are higher, requiring more inventory to be kept, which could increase the chance of products expiring.

The quality and quantity of transport available

Transport availability should be your second consideration in selecting a max-min system. If transport is always available, and the infrastructure (e.g., roads and bridges) good, a continuous review system may be feasible. When transport is limited, either a forced-ordering or standard system is best, because it is easier to make transport available for scheduled times (and to schedule routine maintenance). With limited delivery schedules, you may also be able to *piggyback* or share transport resources with other programs—for example, delivering contraceptives and vaccines at the same time.

The level of investment in/commitment to capacity building and training

Any max-min system will require some training at all levels of the service delivery system. The training requirements, however, may determine the kind of system you implement. For example, at the facility level you may want to keep service providers focused on service and not on extensive calculations and stock assessment. You must first decide on a push or pull system. Pull systems require more training at all levels, especially at the facility level because they are placing the orders. You may elect, therefore, to have a push system, and either use a forced-ordering or standard max-min system. A delivery truck forced-ordering system requires significantly less training investments because the delivery teams receive most of the training. The health facility staff only need to know when the truck will be arriving and the basic stock recordkeeping skills.

The current or expected level of reporting

In forced-ordering and standard systems, reports may come in regularly with orders; in continuous review systems, reporting may not be on a fixed time schedule. Regular reporting can be used as a supervision tool: if a report is submitted on time, the facility tells you how it is doing. In a forced-ordering delivery truck system, you dramatically improve reporting rates from the level to which you are delivering, because you collect and complete the reports during the delivery. Where reporting systems are poor (e.g., limited or slow postal service and/or having to rely on personal deliveries or expensive express package services), the delivery truck system helps improve reporting.

Whether an allocation (push) or requisition (pull) system is best

Your decisions about allocation or requisition help determine your choice of max-min systems. To implement a requisition system, you need staff with the ability and motivation to make the appropriate calculations. At the service provider level, the system should be as simple as possible to keep providers

working with customers rather than filling out forms and making calculations. If you decide to use an allocation system, you cannot choose continuous review. An allocation system will mean more extensive training for the upper level, because they do all the calculations for their supervisees, and they have to understand how to use the data they are receiving to do the calculations. In some systems, lower levels are expected to pick up supplies regularly from higher levels. In such cases, the difference between allocation and requisition is blurred, because the lower and higher levels may calculate the order together.

The supervision system

A delivery truck system helps reinforce supervision because the supervisor arrives with the supplies. This requires additional supervision resources, however, because supervisors must be out of the office for extended periods. Forced-ordering also forces routine reporting, which allows supervisors to check math errors and changes in consumption. In a standard system, if no products are needed, a report might be skipped. The same is true in continuous review. It is difficult to supervise outlets that are not visited regularly and do not report regularly; absence of information is not a positive sign.

The availability of storage space

A standard system requires the most storage space, because the min and max levels are higher. The lead time in the delivery truck system is zero, so the min will be lower and will require less space. For two bin continuous review systems, the designer must be careful when selecting the bin size; they may need to create custom (and perhaps expensive) *bins* for storage. Forced-ordering and continuous review systems require similar amounts of storage space.

The factors involved in selecting max-min systems are summarized in table 4-2:

Table 4-2: Factors for Selecting a Max-Min Inventory Control System

FACTOR	FORCED-ORDERING	FORCED-ORDERING DELIVERY TRUCK	CONTINUOUS REVIEW	TWO-BIN CONTINUOUS REVIEW	STANDARD
Number of items	Few to a small number	Few to a small number	Few	Few	Many
Transport	Needed only at fixed times	Needed only at fixed times	Needed continuously	Needed continuously	Needed only at fixed times
Training	Staff at all levels must be well trained	Staff receiving supplies do not need as much training	Staff at all levels must be well trained	Staff receiving supplies need not be trained or have good literacy skills	Staff at all levels must be well trained
Reporting	Report required with each order helps improve data submission	Ensures that completed reports are actually picked up	May not receive reports often	May not receive reports often	If no items are needed, no report is submitted
Push or pull	Either	Either (usually push)	Must be pull	Must be pull	Either
Supervision	From reports only	Opportunity to include with delivery, but requires more supervisors	From reports only; irregular	From reports only; irregular	From reports only
Storage	Neutral	Lead time is zero, so less room is needed	Neutral	Requires creating numerous "bins"	Extra room needed for additional buffer stock

Choosing a system

Consider a logistics system with the following characteristics—

The logistics system consists of one central warehouse, 50 districts, and 1,000 clinics.

- Almost 30,000 community-based distributors (CBD) agents report to the district level.
- Contraceptives, malaria products, and essential medicines are distributed in this system, with some equipment.
- CBD agents handle only two products: condoms and antimalarials (ACTs).
- Training was conducted two years ago, but only for the central and district levels.
- Mail service is good, but transport is limited, as is the transport budget.
- Reporting from the district to the central level is good.
- Districts report aggregated clinic data, in addition to a separate report for the district store, making it unclear what percentage of clinics report regularly.

Given these factors, we know that—

- Continuous review is inappropriate because transport is limited.
- A standard system would work, but its higher level of safety stock is not warranted for the CBD level, especially because there are only two products.
- Each district has about 600 CBD agents. Therefore, the two bin continuous review system would be most appropriate for the CBD level. Preferably, CBDs should report to clinics rather than to the district.
- For the rest of the system a forced ordering system is the most appropriate. It should be a push system from districts to clinics, because clinic staff are untrained and should focus on service delivery. The system could be pull or push from the central level to districts, but a pull system is probably better, given the large number of districts.

Chapter Summary

In this chapter, you learned the following:

1. An inventory control system is used to inform the storekeeper (a) when to order or issue, (b) how much to order or issue, and (c) how to maintain an appropriate stock level of all products to avoid shortages and oversupply.
2. Key terms in inventory control include the following:
   - max-min inventory control system
   - max stock level/max quantity
   - min stock level/min quantity
   - review period/review period stock
   - safety stock level
   - lead time stock level
   - emergency order point.
3. The three types of max-min inventory control systems use different triggers for ordering for storekeepers—
   - **forced-ordering.** At the end of each review period, review stock levels of all products and order/issue enough stock to equal the max level.
   - **forced-ordering delivery truck system.** At the end of each review period, the delivery truck arrives, stock levels are reviewed and products are resupplied to the max level.
   - **continuous review.** Review the stock level for an item every time a product is issued. If the stock level is at or has fallen below the min, order enough stock to equal the max stock level.
   - **continuous review two bin system.** Order another bin of the product when the first bin is finished; the product in the second bin is dispensed while awaiting the new bin.
   - **standard.** Review stock levels for all products at the end of each review period. For products that are at or have fallen below the min, order enough to equal the max stock levels.
4. How to determine *order quantities* using any max-min system:

   Max stock quantity − stock on hand = order quantity

   …where…

   Max stock quantity = average monthly consumption (AMC) × max stock level (in months)
5. To set the min stock levels**—**

   Forced-ordering and continuous review:

   Min stock level = lead time stock level + safety stock level

   Standard:

   Min stock level = lead time stock level + safety stock level + review period stock level

   When no better information is available:

   Min safety stock level = ½ review period stock
6. How to set the max stock levels:

   Max stock level ≥ min stock level + review period stock level
7. Emergency order points for all three max-min systems should be greater than or equal to the longest emergency lead time, but should not be equal to the min.

8. The advantages of using max-min inventory control include—
   - avoids overstocking and minimizes wastage
   - avoids understocking and stockout
   - simplifies inventory control decision making
   - aids forecasting when there is a consistency of stock levels
   - facilitates standard supervision in a system when everyone uses the same decision rules
   - improves training of storekeepers to follow one rule
   - streamlines job for storekeepers with only one, relatively simple rule to follow
   - increases confidence of storekeepers and service providers that stockouts will not occur, reducing the likelihood that some facilities will hoard (over order) supplies.

9. To select the appropriate max-min system, consider the following factors when you make your decision—
   - number of items managed by your program
   - quality and quantity of transport available
   - investment in/commitment to capacity building/training
   - the current or expected level of reporting from health facilities
   - conclusion about whether a push system or pull system is best
   - supervision system.

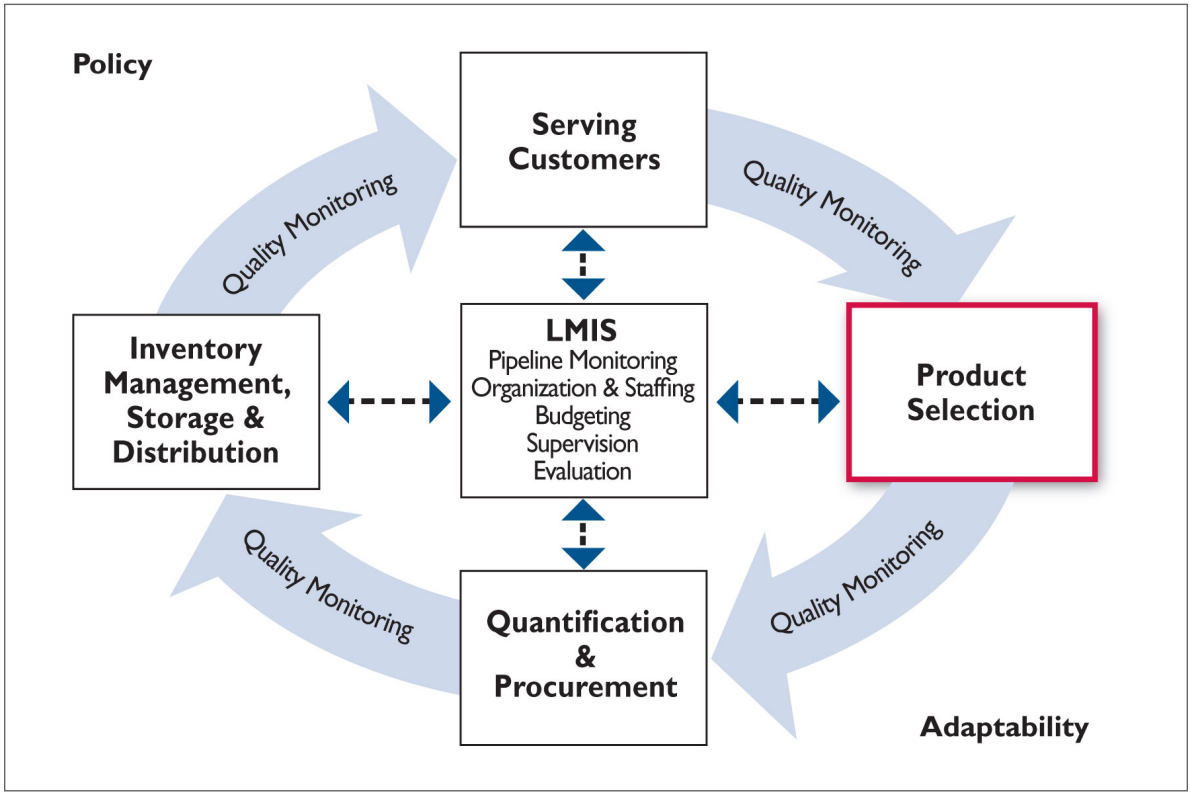
To continue learning about inventory control systems for health commodities, see session 4: Max–Min Inventory Control Systems and session 5: Selecting Max-Min Inventory Control Systems of the online training Lessons in Logistics Management for Health Commodities at this website: http://deliver.jsi.com/dhome/topics/organizational/distancelearning

Objectives

In this chapter, you will learn the following:

- definitions of key terms in product selection
- overview of the product selection process
- supply chain considerations and other criteria for product selection
- how product selection impacts the rest of the supply chain
- importance of standardization of laboratory equipment and supplies for product selection.

Figure 5-1:The Logistics Cycle



5.1 Purpose of Product Selection

Product selection, a key element of the logistics cycle, is directly linked to serving customers by defining what products are procured and used in the health system and the range of products that a customer can receive (see figure 5-1). Limiting the variety of products that are used and available at public sector facilities can make the supply chain more manageable. With a designated list of products, the staff at the central warehouse can become more familiar with the products, can ensure that they meet the needs of the program, and can monitor and maintain stock levels of all products throughout the system. Selecting products enables the development and implementation of a national coordinated logistics system, and allows for the redistribution of products throughout the system. Prioritizing particular products can be a tool for supply chain managers to ensure availability of those products. Product selection facilitates access to more affordable commodity prices through economies of scale and reduction of cost for some supplies, because a larger quantity of a smaller number of products is required. Selecting products is a prerequisite to quantification, because it identifies the products that should be quantified.

In general, when building a product list, it is best to keep the number of stockkeeping units (SKUs) to as few as possible, while providing an acceptable level of service. Fewer products enhance the agility, manageability, and efficiency of a supply chain. It means fewer items to store, distribute, and track. Dealing with a fewer number of options is also easier for health care providers. It means they have fewer products to learn about and have more experience with those with which they work.

Defining a product—What's in a stock keeping unit (SKU)?

Products are assigned an identification number or SKU, based on their characteristics, such as medicine, brand, size, color, etc., which facilitates their management. For example, paracetamol will be given a unique SKU based on its form, dosage and pack size. The information needed to identify a unique product is—

Product name + dosage + form + unit size.

For example:

Paracetamol 500 mg tablet 1,000/bottle

The unit should be stated in the smallest form issued to the facility; even if bottles of 1,000 tablets come in packs of 10, the SKU would represent one bottle and the facility would request 10 bottles rather than one pack of 10 bottles.

Fewer SKUs may also have a financial benefit. Managing fewer numbers of products requires less effort in stockkeeping and information management, and may have an impact on warehousing and distribution costs, as well. Savings can also be realized in the procurement process—buying fewer products, but in greater quantities, could result in reduced unit price.

The product selection process is informed by local policies and guidelines. Products are selected from or become part of a national essential medicines list (EML) and are based on standard treatment guidelines (STGs); products must be registered for overall use in-country. The next section discusses product selection in each of these three components.

5.2 National Essential Medicines List

An NEML describes the medicines that satisfy the priority health care needs of a population, and are approved for use throughout the country. It can cover commodities ranging from malaria and asthma medicines to family planning products and diarrhea treatments. Often, countries develop EMLs for different levels of care in the health system, based on disease patterns commonly treated at each level. For example, not all disease conditions are treated at every facility in the country. Antiretroviral treatment may not be provided in the rural health center, but may be available at the district hospitals and higher levels.

The essential medicines list specifies the medicines that should be used to treat different conditions. To be included on the national EML, a product should be—

- relevant to the local disease patterns
- proven to be of good quality, effective, and safe
- cost effective when considering total treatment cost.

The World Health Organization (WHO) model essential medicines list is published every other year; it is a reference for developing essential medicines lists and is available at www.who.int For a detailed look at drug selection, see chapter 10 in Management Sciences for Health's *Managing Drug Supply: The Selection, Procurement, Distribution, and Use of Pharmaceuticals (1997)*.

The committee that develops the national EML may be primarily comprised of doctors, pharmacists, and ministry officials. Including a supply chain manager on this committee adds a needed perspective on how their selections could impact the supply chain and, eventually, product availability. For example, product characteristics, such as packaging and cold chain, have significant supply chain implications. If the most ideal product requires cold chain, and most facilities do not have a reliable cold chain, then an alternative product may be included on the list. Supply chain managers must ensure that products procured and distributed in the public sector health system are included on the national EML.

WHO publishes a model list of essential medicines that individual countries can use to develop their own national EML. However, ministries of health should also consider the local context and disease patterns when finalizing this list. It should be updated regularly to address any new products on the market or shifts in disease patterns.

What's in a name?—international non-proprietary, brand, generic, and innovator names

Program managers are encouraged to refer to their products using the international non-proprietary name (INN). An INN is the non-proprietary name given to pharmaceutical substances or active pharmaceutical ingredients. Each INN is a unique name that is globally recognized and is public property.

For marketing purposes, brand names are associated with a particular manufacturer, but there should be no difference in chemical composition from one brand to the next. All branded products will also carry the INN name. Branded products can be produced by either generic or innovator companies.

An innovator medicine is the name of the product produced by the manufacturer that initially developed the product. These products are usually given patent protection for 20 years from the date the patent was submitted. This provides protection for the innovator of the medicines to recover the initial costs incurred in research development and marketing expenses.

A generic drug is a pharmaceutical that is produced and distributed without patent protection. It has the same active ingredients as the innovator medicine.

For supply chain purposes, using the INN enables you to purchase products from multiple suppliers, whether branded or generic, and manage them as the same product.

5.3 Registration of Pharmaceutical Products

In most countries, using pharmaceutical products requires prior evaluation and approval from a governing body, often called the national drug regulatory authority (NDRA), or a stringent regulatory authority (SRA). Products to be registered should be proven to be efficacious (effective), safe, and of good quality. Some countries also consider the cost of the product, or whether it is needed. Because the quality of the medications is checked as part of the registration process, each brand (produced by different manufacturers) is registered independently. In most cases, not only the product, but also the packaging, is registered.

Many pharmaceutical products can be registered for use in a country but they may not be on the national EML, or on the standard treatment guidelines. Products not on the EML, but used by the private sector, can still be registered if their efficacy, safety, and quality are acceptable to the regulatory authority.

Failure to follow the pharmaceutical registration protocol could lead to products being held up by customs when they enter the country. Not only does this delay the delivery of important health care products, but it wastes time and money, and risks spoilage or expiry of products while at customs.

The registration of products is the responsibility of the manufacturer, not the ministry of health or supply chain managers. However, supply chain managers must ensure that the products they are responsible for procuring and distributing are registered, as required.

5.4 Standard Treatment Guidelines

Standard treatment guidelines (STGs) are suggested treatment protocols for the most optimal treatment of a specific clinical problem, in a given setting, based on consensus by experts. The treatments for specific clinical problems are selected based on common diseases in the area; they can vary based on the level of the treatment facility. Products chosen to be available at a particular facility, or level of facilities, should be based on STGs.

Following STGs has significant supply chain management benefits. If health practitioners adhere to suggested treatment protocols, a smaller range of products need to be available at each facility; and, as stated earlier, fewer SKUs are easier to manage. The STGs are developed based on the most effective and cost-effective treatment. If treatment providers prescribe the same product for the same condition, product demand is more predictable, facilitating more accurate forecasts. Clear, well-defined STGs are, in fact, a prerequisite for conducting morbidity-based forecasts; they form the basis for the assumptions around forecasting. If clinicians do not follow the STGs, large stockouts and/or expiries of unused medicines could result.

Each time STGs or products change, the supply chain must adapt. Service providers must be trained in prescribing and dispensing new treatment regimens and products. New products must be incorporated into logistics management procedures for ordering, stock monitoring, and reporting on consumption and stock levels.

Key activities for preparing the supply chain to introduce new products, or changes in treatment guidelines, include—

- government approval and registration of new products
- disseminating new guidelines and provider training in prescribing and dispensing of new treatment regimens and products
- ensuring appropriate storage conditions and space to accommodate new products in storage and transport
- transition plan for replacement and/or discontinuation of products to facilitate use of existing stocks before expiry
- incorporating new products and treatment regimens into existing LMIS forms
- updating quantifications to reflect expected changes in product consumption and stock levels
- adjusting the timing of procurement and supplier delivery schedules to ensure continuous supply
- recalculating funding requirements and mobilizing additional funding, if needed.

How to manage substitutions

For some items, you may be willing to accept a substitute when your first choice is not available. For example, if you need ballpoint pens, although you may want blue ink pens, you may be willing to accept black ink. What if, however, you urgently need a blue pen? Would you accept a low-quality blue pen, or pay a higher price for a blue pen somewhere else?

Although substitution of one product for another may work for ballpoint pens, it may not always work for health commodities. A family planning client may not want to switch to pills if an injectable contraceptive is not available. However, in essential medicines, one antibiotic may be substituted for another, in some circumstances. The difference between a pen and a person's health is obvious. A business that sells pens may fulfill most, but not all, of the six rights and still provide acceptable customer service. To be effective, a health system must fulfill all six rights.

5.5 Donor Requirements

Some donors will require that if you use their funds to purchase products, they must meet certain criteria. Some may request that you use a particular procurement agent. Or, often they require that products be on the WHO prequalified list. However, if these products are not on the country's EML and registered, included in the STGs, and included in the pre-service trainings to ensure clinicians know how to use it, the product may be underutilized. Its receipt may get delayed during customs clearance while waiting to be registered, or sit in a warehouse while clinicians are trained how to use it. When selecting products based on donor requirements, be sure they meet the other key criteria for product selection.

What are the key criteria for supply chain managers to consider when making product selection decisions?

Pharmaceuticals that are selected for procurement and national distribution in the public sector health system should typically meet four criteria:

- appear on the national essential medicines list
- registered for use in country
- included in the standard treatment guidelines
- meet all donor requirements for products purchased with donor funds.

5.6 Laboratory Supplies and Equipment Standardization

Laboratory equipment and supplies can be extremely challenging to manage because of the variety and quantity of products. Some countries have product lists with several thousand products associated with the laboratories alone. As a product selection strategy, standardizing laboratory equipment and supplies can contribute to greater ease in supply chain management.

Laboratory equipment primarily includes long-lasting, durable equipment, such as autoclaves and x-ray machines. Not only is this type of equipment expensive, but to run properly, it also requires ongoing maintenance and supplies. Thus, when selecting laboratory supplies, the following should be considered:

- availability of staff trained in operating and repairing equipment
- availability of supplies necessary for the equipment to function
- appropriateness to the setting—e.g., disease patterns, use at the appropriate levels of the system, voltage systems in the country, and gauges in the correct unit of measure.

For the equipment to function dependably, the supplies associated with this equipment, including replacement parts and products required to run tests, *must be* available.

Laboratory supplies include consumables, primarily disposable items, such as syringes, bandages, cotton dressings, catheters, and sutures; reagents, which are the biological or chemical components active in testing; and durables, other than equipment, such as glassware, stands and holders, and other items that do not necessarily require routine resupply. These products are often in large supply, and may not be included on paper-based LMIS forms. Their management can be challenging because many of these products come in multiple pack sizes and variations. Each pack size is considered to be a different SKU, which can mean a very extensive product list.

Every effort should be made to standardize the list of laboratory supplies that are procured and managed through the public health supply chain. Although some health workers prefer a wider selection, it is less expensive and more efficient to narrow the product selection down to one or two pack sizes or types that will be appropriate for most situations. With a standardized list of laboratory supplies, quantification will be much simpler.

Take the following steps when you standardize laboratory programs:

1. **Set test menus.** In collaboration with a wide range of stakeholders, decide which laboratory tests should be provided at each level of the system.
2. **Decide on test techniques.** A smaller, more technical group should decide which techniques to use for the selected tasks.
3. **Select equipment.** After you select the techniques, chose the appropriate equipment to carry out these tests and techniques.

When implemented effectively, standardardized testing menus and test techniques for laboratory services offer advantages to patients (facilitates understanding of disease progression and treatment benefits), providers (gives an opportunity to develop and monitor quality of care standards), and supply chain managers (makes demand more predictable).

Many types of laboratory equipment and the products associated with them are available; a large number of them are complicated to use. Standardizing the equipment and their associated products can greatly ease the process of managing its supply chain.

For example, in Kenya, after laboratory standardization, the list of products to procure was reduced from small quantities of 3,000 products, to larger quantities of 300 supplies. With larger orders, they were able to obtain their laboratory products at a lower price.

Quality Monitoring in Product Selection

Customers deserve quality products. Even after products have been distributed to customers, programs should strive to continue to monitor quality. Programs must know how customers feel about the quality of the products and whether they are satisfied with the product and service they received. Health workers must adhere to standard treatment guidelines (STGs) (which outline the quality of treatment to be given) when serving clients.

Quality monitoring of both the product and the service is critical to the success of efforts to promote the appropriate use of products. Customers should be counseled to correctly use the products they receive. The results of monitoring customer satisfaction can be used to inform/guide decisionmakers on patient preferences and about changes in product selection and use for the next procurement cycle. Remember, serving customers is at the top of the logistics cycle and entails getting the right goods to those customers.

Quality monitoring is also found in the logistics cycle diagram between product selection, quantification, and procurement. To monitor the process between product selection and quantification, you can determine if the products to be quantified are on the NEML, approved, and registered for use in-country; if STGs exist and are up-to-date; and if service providers have been trained in proper use. As described in this chapter, these are key elements in the product selection phase. To help ensure the quality of procurement decisions, it is important to examine guidelines, prescribing practices, and registration status during product selection to avoid delays and procurement of inappropriate products. Furthermore, you should compare prices of substitutable products, ensuring that they are equally medically appropriate and in line with country-specific requirements. Quality monitoring plays an important role in quantifying and procuring the right products at the right price, based on appropriate product selection and use.

Chapter Summary

In this chapter, you learned the following:

1. Product selection is an important activity that impacts the entire logistics cycle.
2. Managing fewer SKUs can enhance the agility, manageability, and efficiency of a supply chain. In procurement, you can focus finances on buying larger quantities of a fewer number of products, potentially resulting in better pricing.
3. Important criteria to consider when you select products for a health system include—
   - the national EML
   - whether the product is registered in the country by the Pharmaceutical Regulatory Authority
   - national STGs
   - donor requirements.
4. Standardizing laboratory supplies and equipment is critical for supply chain management.
5. Quality monitoring should take place throughout the logistics cycle, including product selection.

For more information about the benefits, challenges, and steps in standardization, see *Laboratory Standardization: Lessons Learned and Practical Approaches,* which is available on the USAID | DELIVER PROJECT website.

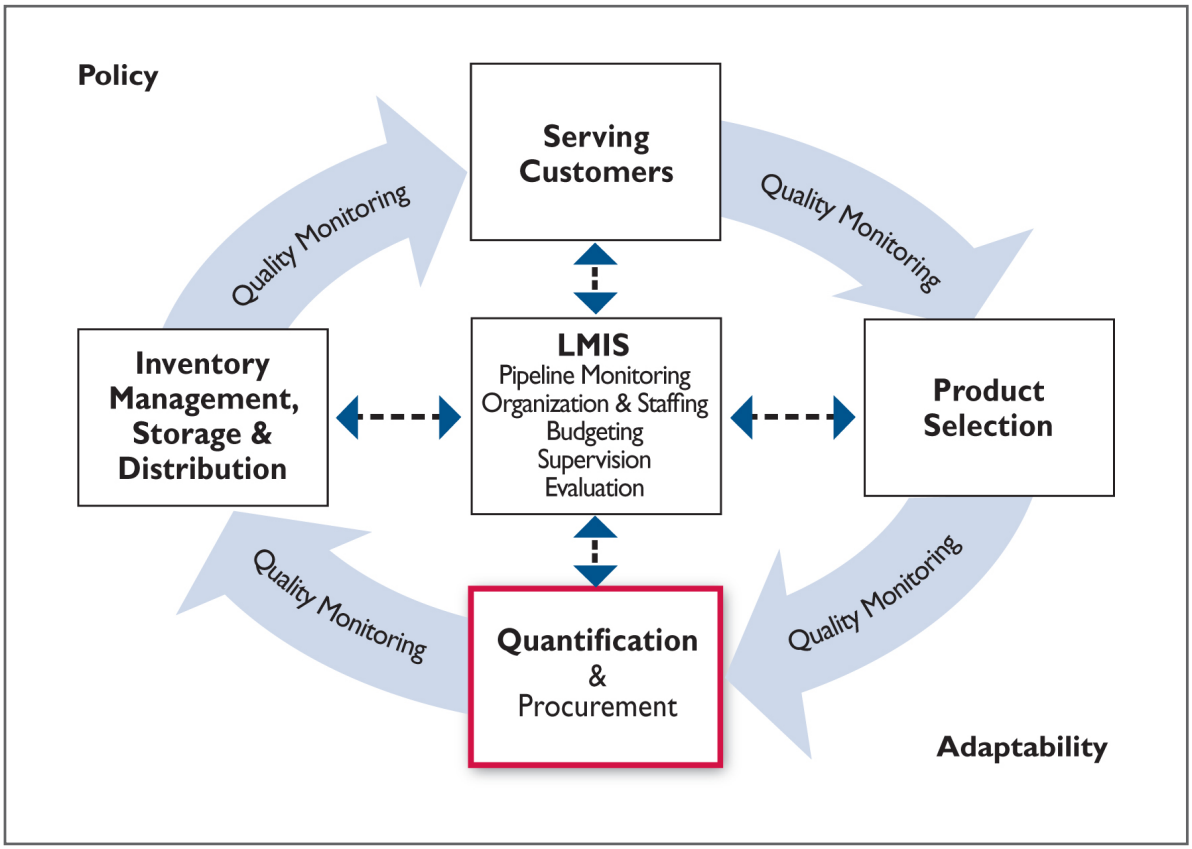
6 • Quantification of Health Commodities

Objectives

In this chapter, you will learn the following:

- definition of quantification
- importance of quantification in supply chain management of health commodities
- key steps in quantification—preparation, forecasting, and supply planning
- how the results of a quantification can be used
- process for reviewing and updating quantifications.

Figure 6-1: The Logistics Cycle



What is Quantification?

Quantification is the process of estimating the quantities and costs of the products required for a specific health program (or service), and determining when the products should be delivered to ensure an uninterrupted supply for the program (see figure 6.1).

6.1 Importance of Quantification

Quantification, a critical supply chain management activity, links information on services and commodities from the facility level with program policies and plans at the national level to estimate the quantities and costs of the commodities required for a health program. Quantification is important for informing supply chain decisions on product selection, financing, procurement, and delivery. The results of a quantification exercise help program managers—

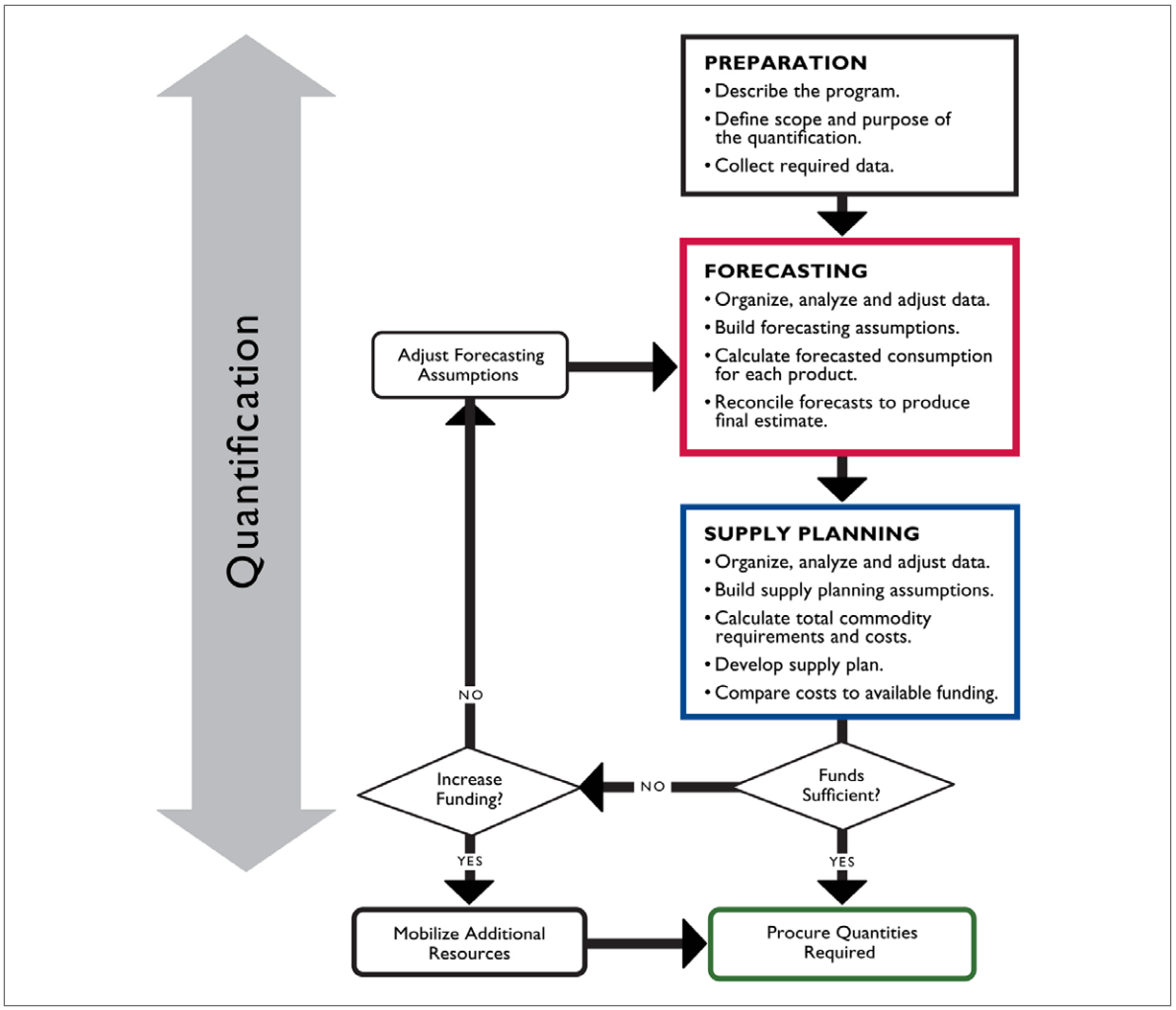
- identify the funding needs and gaps for procurement of the required commodities
- leverage the sources, amounts, and timing of funding commitments to maximize the use of available resources
- advocate for additional resources, when needed
- develop a supply plan to coordinate procurements and shipment delivery schedules to ensure a continuous supply of commodities.

This chapter summarizes the activities in the preparation, forecasting, and supply planning steps of a quantification exercise.

6.2 Key Steps in Quantification

No matter which health commodities a program distributes, a quantification exercise follows the same key steps. These steps, outlined in figure 6-2, include preparation, forecasting, and supply planning.

Figure 6-2: Steps in Quantification



You can see that this diagram has a final end point. Quantification is not a one-time, annual exercise that ends after you determine the final quantities and costs of the commodities. Rather, it is a continuous process of continuous monitoring and regular updating of the quantification results. You should estimate commodity requirements and costs for a 24-month period, and then review and update it at least every six months—even more often for rapidly growing or changing programs. You should update the data inputs and assumptions to incorporate any changes in program policies and plans that could affect the demand for commodities. Each time you review and update your quantification, recalculate the total commodity requirements and costs to reflect actual service delivery and consumption of commodities, over time.

Quantification is not a one-time annual exercise; it is a continuous process that requires ongoing monitoring and routine updates.

Step 1: Preparing for a Quantification Exercise

The first step in quantification is preparation (see table 6-1).

Table 6-1: Preparation Process

PREPARATION PROCESS	
Part 1	Assemble a quantification team.
Part 2	Describe the program (program performance, policies, and strategic plans).
Part 3	Define the purpose and scope of the quantification exercise (products, timing, etc.).
Part 4	Collect required data (for forecasting and supply planning).

Most quantification teams have 6–15 members; team members should include program managers, procurement specialists, monitoring and evaluation (M&E) officers or other information specialists, warehouse managers, service providers, donor agencies, implementing partners, and technical experts in quantification.

All team members should have the following knowledge and skills to complete a quantification exercise for health commodities:

- expertise in the specific program area and knowledge about the commodities and how they are used
- computer literacy and proficiency in the use of Microsoft Excel spreadsheets, or software programs to create and manage databases
- commitment to conduct ongoing monitoring, data collection, and updating of the forecasting data and assumptions, and the supply planning data to update the PipeLine database
- ability to prepare and present the quantification data and methodology and the final quantification results to key stakeholders and implementers.

Preparation for a national HIV test kit quantification program in Malawi

To estimate the total HIV test kit requirements and costs for two government fiscal years, Malawi completed a quantification exercise; the results enabled the ministry of health to maintain the current volume of services being provided and it met the government's plans for scaling up HIV testing and counseling services.

Timing and scope of the quantification exercise: The quantification exercise was coordinated to coincide with the MOH budgeting cycle and donor funding disbursement schedule. National HIV test kit requirements were to be quantified for public, private, nongovernmental organizations (NGO), and mission facilities for two years.

Products to be quantified: HIV test kits: Determine, Uni-Gold, and SD Bioline simple rapid assay tests, and long ELISA test kits.

Sources of funding for HIV test kits: Government funding, Global Fund, and UNITAID

Procurement mechanism: UNICEF

Quantification team: Seven quantification team members were selected from the MOH, HIV and AIDS program management staff, Central Medical Stores staff, NGO representatives, and external technical advisors.

Stakeholders and key informants: A broad range of stakeholders were invited to consultative meetings; one-on-one interviews were scheduled, as needed, with MOH program management staff, NGO representatives, service providers, laboratory specialists, donors, and technical and clinical experts.

Initiation of data collection activities: The following types of documents were researched, collected, and reviewed prior to undertaking any facility level, direct data collection activities: program policy and technical documents, program progress and performance reports, central-level health management information system (HMIS) and logistics management information system (LMIS) reports, including consumption and stock-on-hand data.

Number and selection of sites for data collection: A sample of 20 facilities providing HIV testing and counseling services, plus three Regional Medical Stores, were selected for data collection.

Step 2: Forecasting

Forecasting, the second step in the quantification process, uses the data collected during the preparation step to estimate the quantity of each product that will be dispensed or used during each year of the quantification. These quantities are the basis for calculating the total commodity requirements in the supply planning step. The forecasting step in a quantification exercise is a four-part process (see table 6-2):

Table 6-2: Forecasting Process

FORECASTING PROCESS	
Part 1	Organize, analyze, and adjust the data.
Part 2	Build and obtain consensus on the forecasting assumptions.
Part 3	Calculate the forecasted consumption for each product.
Part 4	Compare and reconcile results of different forecasts.

During preparation for a quantification exercise, team members begin to collect program background information; and as many types of data, from as many sources, as possible. Now, you can begin to evaluate and organize these data. The four primary types of data are demographic, morbidity, services, and consumption (see table 6-3 for examples of these data).

Demographic data are data on population characteristics, growth, and trends. They are not usually recommended for forecasting health commodity needs for procurement purposes, unless they are combined with other sources

of data. However, when forecasting for contraceptives, you can usually find reliable demographic data in the Demographic and Health Surveys, or national census data; you can use this data for forecasting.

Morbidity data are data on estimated incidence or prevalence rates of specific diseases, or health conditions, occurring within a defined population group. These data can be extrapolated to define total estimated need and then refined to determine specific targets, or percentage of total need, to be reached. Because forecasts using morbidity data tend to overestimate commodity needs, you should compare them to forecasts using consumption and services data. Morbidity data is not used to forecast for preventative services, such as family planning and pregnancy prevention.

Services data include number of services provided, number of service visits at which products are dispensed, tests conducted, episodes of a disease or health condition treated, or number of patients on continuous treatment during the last 12-month period (when data is available or can be estimated).

Consumption data are data on the actual quantities of health commodities. Consumption data includes actual dispensed-to-user data, or data on the numbers of commodities that were actually given to clients. Issues data can also be used as a *proxy* for consumption data; issues data are data on the number of commodities transferred from one level of the supply chain to another. For example, if the district warehouse issued 400 cycles of pills to its health centers in this reporting period, 400 cycles is the issues data that could be used to estimate actual consumption.

Table 6-3: Types and Sources of Data for Forecasting Product Consumption

TYPE OF DATA	SOURCES OF DATA	CHALLENGES IN DATA QUALITY
Program background information	Program progress and evaluation reports, policy and strategic planning documents, technical reports, and workplans that specify the timing of training and expansion of services	May be outdated and not reflect current policies, strategies, or context.
Demographic	• Demographic Health Survey (DHS), national census data, Population Reference Bureau • Data on population growth and trends • Data on population characteristics, e.g., geographical distribution, age, gender, occupation	Tends to be outdated (1–4 years old or more). Data may not reflect the same time period and, therefore, cannot be easily aligned.
Morbidity	• Epidemiological surveillance data or research data on incidence and prevalence of disease or health conditions in a given population • Expressed as a ratio or percentage of a defined population (denominator) with a specific disease or health condition (numerator)	Data from epidemiological studies may be outdated (1–2 years). If data are specific to a particular population group, you will need to extrapolate to estimate incidence or prevalence in the general population.
Services	• HMIS reports, program M&E reports, facility surveys of service records, daily registers • Reported number of services provided, e.g., number of cases of disease or health condition treated, number of HIV tests conducted, number of children immunized	Data may be unavailable, outdated, incomplete, or unreliable for the past 12 months.
Consumption	• LMIS reports, facility surveys of stock records and consumption records • Reported quantities of products dispensed to patients/clients or quantities of products used	Data may be unavailable, outdated, incomplete, or unreliable for the past 12 months.
Program targets	• National policy and strategic planning documents • National annual program targets or service coverage rates set as goals for the program	Program targets may be politically motivated for advocacy purposes and not based on realistic program capacity.

Remember that data collection activities initiated during the preparation step will continue throughout the forecasting and supply planning portions of the quantification exercise, as well.

Forecasting Part 1: Organize, analyze, and adjust data

After you collect the available data, you need to assess its quality. To estimate the data that would have been reported, you should adjust for incomplete, outdated, or unreliable consumption and services data, as described in chapter 3. If the program experienced a stockout, you may want to adjust the reported consumption data to account for that. Be sure to document your methodology for making any data adjustments, noting any adjustments made for stockouts, for percentage of facilities reporting, or for outdated data. Table 6-4 describes an example of the assessment of data quality for a quantification in Tanzania.

Table 6-4: Data Quality Analysis for ARV Drug Quantification in Tanzania

TYPE OF DATA	DATA	QUALITY OF DATA	NOTES
Demographic/ morbidity	Total population (40,454,000) HIV prevalence rate (6.1%)	1 year old	Not used for the forecast because, given program capacity, calculated quantity would have been unrealistic.
Services	Total number of patients on antiretroviral therapy (ART) (102,769 adults)	Facility reporting rate is 67%	Includes the cumulative number of patients that ever started ART since October 2004, when services began. Does not account for any patients that discontinued treatment.
	Number of patients on ART by regimen (e.g., 44,190 adults on AZT + 3TC + NVP)	Collected at 9 facilities and from individual partners supporting facilities	Newly revised ART patient registers collect the number of patients on ART, by regimen; but data are not being reported or aggregated at central level.
Consumption	Quantities of ARV drugs issued to facilities over the past 12 months (e.g., 650,000 bottles of d4T/3TC/NVP)	Consumption data not available. Central-level issues data used as proxy for consumption.	Not used for the forecast because central-level data does not represent actual consumption.
	Central-level stock on hand (e.g., 700,000 bottles of d4T/3TC/NVP on hand)	Facility-level stock on hand not available.	Used later during the supply planning step.
Program targets	National program targets for 2011 and 2012 (e.g., target number of ART patients for 2009 is 400,000)	Not based on existing patients or historical scale-up rates.	Not used for the forecast.

Note that some types of data will require conversions. Because consumption data are collected as quantities of commodities, you will not need to convert them later. However, if you use demographic, morbidity, or service data, after you analyze the trends and factors that you expect will influence demand and establish the agreed-upon numbers for the previous years, then you must convert all data into numbers of commodities.

For example, you receive services data as number of visits; however, you receive morbidity data as number of cases. For each type of data, the quantification team will need to translate that data into number of commodities, using the appropriate conversion factor (see table 6-5).

Table 6-5: Conversion of Data into Product Quantities

TYPE OF DATA	CONVERSION FACTOR				FORECASTED CONSUMPTION
Consumption	Estimated quantity of product to be dispensed/used	X		=	Quantities of product
Services (family planning)	Estimated # of visits or users	X	Dispensing protocol (contraceptives)	=	
Services (HIV and AIDS, TB, malaria, essential medicines, labs)	Estimated # of patients, # of episodes of disease, or health condition, # of lab tests	X	STGs, testing algorithm, lab procedure	=	
Demographic (family planning)	Estimated # of users	X	CYP factor	=	
Demographic/ morbidity	Estimated # of patients, # of episodes of disease or health condition, # of lab tests	X	STGs, testing algorithm, lab procedure	=	
Program targets	Targeted # of users, # of patients, # of episodes of disease or health condition, # of lab tests	X	CYP factor, STGs, testing algorithm, lab procedure	=	

Sample assumptions for quantification in Zambia

During Zambia's national quantification of public sector contraceptives for 2010–2012, the forecasting team made the following assumptions:

- The method mix for oral contraceptives was assumed to be 90 percent combined orals and 10 percent progesterone-only orals.
- Use of long-term contraceptives was expected to increase due to promotion of such methods by the ministry of health and training of more health workers in the insertion of IUDs and implants.
- As a result of the quantification:
  - — Consumption of pills was reduced and added to implants.
  - — Use of lactational amenorrhea (LAM) and injectables were reduced and IUDs increased.

Forecasting Part 2: Build and obtain consensus on forecasting assumptions

In many cases, you will find that data are incomplete, outdated, unreliable, or unavailable. Therefore, to develop the forecast, you need to make assumptions about program performance, targets, and future demand.

Even if data are of very high quality, you will still need to make some assumptions about—

- expected uptake in services
- compliance with recommended treatment guidelines
- impact of changing program policies and strategies on supply and demand
- service capacity
- provider behavior
- client access to services
- seasonality
- geographic variations in disease incidence and prevalence
- other factors that might affect demand.

You will need to discuss these assumptions and build consensus among key informants, including program managers, policymakers, procurement officers, providers (e.g., clinicians, pharmacists, nurses) and technical experts.

Forecasting Part 3: Calculate the forecasted consumption for each product

Regardless of the data the quantification team uses for the exercise, they must document the sources of the historical data, actual data collected, data quality issues, and any data adjustments.

Then, for each product—

- Estimate the future consumption of each product—the number of units of each product needed for each month and the year of the quantification period. Base this estimate on a review and analysis of historical trends in consumption and assumptions about program plans, targets, and any changes in product selection, STGs, or other policies and strategies that are expected to affect future demand.

OR

- Estimate the future types and number of services that will be provided; number of episodes of a disease or health condition that will be treated; or number of patients that will be treated, based on historical data. Using table 6-5, convert services, episodes, or cases into actual quantities of products.

You can use a number of different methods when you estimate the future consumption of products. For example, when using historical data from facilities, a historic trend can be determined by either the—

- average percentage increase/decrease from one reporting period to the next

OR

- average absolute number of increase/decrease from one reporting period to the next.

You can then project these trends forward—monthly, quarterly, or annually—to calculate the future number of products, episodes, or patients.

If you use demographic/morbidity or services data, you must convert the number of patients or episodes into the number of products. This is done *after* you establish the forecast number of patients or episodes.

Forecasting Part 4: Compare and reconcile results of different forecasts

If availability and quality of data permits, the quantification team can use different types of data to conduct multiple forecasts. The forecasting steps must be repeated for each of these data types. Use at least two types of data and prepare separate forecasts, if possible. Compare the final forecast consumption quantities from each forecast and consider the implications of the different forecasts for the program, including service capacity, storage and distribution capacity, funding availability; and other issues that could affect demand, supply, and use of the commodities. You can either select one of the final forecast figures; or reconcile the forecasts by adjusting, weighing, or averaging the different forecast quantities. How you reconcile the forecasts will depend on your confidence in the data you used and the strength of your assumptions. Remember that you should use as many different types of data when you do forecasting; this helps improve forecast accuracy, validate forecast results, and foster ownership of the quantification process and results. After you reach the final forecasted quantity, you can go to the supply planning step.

Step 3: Supply Planning

You will use the supply planning step to estimate the total commodity requirements and costs for the program (see table 6-6). To calculate this estimate, start with the forecasted consumption for each product from the forecasting step; then, consider the existing stock on hand; any quantities of product already on order, but not yet received; and the established maximum and minimum stock levels. Be sure to include procurement and supplier lead times and provide a buffer stock for unexpected delays.

Table 6-6: Supply Planning Process

SUPPLY PLANNING PROCESS	
Part 1	Organize and analyze data.
Part 2	Build supply planning assumptions.
Part 3	Estimate total commodity requirements.
Part 4	Develop supply plan.
Part 5	Compare costs to available funding.

Supply planning Part 1: Organize and analyze data

Data for the supply planning step are different from the data for the forecasting step. However, you can collect data for both the forecasting and the supply planning steps at the same time—for example, during individual meetings or consultative workshops with stakeholders. Table 6-7 describes the specific data required for the supply planning step.

Table 6-7: Supply Planning Data Requirements

PRODUCT	SUPPLIER	FUNDING	PROCUREMENT	DISTRIBUTION	STOCK STATUS
Patent, registration, or prequalification status, if applicable Verification that products to be quantified are on the national essential medicines list Specific product characteristics (formulations, dosages, shelf life, temperature requirements, number of units per pack size, unit cost, and others)	Supplier prices Supplier packaging information Supplier lead times Current shipping and handling costs, by supplier Current shipment intervals and delivery schedules, by supplier	Funding sources for procurement of commodities Amount and timing of funding commitments by funder Funding disbursement schedules to determine when funding will be available for procurement from each source	All procurement mechanisms (e.g., competitive international bidding/tendering, donor procurement, local procurement) for all products to be quantified Procurement lead time for each procurement mechanism	Customs clearance fees In-country storage and distribution costs (if applicable) In-country sampling/quality testing costs	Current stock on hand of each product at program level (preferably from physical inventory) Program maximum and minimum stock levels Product consumption and expiration dates to assess months of stock on hand for each product Quantity on order for each product and expected delivery date

Supply planning Part 2: Build supply planning assumptions

As with the forecasting step, you will need to make assumptions in the supply planning step to account for missing, or low quality, data. You will then need to build consensus around these assumptions. Remember, it is important to document clearly and specifically the sources of information and the key informant inputs on the assumptions. Examples of supply planning assumptions include—

- timing of available funds
- amount of available funds

- lead times for each supplier
- arrival dates of supplies
- minimum and maximum stock levels for each level in the system.

Supply planning Part 3: Estimate total commodity requirements and costs

To estimate the total commodity requirements, you must determine the quantity of each product needed to meet the forecasted consumption (this is the output from the forecasting step), *and* ensure the in-country supply pipeline has adequate stock levels to maintain a continuous supply to service delivery points.

First, calculate the additional quantities of product needed to cover procurement and supplier lead times, and to maintain stock levels between the minimum and maximum. Then, subtract the quantity of each product already in stock in-country; any quantities that have been ordered, but have not been received (quantity on order); and any quantities of products that will expire before they are used. You will have then calculated the total estimated commodity requirements. The total commodity requirements should be converted from single units to procurement units. Costs per procurement unit plus freight, customs, and other shipping fees will give you a total cost.

Supply planning Part 4: Develop the supply plan

Developing a supply plan, including the shipment quantities and delivery schedules, will ensure a continuous supply of products to the country.

Developing the supply plan helps program managers to—

- enter and track forecasted consumption data
- identify funders and funding commitments, by product
- identify suppliers for each product
- coordinate timing of funding commitments and procurements
- schedule shipments according to procurement lead times, supplier lead times, and stock levels in-country to maintain stock levels between the established maximum and minimum levels and avoid stockouts and/or losses due to overstocking and expiry.

PipeLine software

PipeLine is a central-level tool that helps users plan optimal procurement and delivery schedules for any type of health commodities and to monitor the status of shipments. Policymakers, product suppliers, and donors can use the software to generate reports, to monitor the status of shipments, and to plan and budget programs.

To access the PipeLine software and user's manual, go to deliver.jsi.com.

Supply planning Part 5: Compare costs to available funding

Ultimately, you will base the final decision on the quantities to procure by the amount of funding available for procurement of products. If sufficient funding is available, the final quantity to procure of each product will be the same as the quantity to order that you determined during the quantification.

However, if funding is insufficient, stakeholders will need to determine whether you can obtain additional resources. You can present the quantification results as an effective mechanism for resource mobilization. During the presentation, you can explain illustrate the funding gap that must be filled to ensure timely procurement and delivery of the required quantities of commodities.

When it is not possible to mobilize additional resources to procure the full quantities of products required, you will need to reduce the forecasted consumption (quantities of products expected to be dispensed). You cannot arbitrarily reduce the forecasted consumption but, to adjust the forecasting assumptions, you can return to the forecasting step in the quantification, discuss the options, and build consensus. For example, for ARV drugs, you would need to reduce the total number of patients expected to start treatment each month. For antimalarial drugs, you would not need to reduce the number of malaria episodes to be treated. Adjusting the forecasting assumptions will reduce the total quantities of products expected to be dispensed or used, thereby reducing the overall total commodity requirements and costs.

6.3 Using the Quantification Results

The quantification team should formally present the results of the quantification to stakeholders. The team will receive feedback about the assumptions made during the forecasting and the supply planning steps, as well as the data sources used. Presenting the results of the quantification is an opportunity for the team to describe the national stock status of commodities to all stakeholders and to outline the supply chain actions required to maintain adequate stock levels.

During a presentation on the key outputs from a national quantification exercise, the team should:

- Review all data sources used and include a discussion of challenges in data collection and data quality.
- Summarize the forecasting assumptions and description of data sources and key informant inputs used to inform the assumptions.
- Summarize the supply planning assumptions (especially if assumptions about the amount and timing of funding commitments will affect procurement and delivery of commodities).
- List the total quantities and cost of each product required, for each year of the quantification.
- Determine the national stock status (months of stock on hand) for each product (PipeLine Stock Status Graphs are very useful to convey this information); highlight products close to expiry; stocked out; or overstocked, based on the national stock status analysis.
- Summarize the shipment delivery schedules, by funder and by supplier.
- List the total funding gaps for the next 24 months.
- List the specific actions required to address any critical stock imbalances and to maintain stocks at the established levels.

These quantification outputs enable program managers, funders, buyers, and suppliers to plan and schedule their inputs, to coordinate available resources, and to advocate for additional resources when funding gaps are identified. Presentation of the quantification results to policymakers, program managers, procurement managers, funders, and commodity managers facilitates the following activities:

- program planning and budgeting
- mobilization and allocation of funding for commodity procurement
- coordination of multiple sources of funding for procurement
- procurement decision making about which products to procure, how much to procure, and when to procure
- adjustment of timing of procurements and shipment delivery schedules to ensure continuous supply while avoiding stockouts and overstocking.

In addition, conducting a quantification exercise typically reveals supply chain management needs, including strengthening data collection and reporting systems and inventory management procedures, and improving dissemination and training of providers in standard treatment guidelines. The quantification exercise is also an opportunity to identify and advocate for other supply chain improvements.

6.4 Reviewing and Updating the Quantification

Quantification does not end after you determine the final product quantities and costs; it is an ongoing process of monitoring, reviewing, and updating the forecasting data and assumptions; and recalculating the total commodity requirements and costs, as needed. For the quantification exercise to be useful and effective, you should review the forecasting assumptions and the supply plan at least every six months; and more frequently for rapidly growing or changing programs. Ideally, the same core team of people who conducted the initial quantification should conduct routine updates. Many country programs have instituted a quarterly quantification review process for specific commodity categories. Ongoing monitoring and updating of the quantification is critical to keep program managers, donors, and other stakeholders informed on the availability of drugs; is required for timely decisionmaking about product selection, financing, and delivery of commodities.

Quantimed software

Quantimed, an electronic tool, helps you calculate the estimated total cost of medicines, supplies, and reagents needed to provide services for your health program. It can be used to determine needs for a single health facility, a national program, or a geographic area. Furthermore, Quantimed has a scaling-up function that can calculate pharmaceutical requirements and costs for expanding programs and compare scaling-up scenarios.

For more information about Quantimed, see MSH's website:
http://www.msh.org/projects/rpmplus/Resources/ToolsResources/QET.cfm

Reviewing and updating the quantification includes the following activities:

- reviewing and updating the forecasting data and assumptions
- calculating or recalculating the forecasted consumption (using Quantimed, Excel spreadsheets, or other software)
- updating the stock on hand for each product
- assessing national stock status for each product (based on product consumption and stock levels)
- reviewing and updating shipment delivery schedules to ensure continuous supply and maintain desired stock levels.

Reviewing and updating a national quantification in Nigeria

Nigeria conducted its first national-level quantification for ARV drugs and HIV test kits for 2009–2013. The two primary funders of HIV commodities in Nigeria—the President's Emergency Plan for AIDS Relief (PEPFAR) and the Global Fund—regularly review the quantification.

Because of their pooled procurement, PEPFAR partners instituted quarterly quantification reviews. At these meetings, the working group reviews quarterly logistics management information system (LMIS) data and PipeLine shipment data. Quarterly reviews also involve commodity transfers and loans between PEPFAR-supported programs to avert stockouts or minimize expiries.

For HIV commodities funded by the Global Fund, quantification reviews are conducted every six months. The main sources of data for the review are bimonthly service delivery point logistics reports from the LMIS and PipeLine shipment reports. If patient targets, testing algorithms, or product selection change, the Quantimed database is reviewed and updated.

Quality monitoring of quantification

As noted in this chapter, quantification is a continuous process that includes regular monitoring and updating. Not only is it important to assess the quality of the data and the assumptions used to calculate the initial forecast; but, to assess the accuracy of your forecast, you should go back periodically and compare *actual* quantities consumed with your *forecasted* quantities.

Because forecasting for public health products is more of an art than a science, actual consumption almost always differs from the forecast consumption. By calculating the mean absolute percent error (MAPE)—the absolute difference between the forecasted and actual values, expressed as a percentage of the actual values—you can monitor error rates. If error rates are high, you should revisit your assumptions and try to improve the quality of your data, so that your revised forecast will better reflect actual consumption. Over time and with regular monitoring, you can improve the accuracy of your forecasts and the overall quality of your quantifications.

Chapter Summary

In this chapter, you learned the following:

1. Quantification is the process of estimating the total quantities and costs of the products required for a specific health program, for a future period of time.
2. Quantification is a critical supply chain management activity that links information on services and commodities with program policies and plans to estimate the required commodity quantities and costs. Quantification is key to informing supply chain decisions on product selection and use, financing, procurement, and delivery.
3. The key steps in quantification are preparation, forecasting, and supply planning.
4. The results of a quantification facilitate the following activities:
   - program planning and budgeting
   - mobilization and allocation of funding for commodity procurement
   - coordination of multiple sources of funding for procurement
   - procurement actions on which products to procure, how much to procure, and when to procure
   - adjustment of timing of procurements and shipment delivery schedules to ensure a continuous supply while avoiding stockouts and overstocking
   - identification of and advocacy for other supply chain improvements, such as strengthening data collection and reporting systems, and inventory management procedures.
5. Quantification does not end when the final product quantities and costs have been determined; it is an ongoing process of monitoring, reviewing, and updating the forecasting data and assumptions and recalculating the total commodity requirements and costs, as needed.
6. To improve the quality of quantifications, it is important to compare actual quantities consumed with forecasted quantities to assess the accuracy of the forecast. You should revise assumptions and data accordingly to ensure that the revised forecast better reflects actual consumption.
   - updating the amounts and timing of funding commitments
   - recalculating the commodity requirements and costs over time
   - estimating and updating funding needs and gaps for procurement.

For more specific guidance and instructions on how to conduct a quantification exercise, see *Quantification of Health Commodities: A Guide to Forecasting and Supply Planning for Procurement,* available at deliver.jsi.com. For more detailed information on quantification of different types of health commodities, please see the following complementary documents, also available on the website:

Quantification of Health Commodities: ARV Companion Guide, Forecasting ARV Drugs Using the Morbidity Method

Quantification of Health Commodities: Contraceptive Companion Guide

Quantification of Health Commodities: HIV Test Kit Companion Guide, Forecasting Consumption of HIV Test Kits

Quantification of Health Commodities: Laboratory Commodities Companion Guide, Forecasting Consumption of Laboratory Supplies.

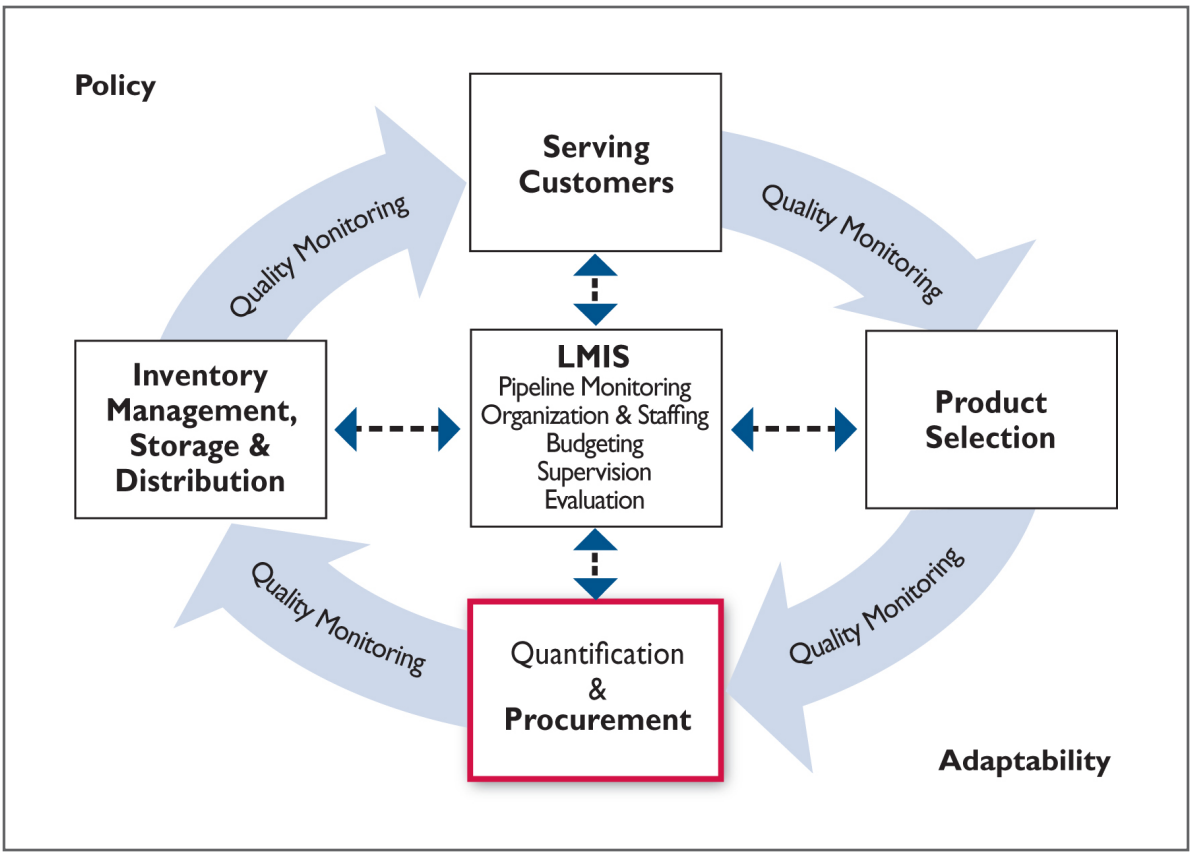
7 • Health Commodity Procurement

Objectives

In this chapter, you will learn about the following:

- the procurement process for public health sector systems
- stakeholder involvement in national health product procurement
- common procurement challenges
- procurement manager's role in supporting effective and efficient health commodity procurement.

Figure 7-1: The Logistics Cycle



7.1 Why Procurement in the Supply Chain Is Important

Procurement is a critical part of the logistics cycle (see figure 7-1). Procurement planning and the procurement process are important activities that ensure the correct products are available in-country and are ready for distribution when they are needed. Without procurement procedures and processes, you would not be able to meet the six rights. A procurement unit with staff also ensures that national procurement regulations and procedures are properly implemented.

Introduction to health commodity procurement

In many countries, a procurement unit within the ministry of health or central medical stores (or similar entity) manages procurement for public health supplies. The unit purchases the appropriate quantities of quality products, which are necessary for ensuring continuous product availability. Usually, another unit within the health system instructs the procurement unit on what to purchase; with what funding sources, including quantities and the specifications of products to be purchased (see chapters on Quantification and Product Selection). However, staff in the procurement unit probably have experience with earlier processes; the staff responsible for quantification usually understand the product prices, how to develop the budget, and what quantities to order.

Key stakeholders in the procurement process

The procurement process involves many different parties, whose input helps determine the how, what, and when of procurement. Many countries have a procurement coordinating committee to help ensure that all the key stakeholders are informed of each others' activities and plans, both to avoid duplication and to ensure appropriate coordination and decisionmaking.

- The program unit (i.e., the Family Health Division, National Malaria Control Program, etc.) usually determines what products need to be procured to support their programs. Most of the time, they use the national standard treatment guidelines to select the products that different populations need and to inform product selection. The program units are usually closely involved in the quantification process to estimate requirements and to determine if they can meet the program demands or coverage targets.
- The National Drug Regulatory Agency should be part of this process; this will ensure that the procured products are registered for use in the country (or have the appropriate waivers, if necessary) and that the products meet quality standards. The agency will have the most up-to-date information on what products are registered, when registrations will expire, and what new products are in the process of being registered. You should consult the agency during each round of procurement. They may be involved throughout the process, or at specific milestones; they may help sample products sent from suppliers, as part of their bids; or they may batch test samples from the eventual shipments, before the country receives them for distribution.
- Funding agencies are another important stakeholder in the procurement process. Whether funding comes from donor organizations, intergovernmental loans, or national treasury funds managed by the Ministry of Finance, each has procurement requirements as a condition of their support. The procurement unit must work with these sources to understand when funds will be released for procurement and the procurement regulations they must follow as a condition of their funding. This means that procurement units must understand procurement regulations and align procurement cycles with funding availability.
- Last, manufacturers are important stakeholders; although, frequently, they are not directly involved until the later stages of the procurement process. Manufacturers are responsible for registering products in countries before procurement takes place; however, frequently the procurement unit does not know about nor is involved in this process. Procurement units usually establish contact with suppliers during the tender process, but they may have longer term relationships with suppliers, which may date back to previous procurements.

Key terms in health commodity procurement

For a full list of terms related to procurement, see PATH's *Procurement Capacity Toolkit* (see text box).

tender. The documentation and initiation of a process for soliciting bids; the specifications for the product/service desired and opening the contract to the bidding process.

bid. A written offer for a quantity of goods, works, or services, at a stated price; based on technical specifications and other terms and conditions. Bids are submitted to a purchaser by an interested seller in response to an Invitation for Bids.

contract/framework contract. A contract is an agreement entered into by two parties for the execution of a certain activity; for example, a sale and purchase, or provision, of services. A framework contract is a general term for an agreement with a supplier that sets out terms and conditions against which specific purchases can be made throughout the life of the agreement. This enables purchasers to draw down against an on-going arrangement, rather than engage in a one-time contract for a definite quantity of goods.

good manufacturing practices (GMP). A quality system covering the manufacturing and testing of active pharmaceutical ingredients, diagnostics, foods, pharmaceutical products, and medical devices. GMPs are guidelines that outline the aspects of production and testing that can impact the quality of a product. Many countries have laws requiring that pharmaceutical and medical device companies follow GMP procedures; and they have created their own GMP guidelines that correspond to their legislation.

prequalification (WHO). This is a process of predetermining that a specific product, from a specific manufacturer, meets stated requirements. WHO prequalified products use their own mechanism to provide assurance of quality, especially for countries unable to undertake the process.

supplier. The party that transfers goods out of its control and to a named recipient.

direct procurement. Purchaser contracts for goods directly with a manufacturer or its representatives.

indirect procurement. Purchaser contracts for goods through an intermediary that has or will purchase directly from a manufacturer.

The procurement process is often complex and, frequently, has many regulations and policies. Therefore, you must undertake procurement carefully and methodically, and with a good understanding of local procurement laws and processes.

This chapter outlines the main steps of procurement, but it is only an overview. For a more detailed, comprehensive guide, see PATH's *Procurement Capacity Toolkit* (version 2 - 2009). The process in the section below will follow the same 10 steps used in PATH's toolkit, but with less detail. While the focus of the toolkit is reproductive health products, the concepts can also be applied to public sector health procurement.

To access the toolkit, go to the following URL: http://www.path.org/files/RH_proc_cap_toolkit_v2.pdf

7.2 Procurement Process

Procurement is the decisionmaking process you follow when you buy products; you usually have many options. Because this involves the transfer of money, frequently substantial amounts of money, most of the procurement process focuses on making it as fair and competitive as possible. Therefore, good public sector procurement relies on thorough documentation and transparency throughout the process to ensure that no party can claim that one group was unfairly favored over another. This means that each step must be standardized and regulated according to public laws and regulations. However, this can also make the procurement process time consuming. It is important for supply managers, program managers, procurement units, and other stakeholders interested in supply chain management to understand how long the procurement process usually takes; to ensure continuous availability, they must be able to plan procurement schedules and order quantities in a reasonable time.

The process (10 elements)

The description of the procurement process in this chapter follows the format developed in the *Procurement Capacity Toolkit*. The toolkit identifies three phases: (1) program planning, (2) procurement process, and (3) performance—these processes are necessary for obtaining supplies. Each phase is divided into elements that, together, comprise the end-to-end process for procurement. Table 7-1 identifies the elements that make up each phase.

Table 7-1: The Product Supply Process (PATH 2009)

THREE PHASES	TEN ELEMENTS
I. Program Planning	Defining Reproductive Health Supply
	Specifications
	Assessment of Procurement Options
	Budget, Funding, and Procurement Requisition
Critical Link: Funded Procurement Requisition	
II. Procurement Process	Procurement Planning
	Developing Bidding Documents and Inviting Offers
	Selecting Suppliers
	Contracts
Critical Link: Signed Contract and Payment Guarantee	
III. Performance	Contract Performance and Monitoring
	Delivery of Goods
Critical Conclusion: Delivery and Acceptance of High-Quality Products	

Product Selection and Quantification

After you complete the product selection (see chapter 5) and quantification process (see chapter 6), the information is submitted to the procurement unit to obtain the correct quantities of the correct products from international, regional, or local marketplaces. In table 7-1, this is listed as "Defining Reproductive Health Supply" as printed in PATH's toolkit, but refers to product selection and quantification.

Specifications

The procurement unit must ensure that, in addition to the product information provided by program managers (including generic name, dosage, formulation, and unit packaging requirements), suppliers must produce products that meet regulatory and shipping/packaging requirements—including proof that products are manufactured at facilities that meet GMP certification requirements, or have WHO prequalification status—and that they can provide products that meet certain technical specifications, including standards for raw materials; and requirements for shelf life, labeling, language, and inner and outer packaging.

Technical specifications also include testing requirements for quality assurance, and packaging and shipping requirements. The specifications are the primary way that countries protect their populations against counterfeit or substandard products; they also help ensure that the products are properly labeled and adequately protected from heat and cold during shipping. As part of the bid, quality assurance specifications should also be clearly written, identifying all documents that the purchaser will require from the supplier—including manufacturing records, the Certificate of Analysis, test data, and regulatory certificates. These specifications should also detail the plans for inspection by the purchaser, product sampling procedures, and the manufacturer's process for sampling their production lots. Countries may involve many of the key stakeholders mentioned above, as well as technical specialists to ensure that product specifications are followed and are complete.

Why product specifications are important for procurement

Good product specifications need to be complete, comprehensive, and accurate. If they do not fulfill these requirements, suppliers may offer products that do not meet the product, or quality standards, of the country. However, specifications must be as product-neutral, as possible, to ensure that if products truly are comparable, the specifications are not written to favor one supplier over another.

Good technical specifications not only tell the supplier exactly what the purchaser is looking for, but also the criteria the purchaser will use to evaluate potential suppliers, and how the selected supplier's performance will be judged.

Assessment and Selection of Procurement Options

Most of the time, procurement units have two main procurement options: direct and indirect procurement.

Direct procurement is when the purchaser establishes direct contact with suppliers or their representatives. Usually bids are solicited from the marketplace, individual suppliers respond, and a contract is established between the purchaser and selected supplier. The contract is based on competitive pricing and the ability to meet other product specifications. The direct approach to procurement can be a cost-effective option, but it may require substantial resources to conduct and manage, depending on how many suppliers they need to evaluate and the number of products to procure. The two main types of direct procurement are *international competition* and *small-scale national competition.*

- *International competition* involves adherence to standardized procedures that the public sector uses when there are multiple potential suppliers. The procurement unit creates an invitation to tender, or requests bids directly, to solicit formal offers from suppliers. This process follows international good procurement practices, including formal bidding documents; sealed bid responses; a public bid opening; and a contract award, based on evaluation criteria included in bidding documents.

- *Small-scale national competition* is used to solicit offers from a local marketplace. Offers are usually requested from a few suppliers and prices are negotiated; this is often called shopping. This option works well when only a few local manufacturers produce needed products, such as certain essential medicines; however, is not feasible for procurement of products that are not available locally, or when the quality of local products may not be sufficient.

Indirect procurement is conducted by an intermediate organization; the procurement unit does not interact with the marketplace. The procurement contract is between the procurement unit and another organization; the procurement unit usually pays a fee to provide this service. The indirect approach can be more expensive—it often includes service fees when small quantities are involved—but this approach may reduce the resources necessary to follow good procurement practices. Several types of organizations provide indirect procurement services: *international supply services* and *international procurement agencies*.

- *International supply services* and *international procurement agencies* are organizations that purchase health products in bulk and resell to non-profit health care organizations in developing countries. They maintain catalogues of products and sell to donor organizations and governments at-cost plus fees. An international procurement agency procures specific items requested on behalf of the procurement unit, not necessarily items kept in stock; they often require cash in advance for these procurement services.

Another option available to some countries is participation in a ***regional pooled procurement system***. With this system, purchasers join together to benefit from better pricing by increasing their bargaining position in negotiations with suppliers. Examples of successful pooled procurement mechanisms include the Pan American Health Organization (PAHO) Expanded Programme on Immunization (EPI) Revolving Fund for vaccines, the Gulf Cooperation Council group purchasing program, and the Pharmaceutical Procurement Services (PSS) of the Organization for Eastern Caribbean States (OECS).

Another pooled procurement option that recently became available to principal recipients of the Global Fund to Fight AIDS, Tuberculosis and Malaria (GFATM) grants is the GFATM's Voluntary Pooled Procurement (VPP) service. Initiated in 2009, the VPP consolidates forecasts, and establishes long-term supplier contracts and direct payments to obtain favorable pricing and delivery conditions from suppliers.

Case Study: Pooled procurement in the Eastern Caribbean

The Pharmaceutical Procurement Service of the Organization for Eastern Caribbean States (OES/PPS), previously known as the Eastern Caribbean Drug Service, combines or *pools* public sector drug procurement from nine island nations, which have a combined population of 550,000. When it started in 1986, founding members deposited one-third of their annual pharmaceutical budget into individual country accounts at the Eastern Caribbean Central Bank (ECCB) to establish a revolving drug fund and to ensure payments to suppliers. The service became financially self-sufficient in 1989; participating governments were charged a 15 percent administrative fee. Building on its success with the pooled procurement of pharmaceuticals, the PPS has expanded its product portfolio to include contraceptives and other medical supplies.

The PPS produces a Regional Formulary Manual, from which large-volume and high-cost items, with consistent demand, are selected for pooled procurement. To increase order sizes and decrease unit costs, the PPS has standardized drug choices; all member countries use the same products, pack sizes, and dosages.

The PPS operates a centralized bidding system that is restricted to suppliers who have been pre-qualified, based on their technical competence, quality standards, past performance, and financial viability. After soliciting bids from more than 75 international suppliers, the PPS awards Regional Price Contracts to selected suppliers, who are guaranteed to be the sole source of supply for all participating countries. Individual countries can order as often as they need during a contract year, although the system has gradually moved toward consolidating two to three orders per country, per year. Suppliers ship consignments directly to participating countries. The countries reimburse their accounts to the ECCB; which, in turn, arranges for prompt payment of foreign exchange to suppliers.

During its first procurement cycle, competitive bidding reduced unit drug costs by 52 percent, followed by an additional 18 percent for the second cycle. The average country savings from the first tender ranged from 16 percent to 88 percent. During the 2001/2002 tender cycle, a survey of 20 popular drugs found that regional prices were 44 percent lower than individual country prices. The service's ability to pay suppliers promptly in foreign exchange was one of the most critical elements in its ability to reduce drug costs. Recently, slow reimbursements by some member countries experiencing economic difficulties have diminished the PPS's reputation for prompt payment. Instability in the regional currency and weak forecasting have also diminished the full potential of pooled procurement.

The decision about what kind of procurement option to choose depends on the context—including the products and quantities to be procured; procurement personnel skills and experience; infrastructure; access to foreign currency; and timeline. While the direct procurement option can result in more competitive deals, using good practices requires significant time and expertise. Furthermore, small order quantities may mean few or no interested bidders.

Indirect procurement can be more expensive, for product cost and fees, but may include money-saving advantages throughout the entire procurement process, because the service organizations are responsible for vetting suppliers and establishing quality assurance procedures. This ensures that manufacturers follow GMP practices and, also, do random testing of product and site inspection. Additionally, these organizations usually have expertise in shipping, customs clearance, and importation regulations in many low-income countries, which often helps avoid demurrage charges and delays if the procurement unit is unfamiliar with these. Overall, the decision requires an understanding of the risks and benefits of each method and a careful evaluation of internal capacity and needs.

Budget, funding, and procurement requisition

The procurement unit supports the supply chain and program managers with important planning inputs on product pricing. Procurement units can research reference prices and share historical price information with program managers. Because they also have access to and relationships with suppliers and other players in the marketplace, they should also be aware of and able to share information about product improvements or developments; including the availability of generic products, which may yield cost savings. The program can use this information to calculate budget requirements based on their quantifications. It will also be necessary to factor in other expenses related to the shipping, insurance, storage, and clearance of products. These additional fees and expenses contribute to the overall cost of procurement.

It is also the responsibility of the procurement unit to coordinate with the ministry of health/ministry of finance stakeholders and funding agencies to determine when funds will be released to procure the products. Purchasers usually need to have access to the funds (typically in their account) before any bidding documents can be released. Delays with funds are one of the major (though, by no means, only) reasons for procurement delays.

Procurement planning

As mentioned before, procurement can be a lengthy process and, because it involves the transfer of money, including fund availability and potentially currency exchange issues, it needs to be planned carefully and often well in advance of the actual activities. A procurement plan is similar to a supply plan, which was discussed in chapter 6 on quantification, but it includes more information. The supply plan, which is the final output from the quantification exercise, provides critical inputs to the procurement plan.

The information generated from the supply plan, which will become part of the procurement plan, includes the required shipment quantities, with a schedule of each desired delivery date. In addition, a procurement plan includes the identification of the procurement method to be used, a list of the key steps in the procurement process (such as advertise bid, open bid, evaluate bid, award contract, disburse payments, etc.), and a timeline with estimated dates for completing each step of the process, including the names of the responsible parties. Like the supply plan, the procurement plan should be started 24–36 months ahead, and be updated regularly (i.e., rolling procurement plan). The rolling part represents the cyclical nature of procurement of health products—rarely is it a one-time activity, but rather a cycle that will be repeated at regular intervals. This process also ensures that all steps and timelines are accounted for to ensure that the right products, in the right quantities; arrive at the right time, in the right condition, at the right price, and to the right place.

The procurement unit or the logistics management unit, usually maintains this plan; they share it with other stakeholders, as needed. Part of the plan should clearly state timelines, dates, and responsibilities assigned for each activity. Dates for completion should be set for all activities; but they must be realistic, based on past experience and current capacity. They should include dates all the way through to product delivery and payment schedules to ensure on-going procurement planning (to ensure continuous availability). Knowledge of when stock will arrive will help determine when the next order needs to be placed.

Procurement methods typically include competitive bidding, requests for quotations, sole source procurement, and shopping. Each procurement method has different tasks associated with it, so each procurement will have its own timeline. If possible, think about longer term contract options to increase the competitiveness of bids—including framework contracts. However, certain countries have regulations that limit their ability to enter into long-term agreements with suppliers.

Develop bidding documents and invite offers

For effective competitive procurement, it is important for you to create detailed bidding documents against which suppliers will assess their ability and interest in providing the goods. Bidding documents should explain in detail the—

- quantities, specifications, and quality assurance requirements of the desired products
- delivery dates and required destination of the shipment
- regulations, procedures, and timing for responding to the bids
- selection criteria that will be used to evaluate and select suppliers.

Depending on the local context, it may be necessary to obtain document approval for bidding documents by government agencies or donors before they are publicly available. It is important to review the documents carefully before they are finalized to ensure that changes made to one section correspond to changes in another; and that wording, terms, and clauses are consistent throughout.

Now, you are ready to use the final bidding documents to solicit bids. The objective is to reach a broad range of interested suppliers to ensure that the selection process is as fair and competitive as possible. You can advertise in newspapers, trade bulletins, journals, organizational and government websites, and local bulletin boards. Additionally, the procuring agency can send invitations directly to suppliers it would like to bid.

Select suppliers

A program's success depends on selecting suppliers that will be able to deliver high-quality goods, at an affordable cost, within the required timeframe. Therefore, after bids come in, it is important for you to ensure that the evaluation process is structured as fairly and transparently as possible. Often, committees are created for bid evaluation; they compare and recommend bids to the contracting authority. The first step of the evaluation process is to evaluate the bids against the requirements that were set out in the bidding documents.

This includes ensuring that the bids are in the correct format; contain all the required information, samples, and terms; and are otherwise complete.

The following are general guidelines for reviewing bids that meet the minimum requirements:

- Evaluate all bids or proposals by the same criteria to ensure equity, impartiality, and transparency. Bids must match the requirements included in the bid documents at the time the bid was released.
- Reject and do not evaluate bids and proposals that do not qualify.
- Evaluate all qualified bids and proposals based on the lowest price.
- If it is a policy to give preference to national companies, clearly state the nature and extent of the preference in the initial invitation to tender or request for proposals.

Additional commercial and technical criteria for selection include—

- The program or agency has sufficient financial resources to meet any monetary obligations associated with the contract.
- The bidder has the necessary organizational capacity to comply with the terms and conditions of the contract and to complete it.
- The bidder must provide references, or another indication, that it has performed satisfactorily under similar contract terms in the past.
- Manufacturers meet GMP criteria and appropriate ISO standards, as required by the government or funding agency.

All bids that meet the technical and commercial requirements are then evaluated based on the financial comparison of total price (including currency conversions, if necessary) and ranked according to the lowest price.

The bid evaluation committee then writes a report of the evaluation process and the bidders' performance, including a recommendation for the contract award. This report and recommendation should include information on all bidders and a clear explanation for the recommended supplier. The evaluation committee members sign the report with its recommendation, certifying that it was a fair and complete process. This is important in public procurement—you must maintain supplier confidence in the system to encourage them to bid again in the future and to avoid protests against unfair procurement practices.

Award contract

The contract is the outcome of the bidding process; it is the document that will legally bind the purchaser and supplier to an agreed-upon set of product specifications, delivery requirements, performance and payment obligations of both parties, and legal recourse in the case of non-compliance on either side. A variety of contract types are commonly used, but local procurement policies may dictate the ones you should use, or are permissible, in your country.

Determining payment methods is an important part of the contracting process. To avoid delays in receiving supplies, you must complete payment arrangements as soon as possible after the contract is finalized. Especially for large international orders, suppliers will not risk beginning production without proof of payment. In large volume orders, via international competitive bidding, the most common methods of payment are a letter of credit or a down payment. For indirect payment via international supply services, it is common for the service to require full payment in advance of ordering products on behalf of the purchaser.

The final step is to obtain any necessary approval by the contracting authority and funder, if required; you must ensure that all documents are properly signed and authorized by the appropriate parties.

Monitor contract performance

The next step is to ensure that the established contract is adhered to and that supplies are received, as planned. This means that you must have a process to monitor supplier performance. A contract monitoring system ensures that the technical specifications and contract requirements are met, enables the purchaser to identify any potential issues, and evaluates the supplier in light of consideration for future contracts.

The basic parts of this type of system are—

- procurement documents and key performance indicators
- procedures for addressing issues or disputes
- pre-shipment compliance plan
- procedures for monitoring shipment transport.

Examples of frequently used key performance indicators are—

- timeliness of deliveries
- adherence to—
  - technical specifications, labeling and packaging requirement
  - shelf life requirements
  - other terms and conditions outlined in the contract.

Establishing a contract performance monitoring system and implementing it early in the contract process ensures that problems are identified and resolved early, before they become bigger problems. It also means that if there is an issue with production, the purchaser and supplier can work together to identify alternatives sooner, rather than later, when options may be more costly because the need is more urgent.

One method of monitoring supplier compliance is to conduct preshipment sampling, inspection, and testing. This may be a requirement of the government or funder, or it may be optional; but, this is usually considered a good opportunity to ensure product compliance and quality before the product leaves the supplier's property.

The three basic levels of preshipment compliance are—preshipment document review, visual inspection of product, and laboratory or physical testing of the product. The level(s) of preshipment compliance selected may vary by product or supplier; if suppliers establish a reputation for providing quality products, the levels are reduced. However, to ensure consistency of quality over time, you should occasionally do random checks of different levels.

After products leave the supplier's plant or warehouse, it is also important to monitor transportation and delivery arrangements of consignments to ensure that they arrive on time and in good condition. The key areas to monitor are proper packaging; compliance with shipping instructions; compliance with delivery schedule; and compliance with temperature, or other special shipping requirements.

Delivery

The last step in the procurement process is to ensure delivery and receipt of the goods at the required destination. For international shipments, this includes the shipment of goods from the supplier's warehouse, through the port of entry, clearance through customs, receipt and inspection at the designated place of delivery, and resolution of any insurance or damage claims. While shipping terms and responsibilities may vary, it is the responsibility of both the purchaser and supplier to support the customs clearance process by ensuring that they have the necessary documentation to facilitate clearance. Insufficient or incorrect documentation can cause unnecessary delays in clearance, which frequently leads to charges that the purchaser is responsible to pay. Customs requirements should be clarified with the national agency, and shared with the supplier, before the shipment is sent, so that all documentation can be provided to the purchaser in a reasonable time.

When the consignment is delivered at the destination, the warehouse must officially receive the shipment by confirming receipt of the correct documentation; including the commercial invoice, packing list, and any other required documentation. At this point, the warehouse staff should inspect the consignment to ensure that the shipment includes the correct products, in the correct quantities, in good condition (with no damage), in correct packaging and labeling. Products must also meet any special packing or expiry date requirements included in the contract, and include a complete packing slip and the manufacturers' certification of product.

After inspection, if no problems are detected, products can be accepted into the warehouse and added to the usable inventory. Warehouse records should be updated to include the new shipment and all shipment paperwork should be shared with the procurement manager to show proof of delivery and to authorize them to process payment to the supplier. If the contract has been fulfilled and payment made, you can consider it closed.

7.3 Key Challenges Faced in Procurement

As is evident from the steps described earlier, public sector procurement of health care supplies is a complex process that engages several stakeholders over an extended period of time. Given the number of stakeholders, the strict nature of procurement procedures, and the often high value of funds allocated for procurement, it is not uncommon to have challenges during the procurement process. While you may have a wide range of problems that can impact procurement, the more common and critical procurement challenges revolve around the following:

Accurate quantification/forecast data

This data is essential for ensuring the procurement process results in the correct quantity of commodities that will best support the program's projected needs. A forecast that is too low could result in stockouts,

which often trigger expensive emergency procurements, creating a financial strain on limited health care budgets. A forecast that is too high can cause excess holding costs, storage-capacity strain, and an increased chance of products expiring on the shelf.

Lengthy procurement process

Each of the process steps described above—from quantification of requirements to delivery of goods—requires a specific amount of time to complete. While some steps can be done in parallel and will vary in the time required, some are often fixed for a set period of time. For example, most national procurement regulations will stipulate the amount of time a bidder has to respond to an international bid—which can range from 30–90 days. Donor requirements may also add time to the procurement process. The World Bank, for example, will often require that bidding documents be submitted for their review and *no objection* prior to release. If corrections are needed, the documents are returned to the procurement unit; the unit must correct and resubmit them for the World Bank's no objection, all of which takes time. You must also consider the manufacturer's production time, as well as shipping transit time and customs clearance time. Together, it is not uncommon for the public sector procurement process for health care commodities to take from 10–16 months, and sometimes longer, to complete.

As noted earlier in this chapter, it is important for supply and program mangers to understand procurement lead time requirements to ensure that quantification and procurement planning can be initiated early enough to support the procurement and supply cycle.

Delays in funding allocation and release

In many countries, national polices require that funding for procurement be allocated and available to the program, or procurement unit, before bidding documents can be publicly released. Delays in government funding approval and allocation of program procurement budgets delay the release of bidding documents; which, in turn, can delay the eventual delivery of the commodity. Donor funding cycles may also create delays in the procurement process if their funding cycles are not aligned with the government procurement cycle. Delays in supplier payments, because of national cash flow and treasury management constraints, can cause suppliers to hold shipments; this can lead to supply problems.

Product quality assurance

Counterfeit and substandard products are in the marketplace, creating a significant product quality risks for the supply system. To address this risk, public sector procurement processes and national regulatory agencies must implement appropriate quality assurance measures to ensure that only quality products enter the supply system. Procurement addresses this responsibility through the technical specifications, issued with the bidding document, that identify key product quality requirements, such as product certification requirements, pharmacopeia standards (when applicable), labeling and packaging requirements, shelf life requirements, etc. These requirements become the contractual obligations the supplier must comply with when a contract is awarded. The bidding and contract documents should also include the right to conduct preshipment or postshipment inspection and testing, as required, to confirm that the product complies with the stated quality assurance requirements.

Quality monitoring of procurement

As with every other function in the logistics cycle, you should consider quality monitoring during every step of procurement. In addition to the quality assurance steps mentioned in this handbook, quality must be part of every step—from the determination of what to order through to the receipt and acceptance of products in the national inventory. You should monitor all procurements to ensure that product specifications and quantities are precise and accurate, that the bidding process follows regulations and procedures and is documented appropriately, that contracts are written carefully, and that you receive the correct products, in good condition, after shipment and delivery.

Transparency throughout the procurement process

Because of the large sums of money involved in health care commodity procurement, it is not uncommon for fraud and corruption to occur. Special interests, suppliers, procurement personnel, and others may seek to influence product selection, manipulate order sizes, and manipulate supplier selection and contract award decisions to increase sales and profit margins for their personal benefit. Procurement officials must support an open procurement process by consistently applying national procurement regulations and procedures, and international best procurement practices that promote transparency.

Fighting corruption in Paraguay

In Paraguay, public procurement officials often lacked the technical knowledge and legal understanding to conduct procurement effectively, punctually, and transparently. Procurement decisions were frequently improvised, without following the regulations that were supposed to govern the process. Some officials worked closely with private sector contractors, effectively stifling competition and maintaining high prices.

To address these problems, workshops were held for procurement officials throughout the government. Participants in the seminars used their shared experiences to identify commonly used informal and illegal practices that can cover corruption and bribery. They used this information to develop a map of potential risks and dangers in the procurement process, which they contrasted with the norms and practices that promote transparency and efficiency. In addition to increasing officials' technical knowledge of the procurement process and its regulations, one of the workshop goals was to develop and promote a more ethical culture among participants to help guide their future procurement activities. (Transparency International 2002)

Chapter Summary

In this chapter, you learned the following:

- Good product specifications are critical to good procurement and to ensure that the procured products meet all program requirements and quality standards.
- Selection of a procurement method will depend on the types and quantities of products to be procured.
- Aligning procurement cycles with the availability of financing will help ensure that availability of funding does not delay procurement.
- Procurement is often a lengthy process. The full timeline needs to be known and communicated with other stakeholders to ensure that quantification and procurement planning can be initiated early enough to support the procurement and supply cycle and to avoid stockouts.
- It is critical to manage the bidding process to ensure that procedures are followed and the process is well documented. An open and transparent process will increase competition and the perception of fairness; it will decrease the risk of bidder protests.
- While lowest cost is important to selecting a supplier, other important criteria to consider when selecting suppliers include—
  - quality of products
  - ability to meet delivery schedule
  - past performance.
- Contract monitoring is necessary to ensure that the supplier is meeting its obligations. and that products arrive on time and in good condition.

For specific guidance and instructions about how to conduct public sector procurement for health products, see the following resources:

Procurement Capacity Toolkit (PATH 2009)

Managing Drug Supply (MSH 1997)

Procurement and Supply Management toolbox: www.psmtoolbox.org

Malaria Booster Control Program: Procurement and Supply Management Toolkit (World Bank) http://siteresources.worldbank.org/INTPROCUREMENT/Resources/Malaria-Toolkit.pdf

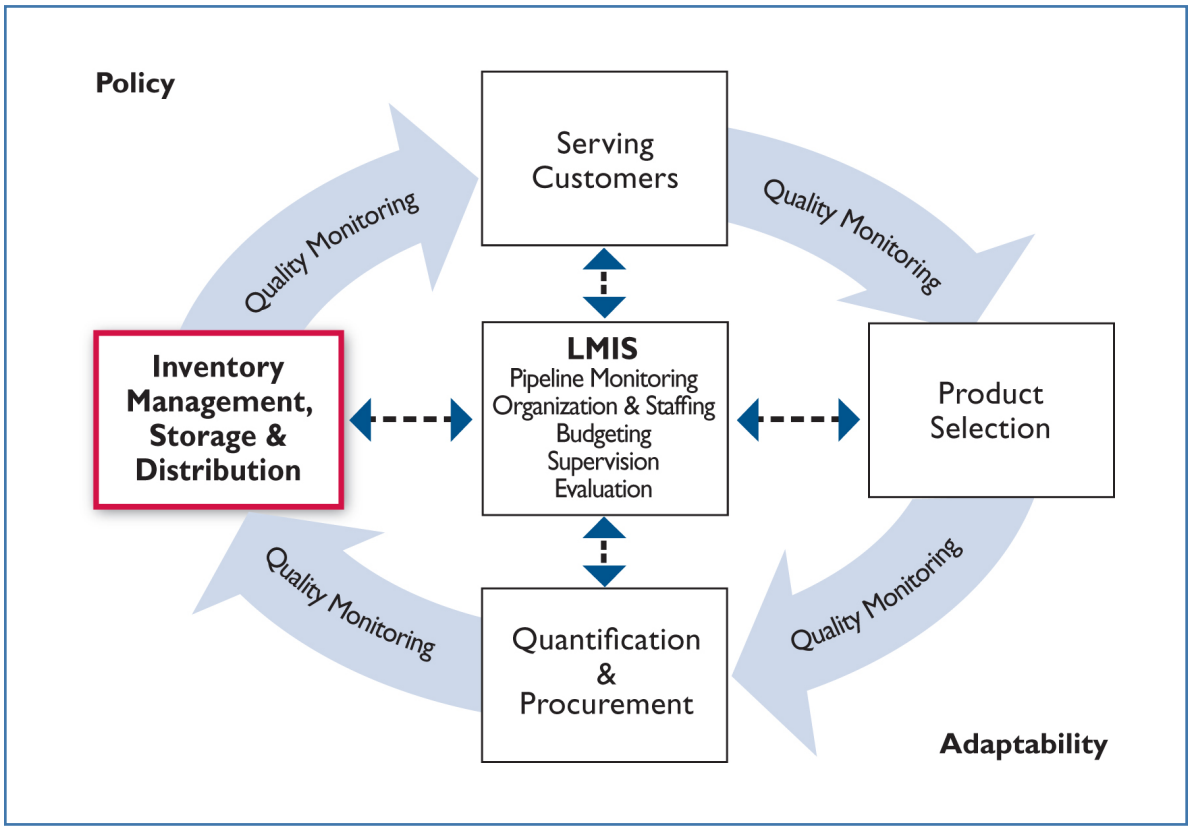
8 • Storage and Distribution

Objectives

In this chapter, you will learn the following:

- guidelines for proper storage of medicines and other health commodities
- definition for visual inspection and instructions on how and when to conduct a visual inspection
- how to identify and resolve common product quality problems found during a visual inspection
- how to calculate warehouse space requirements
- purpose of a physical inventory count and how and when to conduct a physical inventory count
- main logistics activities involved in health care waste management
- what to consider when designing a transportation network
- main activities involved in a transportation management system.

Figure 8-1: The Logistics Cycle



8.1 Storage

Products are stored at every facility in the pipeline; almost everyone working in the supply chain is responsible for product storage. Storage ensures the physical integrity and safety of products and their packaging, throughout the various storage facilities, until they are dispensed to clients. An important goal in storage of health products is the correct staging of health products to ensure that orders can be filled and distributed.

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 will vary based on the volume of products to be managed and storage facility size; as well as particular requirements, such as cold storage.

Key storage activities

Material receiving and incoming inspection: This activity occurs during the unloading of 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 you verify the quantities of products received against the packing slip or shipping invoice. Report any discrepancy.

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; an inventory control system helps you manage them. Whether the process is manual or automated, the best practice is to put away products the same day they are received.

Picking and packing. To fill shipping requests (or picking lists), products must be located, pulled from inventory, and prepared for shipment. In some cases, products need to be packed into shipment 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.

Shipping: To guarantee good shipping accuracy, the list of products and their quantities must be checked against shipping orders, or requests, prior to preparing the required shipping documents and loading of the cargo for transport. To avoid damage during transit, products must be arranged and secured within the vehicle using the requirements and conditions for adequate loading and transport.

Shelf life

To maximize the products' shelf life and make them readily available for distribution, you must have procedures for safe storage for all products.

All pharmaceuticals have a shelf life, usually specified by the manufacturer; but, often, a national formulary and therapeutics board must also approve the shelf life. Contraceptives are relatively stable products, with a shelf life of four to five years. The shelf life for essential medicines varies: anywhere from six months to more than five years, depending on the medicine. Pharmaceuticals must be stored and distributed in a way that ensures customers can receive them in good condition and in time to use them before their expiration dates.

Shelf life is the length of time from manufacturing date to the final date a product can be safely used, or the length of time that product can be stored without affecting its usability, safety, purity, or potency.

Some basic questions and answers on shelf life are—

How important is the expiration date?

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 contraceptive or medicine. Staff should not dispense any products that are at or close to their expiration dates.

What is the shelf life in my country?

In the U.S., the U.S. Food and Drug Administration (FDA) requires that drug manufacturers thoroughly test their medicines and packaging to determine the appropriate shelf life. Many countries believe that U.S. standards are acceptable, and many national formulary and therapeutics boards accept these guidelines. In some countries, national policies are more restrictive than in the U.S. They recognize, for instance, that their storage conditions (i.e., heat and humidity) may be more severe, so they have reduced the shelf life for products; one example is condoms, which may be damaged more easily by poor storage conditions. In other countries, the government's drug regulatory authority requires its own testing for some products. Refer to your country's national formulary and therapeutics board, or similar authority, for the applicable policy.

Why does shelf life change?

If you have worked in family planning for many years, you may have noticed that the shelf life for some products, notably Depo-Provera and Copper T 380A IUDs, has changed: Depo-Provera from 36 months to 48 months in 1997 and IUDs from 60 months to 84 months in 1994. Testing for shelf life takes time and it cannot be completely simulated in a laboratory. The shelf life of Depo-Provera and IUDs (and their packaging) was extended when they were proven to maintain purity, potency, safety, and effectiveness for longer periods of time.

Shelf life depends on real-time testing, combined with simulated lab testing. When procuring supplies, purchasers should specify the shelf life they require in their procurement documents. To ensure that the packaging and products are acceptable over time, you may need to work with the manufacturer to allow for real-life testing.

Where can I find the shelf life for essential medicines, contraceptives, and other health commodities?

You can obtain shelf life information directly from the manufacturer.

Everyone in the logistics system, from the central store to SDPs, should have access to shelf life information and other storage considerations for medicines, contraceptives, and other health commodities.

The USAID | DELIVER PROJECT developed fact sheets for several health commodities, including contraceptives (condoms, oral contraceptives, IUDs, injectable contraceptives, and implants), antiretroviral drugs, and HIV test kits. The fact sheets list the—

- description of the method
- visual indicators of potential quality problems
- special considerations
- donor, manufacturer, and brand
- primary and secondary packaging presentation
- units per shipping carton
- dimensions and weight of carton.

See the references and resources list in this handbook.

Storage Guidelines

Table 8-1 describes the storage guidelines that you should follow, regardless of the size of the facility. However, you may need to adapt these rules to your facility. 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.

For a comprehensive description of storage procedures, consult *Guidelines for the Storage of Essential Medicines and Other Health Commodities John Snow, Inc./DELIVER. 2003,* and the *Guidelines for Warehousing Health Commodities John Snow, Inc./DELIVER. 2003* (see the references and resources list in this handbook).

Table 8-1: Storage Guidelines

STORAGE PROCEDURES	WHY THIS PROCEDURE IS IMPORTANT
Clean and disinfect storeroom regularly.	Rodents and insects (e.g., termites and roaches) eat oral contraceptives 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. If rodents are a serious problem, cats may be an inexpensive, nontoxic alternative to traps or poisons.
Store supplies in a dry, well-lit, well-ventilated storeroom out of direct sunlight.	Extreme heat and exposure to direct sunlight can degrade contra-ceptives and essential drugs and dramatically shorten shelf life. If warehouse temperatures rise above 104 degrees F (40°C), the 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. Although air conditioning is an ideal means of controlling the temperature, it is expensive; alternatives include ceiling fans and forced ventilation. Direct sunlight is also a danger, as it raises 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 both 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). If extinguishers are not available, use buckets of sand. No matter which method you use, 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 flourescent lights and electric motors. Electric motors and flourescent 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 bottled gas or kerosene-powered refrigeration. During immunization campaigns, cold boxes or insulated coolers may be sufficient for rapid transport.

STORAGE PROCEDURES	WHY THIS PROCEDURE IS IMPORTANT
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. Like many other drugs, contraceptives can be sold on the black market as well. 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 appro-priate safety precautions.	Some medical procedures use flammable products. Bottled gas or kerosene powers refrigerators; 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, and hold more stock for the space they occupy. Stack cartons not more that 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 contraceptives. 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 the first to expire are also the first products issued (FEFO) (regardless 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, for example, can affect the usability of Depo-Provera®.
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 dispose of damaged or expired products immediately.	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, quickly dispose of them. Check policies for destruction. Donors and governments usually have specific guidelines for disposing of damaged or expired products.

8.2 Visual Inspection

In a perfect pipeline, all products would be stored under ideal temperature and humidity conditions, and according to proper storage guidelines. In the real world, the quality of storage conditions may vary widely from place to place. You may want to verify the quality of some products. In a warehouse facility, storekeepers can best verify quality by visually checking the condition of all products in their facility on a regular schedule.

Visual inspection is the process of examining products and their packaging to look for obvious problems with product quality.

When to conduct a visual inspection

To ensure the quality of the product in your warehouse and pipeline, you should conduct a visual inspection when any of the following occur:

- receive products from the manufacturer (usually at the central level)
- warehouse or health facility receives supplies
- conduct a physical inventory count
- dispense products to a client
- issue products from one level to another
- receive complaints from lower levels or customers
- products are about to expire
- products show signs of damage
- products have been kept under improper storage conditions.

Checking for quality: What to look for in a visual inspection

Products may have two basic types of damage during shipping and storage that affect their 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 is usually not obvious 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.

What about laboratory quality assurance testing?

If you have questions about a medicine or other product, laboratory testing may be the most appropriate way to verify product quality. But, laboratory testing is expensive and time-consuming, and many countries do not have the facilities to carry out the appropriate tests.

If you need to conduct laboratory tests on a product whose quality is suspect, the entire lot or quantity of product manufactured under similar conditions must be quarantined, making it unavailable for distribution. A statistically significant random sample of the product must be removed and sent to a lab for testing. Test results will indicate whether the product should be distributed or destroyed. Given the cost of conducting the tests necessary to verify the quality of health commodities, as well as the cost of drawing and shipping samples, the size of the lot or cost of the product should be large enough to justify testing. In some cases, it may be less expensive to destroy the suspected product than to test it.

This is not to suggest that lab testing should never be used. When preparing procurement contracts, governments, nongovernmental organizations, and donors may require lab product testing prior to delivery to the central/national country warehouse or recipient. This compliance testing verifies that the characteristics specified during procurement have been met. Similar steps should be taken to ensure that products procured at the country level are the same as their specifications.

Generally, mechanically damaged items are removed from stocks; the remainder of the box, or carton, is distributed as usual. You should remove chemically damaged items from inventory, and remove all like items (i.e., from the same lot) from inventory; quarantine and destroy them using per local disposal procedures.

Specifically, look for the common quality problems shown in table 8-2 and take the recommended action.

Table 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.
Oral contraceptives and spermicidal tablets: Changes in color of pills or crumbling under pressure of a finger Condoms: Lubricant has dried or changed color and/or the condom is broken	Check expiration date on cycle or carton. If expired, destroy according to established procedures. If within the shelf life, check to see if any storage history is available. If ideal conditions probably have been followed, remove any broken or crumbled cycles/tablets. Remove any dried-out or discolored condoms and condoms with broken packaging. Destroy these as appropriate. Distribute remainder as normal.
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, throughly inspect product for damage. If you are unsure that no damage has occured, 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 removal by a donor for testing. Notify upper level about missing stock.
Contents not idendtified 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.
Water-damaged cartons	Visually inspect all products. Remove any product that appears damaged or unacceptable.
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.

8.3 Storage Space Requirements

Proper storage includes the effective use of storage space. If too much space is unused, a storeroom is underused and money is wasted. But, if products are crammed into too small a space, they may be damaged because good storage procedures are harder to follow. Thus, warehouse managers must learn how to calculate the space needed to store incoming shipments and how to calculate overall storage requirements for the warehouse, as well as an ideal layout.

To develop a workable layout and to calculate storage requirements at a large warehouse, which may serve multiple purposes; 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 need to consider—

- 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.

Some issues to consider before purchasing racking or shelving include—

- product volume (size and weight of loads)
- pallets/containers (type, condition, dimensions, and weight)
- equipment clearance (standard height of equipment and height of equipment extensions, such as forklifts and load heights)
- building dimensions
- warehouse floors (stress and strength requirements).

For smaller storerooms, you will probably not use pallets but will use shelving rather than racks; you still need to consider—

- total product volume, by commodity, based on a peak month
- required space for receiving, picking/packing, and shipping
- organization and labeling of cartons to ensure accessibility and first-to-expire, first-out (FEFO)
- required operation aisle distances.

Your calculations begin with the total number of units for the product you need to store. If you are calculating space for a single shipment, use the number of units in that shipment. If you are calculating space requirements for the entire quantity of a product that you need to be able to keep in your store, use the maximum quantity, as calculated in chapter 4 (max stock level × AMC). If you are making a long-term plan for your storage needs, you must use the largest quantity you might need to store during the period of your plan—i.e., the max level times the largest AMC program planners have forecast.

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

- number of units in a carton (exterior packaging)
- size of the carton.

If you do not have this information, you should request it from the supplier.

To calculate the amount of floor space needed to store any product, follow the steps below (also see table 8.3).

For example, to store 1,000,000 syringes of chloroquine phosphate injection—

1. Divide by 100 syringes of chloroquine phosphate injection per carton, which equals 10,000 cartons of chloroquine phosphate injections.
2. Multiply by 0.004307 m^3 per carton of chloroquine phosphate injections, which equals 43.07 m^3 of the total volume.
3. Divide by 2.5 m the maximum carton stack height, which equals 17.23 sq. m of floor space.
4. Multiply by 2 to allow 100 percent for handling space, which equals 34.46 sq. m of total floor space.

The square root of 34.46 sq. m is 5.87 m. But, because 7×5 = 35, you can also compute the area using basic math.

Table 8-3. How to Calculate Floor Space

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 units to be stored by the number of units 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. Multiply 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 multiply 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, may 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 volume requirements and perform steps 4–6 on this total.

By calculating space requirements for future shipments, you or the warehouse managers can determine whether they have adequate space to receive the shipment. If sufficient space is not available, you should ask to receive the order in several small shipments, instead of one large one. However, large shipments are usually less expensive, and some donors may prefer to provide the entire forecasted need in a single shipment. You can consider alternatives, such as renting additional space, when space is not available. When procurement contracts are set, it would be advisable to set the size of allowable shipments and include a shipping schedule in the contract. Knowing how to calculate storage space before shipments arrive can save a program time and money.

To use the formula to calculate the space needed in an entire warehouse, begin with the maximum quantity of product expected to be stored, instead of the number of units expected. You will usually want to add extra room for loading and unloading docks; quality inspection and quarantine; packing, preparing shipments; and offices for administrative staff (see table 8-3 for a description of the process to calculate space needed in a warehouse).

8.4 Physical Inventory Count

Throughout this handbook, we have discussed how stock-on-hand information is recorded on stockkeeping records. But how do you know if the information recorded on the stock card is correct? The only way to be certain is to conduct a physical inventory count.

While conducting the physical inventory count, be sure that you 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.

A physical inventory count is used to compare actual stock on hand for each commodity with the amount recorded on the stock card.

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

The frequency of physical inventory counts may be governed by local regulations. 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 you complete your monthly report. If you find that the stockkeeping records do not match the actual stock, conduct a physical inventory count more often and take steps to improve recordkeeping.

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

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. 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. In this process, divide products into three categories, based on monetary 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.

8.5 Health Care Waste Management

Health care waste (HCW) products are generated at health care facilities, laboratories, and research facilities during diagnosis; and during the immunization of humans and animals, medical treatment and research, and the production or testing of biological products. Sharps (including used needles), used gauze, blood/IV lines, gloves, infusion sets, scalpels, blades, and broken glass are examples of HCW. Expired drugs, laboratory reagents, and cleaning solvents are also HCW products. Another category—non-hazardous waste—includes paper and packaging, bottles, cans, and glass for general use.

HCW is a major health and environmental concern; the primary objective is to protect health workers and facility staff, the community, and the environment. A well-functioning logistics system is fundamental to the proper management of HCW at various levels in the logistics system, including adequate storage, handling, and transport from the originating facility to the final HCW disposal.

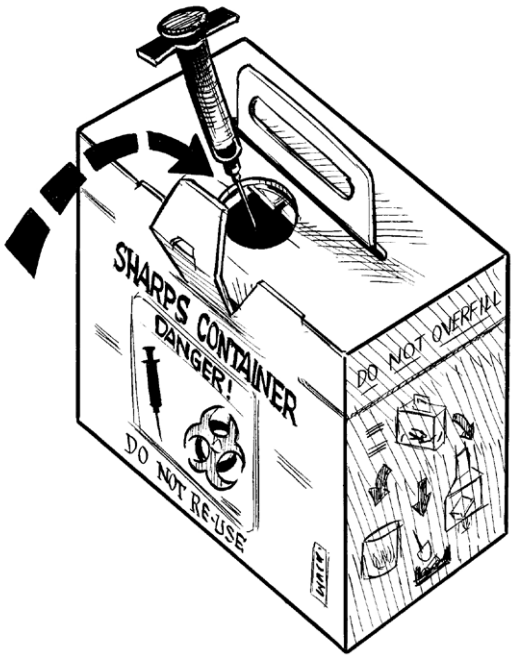
HCW storage and handling

To store HCW properly and safely, we recommend that you follow any existing standard operational procedures (SOPs). Store chemical waste, such as expired pharmaceuticals, separately from unexpired product. When possible, separate HCW where it is generated, based on the main categories:

- infectious hazardous
- non-hazardous waste
- non-infectious but hazardous
- general waste.

Hazardous waste must be contained and separated from general waste. You will need a variety of packaging supplies to collect or store HCW at every facility, including non-corrosive color-coded bins or containers and bin liners. Sharps boxes (or safety boxes) are used for used needles, syringes, scalpels, blades, or broken vials or ampoules, and any other items that could injure the service provider or any worker in charge for handling HCW (see figure 8-2). People handling waste should have access to protective equipment that will enable them to safely carry out their duties.

Figure 8-2: Sharps Box



HCW transportation and disposal

Moving HCW can be dangerous, and it involves movement of HCW internally from the point where the waste is created to a storage area; to intermediate facilities; and, eventually, to a disposal site. To avoid contamination during transport, separate hazardous waste from regular waste.

Individual facilities could also send the waste to the central level instead of running their own disposal. This type of reverse logistics could consolidate HCW from various facilities and, potentially, lower costs related to waste disposal.

The disposal of HCW uses different methods, depending on the type of waste to be treated. Some disposal requires autoclaving, others incineration. Waste or its residue can be buried in a protected pit or sent to a landfill for disposal.

For a comprehensive description of the logistics functions and information about procurement planning for HCW, go to the USAID | DELIVER PROJECT (deliver.jsi.com), *Logistics of Health Care Waste Management* 2009.

8.6 Distribution

Because most of the 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 regions; and, ultimately, to service delivery points. Similar to storage of health products, 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. However, to maintain a well-functioning distribution system, you must consider several essential points in transportation planning and execution.

Transportation network design

When designing a new transportation network or redesigning an existing one, answer 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 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 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 transport 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 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.

Transport Management System (TMS)

Just designing a transport network and allocating resources will not guarantee a well-functioning system. Development and implementation of a formal TMS will support and sustain a successful distribution network.

A comprehensive TMS should include the following activities, which will impact the transport of health products:

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 that you 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 that you define and apply key performance indicators (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.

For additional information about transport management system, go to *Transport Management: A Self-Learning Guide for Local Transport Managers of Public Health Services* at deliver.jsi.com.

Quality monitoring of storage and distribution

You can approach quality monitoring for storage internally and externally. Internally, you should assess and monitor warehouse management for productivity, timeliness, use of resources, and safety—they all influence cost and service. External measurements focus on satisfying customers, including indicators of quality (e.g., fulfilling orders accurately and on time) and length of lead time (e.g., between order and delivery). Some customer service-specific performance indicators include order cycle time, stock availability, documentation quality, and order completeness. Other performance measurement categories for warehouses include inventory accuracy, inventory control, space utilization, equipment methods, and safe practices.

For distribution, performance indicators for transport management systems should include measures for the timeliness, frequency, reliability, and accuracy of products supplied to health facilities; condition and availability of transport vehicles; and staff performance (both drivers and managers).

As with other aspects of the logistics cycle, monitoring of storage and distribution requires that you collect data using a waste management system (WMS) or a transport management system (TMS), and provide regular supervision and feedback.

Chapter Summary

In this chapter, you learned the following:

1. Key activities in storage include—
   - material receiving and incoming inspection
   - put away
   - picking and packing
   - shipping.
2. Shelf life is the length of time from the manufacturing date to the final date a product can be safely used, or the length of time that product can be stored without affecting its usability, safety, purity, or potency.
3. Guidelines for proper storage of health commodities include the following:
   - Clean and disinfect storeroom regularly.
   - Store supplies in a dry, well-lit, and well-ventilated storeroom, out of direct sunlight.
   - Secure the storeroom from water penetration.
   - Ensure that fire safety equipment is available and accessible, and that personnel are trained to use it.
   - Store latex products away from electric motors and fluorescent lights.
   - Maintain cold storage, including a cold chain, for commodities that require it.
   - Keep narcotics and other controlled substances in a locked area.
   - Store flammable products separately, using appropriate safety precautions.
   - Stack cartons at least 10 cm (4 in) off the floor, 30 cm (1 ft) away from the walls and other stacks, and no more than 2.5 m (8 ft) high.
   - Store medical supplies separately, away from insecticides, chemicals, old files, office supplies, and other materials.
   - Arrange cartons so that arrows point up; ensure that identification labels, expiry dates, and manufacturing dates are visible.
   - Store supplies in a manner accessible for FEFO, counting, and general management.
   - Separate and dispose of damaged or expired products without delay.
4. Visual inspection is the process of examining products and their packaging to detect obvious problems in product quality.
5. Typically, mechanically damaged items are removed from stocks, and the balance of the box or carton is distributed as usual. Remove chemically damaged items from inventory; remove all like items (i.e., from the same lot) from inventory and destroy them.
6. When you calculate storeroom space requirements—
   - Begin with the number of units.
   - Divide the number of units by the number of units in a carton.
   - Multiply the number of cartons by the volume of the carton.
   - Divide the total volume by 2.5 m or 8 ft.
   - Multiply the floor space needed to store the product by 2 or add 100 percent.
   - Using the square root function on a calculator, calculate the dimensions of the total amount of floor space needed.

7. During a physical inventory count, compare actual stock on hand for each commodity with the amount recorded on the stock card.
8. HCW can be hazardous waste (sharps, used gauze, gloves, scalpels, expired drugs, laboratory reagents, etc.) and non-hazardous waste (paper and packaging, bottles, etc.) generated at health care facilities, laboratories, and research facilities. Contain and separate hazardous waste from general waste.
9. When designing a transportation network, consider the following factors:
   - monthly demand of products
   - location and distance of facilities from their supplying facility
   - fleet details
   - staff trained in activities related to transportation.
10. Key activities in a transport management system include—
    - operations management
    - fleet management
    - human resources
    - performance monitoring and costs.
11. Quality monitoring of storage and distribution includes collection of data, as well as supervision and feedback. You can use a WMS to collect information about—
    - stock availability
    - order fulfillment
    - inventory accuracy
    - space utilization
    - safety.
12. You can use a TMS to collect information about—
    - frequency, reliability, and accuracy of product distribution
    - condition and maintenance of transport vehicles
    - staff performance.

9 • Monitoring and Evaluation of Supply Chains

Objectives

In this chapter, you will learn the following:

- definitions of basic monitoring and evaluation (M&E) terms and concepts
- program cycle for supply chain systems improvement
- role of M&E in strengthening supply chains and the overall goal of product availability
- steps in developing an M&E workplan
- key components of an M&E workplan
- how to write recommendations for system improvement
- connection between objectives, interventions, and indicators
- how to select and use indicators to measure system performance
- data collection methodologies, including routine monitoring and periodic evaluation
- steps in planning and conducting a supply chain assessment
- various tools that can be used for M&E for supply chain management
- importance of providing feedback and reporting results to stakeholders.

9.1 Monitoring and Evaluation Basics

This section presents the basic concepts in M&E and its importance in supply chain management.

To begin, certain terms will help you understand M&E. We will cover these terms in more detail throughout this chapter.

Key M&E Terms

monitoring. Routine collection and analysis of measurements or indicators to determine the ongoing progress toward objectives

evaluation. Periodic comparison of objectives, with accomplishments, to determine how well the objectives were achieved

baseline. Basic information gathered before a program begins; it is used later as a comparison for assessing program impact

data. Individual facts, statistics, and raw numbers

information. Knowledge acquired in any manner; facts and data that have been turned into useful material

analysis. Converting data into information; should be in a format that is useful for decisionmaking

goal. A statement, usually general and abstract, of a desired state toward which a program is directed (usually not measurable)

objective. Specific statement describing the desired accomplishment(s) or results of an intervention or program; how the goal will be achieved (objectives should be measurable and should address existing problems, program weaknesses, and/or client needs [or build on strengths])

indicator. Variable that measures a particular aspect of a program (input, process, output, outcome, impact), usually related to achievement of objectives

M&E plan. Relates goals, objectives, and interventions to problems; shows how indicators and tools measure achievement of objectives

quantitative. Measure that is *objective* and verifiable, usually a numeric value

qualitative. Measure that is *subjective* and descriptive, usually based on an individual's perception or interpretation

inputs. Set of resources (e.g., funds, policies, personnel, facilities, supplies, etc.) required to implement a program/activity

process. Set of interventions (e.g., training, supervision, reporting) in which inputs are used to achieve objectives and desired results

outputs. Results obtained at the program level, direct products or deliverables of a program (e.g., number of people trained, M&E materials developed and available for use)

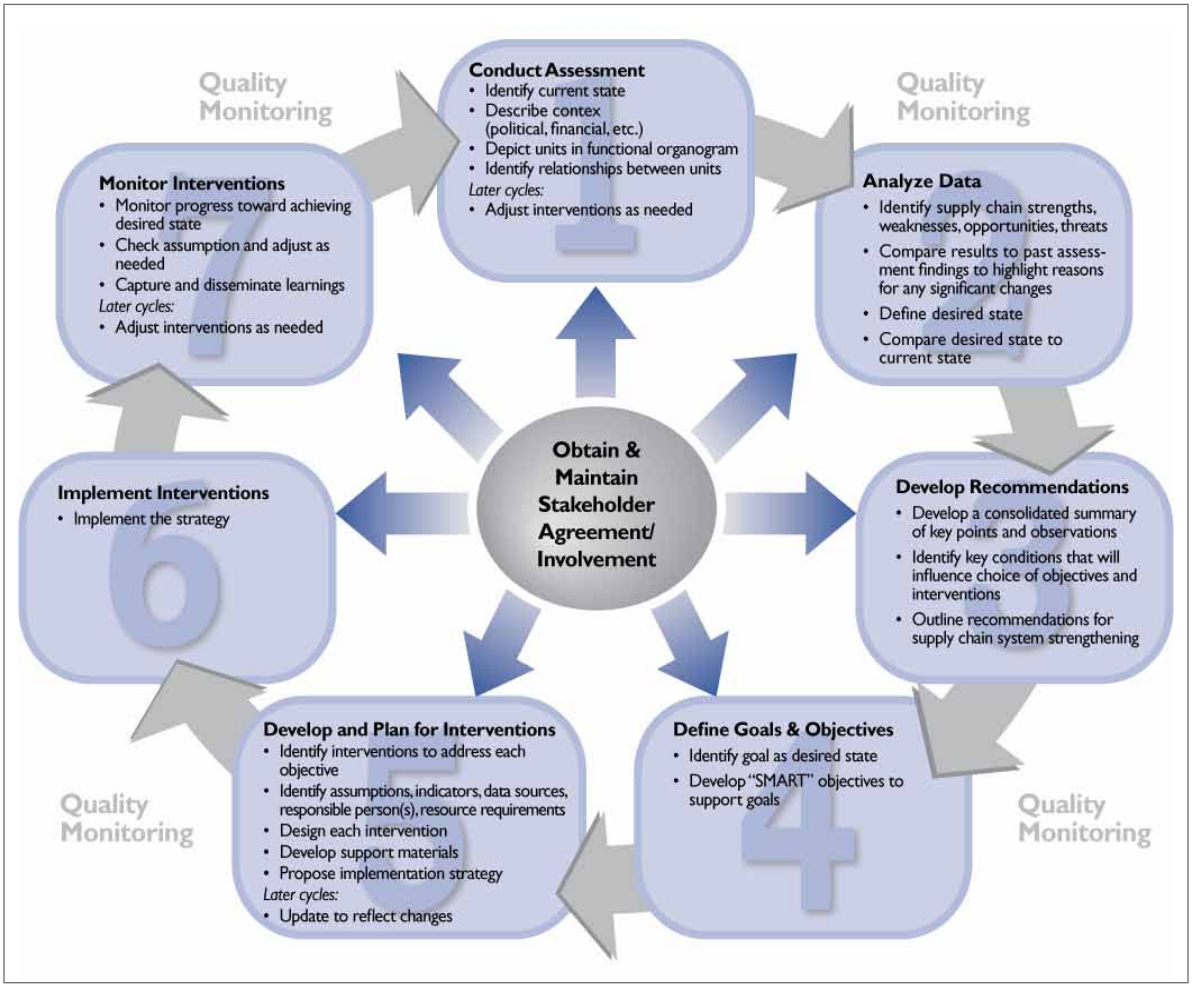
outcomes. Results obtained at the population level following interventions (e.g., improved access and product availability, improved skills)

impact. Long-term results or outcomes also obtained at the population level (e.g., changes in total fertility rate [TFR] or in morbidity and mortality)

feedback. Presentation of information to decisionmakers or lower-level personnel, based on information received.

Figure 9-1 shows a typical program cycle for supply chain systems improvement; it shows how M&E plays an integral and continuous role in supply chain management and system strengthening. M&E must be built into a program from the beginning, or from the launch of a new workplan cycle.

Figure 9-1: Program Cycle for Supply Chain Systems Improvement



Collecting M&E data enables program managers to provide feedback to staff throughout the supply chain to improve system performance; to report results to funders and other stakeholders; and to justify the need for additional resources, when appropriate. One important reason to do M&E is to improve program management and, ultimately, the logistics system performance. Improving program management and system performance are critical for improving customer service and for ensuring *commodity security*—that clients have the products whenever and wherever they need them.

Why do we do monitoring and evaluation?

Monitoring and evaluation is important to—

- provide feedback and report results
- mobilize resources (financial, human, capital, etc.)
- improve program management and system performance.

As shown in figure 9-1, the program cycle (or workplanning process) usually begins with an assessment of the current situation. In addition, quality monitoring happens throughout the program cycle; it can help identify which components are not functioning efficiently and where improvements are needed. Think back to the logistics cycle in chapter 1 and how quality monitoring is part of that cycle. Quality monitoring appears throughout the logistics cycle, between all the functions. Similarly, it is part of the program cycle. This chapter explains how to actually conduct this quality monitoring, which is discussed primarily in relation to system improvement.

To make improvements, staff need to—

- collect information
- analyze system strengths and weaknesses
- develop recommendations to take better advantage of the strengths of the system and to address the specific weaknesses in the system
- define goals and objectives, and select interventions based on findings from the assessment
- develop and plan implementation strategies, including an M&E plan
- implement the interventions
- monitor the interventions
- reassess and adjust interventions, as needed.

See the next section for how to develop an M&E plan as part of this process.

Why is quality monitoring a continuous process?

Changes in the organizational environment and policies can affect a supply chain (e.g., health sector reform, integration, privatization, cost recovery).

Changes in resources (financial, human, capital) that are available to the system can affect a supply chain.

Adding new services with new commodities, which may have different storage and distribution requirements (HIV and AIDS programs, Expanded Programme on Immunization [EPI], etc.), can affect the supply chain.

9.2 Developing an M&E Plan

An M&E plan is a document that describes the complete system for monitoring and evaluation; it links strategic information obtained from various data collection systems to decisions that will improve health programs. An M&E plan is different from, but related to, a program workplan. The program workplan lists a series of activities that will be conducted throughout the upcoming year; the M&E plan links those activities to the overall goals of the program, and describes how these interventions will be measured and evaluated.

As noted above, the first step in developing an M&E plan to support the overall program workplan is to collect and analyze data related to the system. After identifying the system strengths and weaknesses, you should present recommendations to the stakeholders.

The main steps in developing recommendations include the following:

- Develop a consolidated summary of the key points and observations (e.g., strengths, weaknesses, opportunities, and threats).
- Identify key existing conditions or circumstances (the context) that will influence the choice of objectives and interventions.
- Compare results to past assessment findings to highlight the reasons for any significant changes, including assumptions that did not work.
- Outline recommendations for supply chain system strengthening.

The recommendations should define the problems, state the consequences of the problems, suggest a course of action(s) to solve the problem; and identify who should take action on the recommendations, the resources required, the expected timeframe, and the expected outputs and outcomes.

After the stakeholders have validated and approved the recommendations, they should be used to directly to inform the development of appropriate *goals* and *objectives* for the program's workplan, including a comprehensive M&E plan developed through a participatory process (see definitions in section 9-1).

SMART objectives

After the overall goals are outlined, you should develop SMART objectives using the following principles:

Specific: The objective clearly speaks to the single problem that it is intended to address.

Measurable: This includes benchmarks, or points of reference, that can be used later to compare results. Note: At the objective level, you will not necessarily need to express them as a percentage or number. Instead, you can do this for the indicator related to the objective.

Appropriate: The objective is related to and clearly supports the goal.

Realistic: The capacity and resources are available and can be used to reach the objective.

Time-bound: Objectives are planned over time to ensure that they can be met and are measured within a specific timeframe. Note: In programs with a specific time period, such as a five-year project, you do not always need to state the time period as it is implied. This is especially true when you are working within a workplan structure.

Do not write strong objectives as interventions or activities, but write impact-oriented statements, with a clearly identified impact on the system, program, or population, as a whole. They will support the overall goal.

An example of an objective is to reduce stockouts for all modern methods to less than 10 percent in five years.

The next step is to identify the interventions that will be done to achieve the objectives. A sample of an intervention to support the objective listed above is train all facility-level staff on how to report and order supplies by the end of year 2.

After you identify the objectives and interventions, you can use the criteria below to outline the priority areas, their feasibility, and the availability of resources. Score each objective and intervention on a scale of 1–3, with 1 being low priority, feasibility, or level of resources; and 3 being high (see table 9-1).

- For priority, consider how large and how broad the impact will be, whether this is an important pre-cursor/first step for, or synergy with, other objectives/initiatives.
- For feasibility, consider the extent of political support, relevant policies, country and logistics system infrastructure, and cultural support. Independently, score the objectives; then score the interventions within each objective to reflect the feasibility of accomplishing the overall objective or intervention.
- For resources, consider if available resources (e.g., funds, materials, knowledge/skills) meet, exceed, or fail to meet the resource requirements. Assign a score that reflects the level of resources available, compared to what is required to accomplish each intervention.

Table 9-1: Objectives and Interventions Worksheet

	Priority	**Feasibility**	**Available Resources** (vs. requirements)
Objective 1:			
Interventions • •			
Objective 2:			
Interventions • •			

*Score: 1 = low 2 = medium 3 = high

After you prioritize the interventions, use the results to develop an M&E plan consistent with the program's policies and procedures; focus on the objectives and interventions with the greatest need, greatest likelihood of success, and/or available resources. If the priority and feasibility are high, but resources are not available, you can develop a resource mobilization plan.

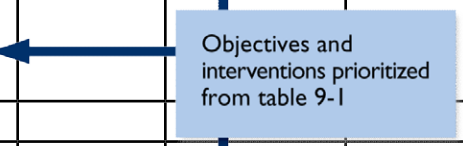
Finally, program managers and M&E advisors should identify relevant *indicators* that can highlight whether interventions; objectives; and, ultimately, goals have been achieved (see section 9.3 for more details). Table 9-2 can help you organize the components of the work plan by identifying the following:

- a description of the *desired state* that each intervention is expected to produce
- *key assumptions* underlying each intervention; what needs to be in place to carry out the intervention
- *indicators* for measuring progress toward completing the interventions and, therefore, toward achieving the objectives (see section 9.3 for details on developing indicators)
- *data sources* for each indicator

- *person(s) responsible* for carrying out the interventions and ensuring that objectives are met over the course of the workplan
- *resource requirements* for each intervention and their sources.

Table 9-2: M&E Workplan Worksheet

	Desired State	Key Assumptions	Indicators	Data Sources	Person(s) Responsible	Resource Requirements
Objective 1:						
Interventions • •						
Objective 2:						
Interventions • •						



Again, link this M&E plan directly to the program's overall workplan and priorities that address specific weaknesses, based on solid information collected during a baseline or other assessment, and validated through a participatory process.

You can use the information from this worksheet to develop a comprehensive M&E plan, organized as suggested below. An M&E plan should include the following components—

Introduction: Provides any relevant background and country-specific information, leading to the purpose of the M&E plan. Identify some of the key system problems in the introduction.

Description of program: Clearly states the overarching goal(s) and the objectives developed to achieve system improvements, and describes the *desired state* and *key assumptions*. Includes a general description of the interventions that will be implemented to meet the objectives. This is where you should establish a clear link to the overall program workplan.

Monitoring plan: Describes how progress on the interventions and processes will be routinely tracked to ensure smooth implementation, and to monitor advancement toward objectives.

Evaluation plan: Describes the methods that will be used to evaluate success in meeting objectives.

Indicators: Carefully select the indicators in the M&E plan to ensure they reflect directly on the program interventions, which were designed to achieve the specified objectives (see section 9.3 for details on developing indicators).

Data sources: Specifies where staff will get the data to report on the selected indicators.

Data collection and management tools: Outlines what data collection, or other management tools (e.g., LMIS), will be required for data collection.

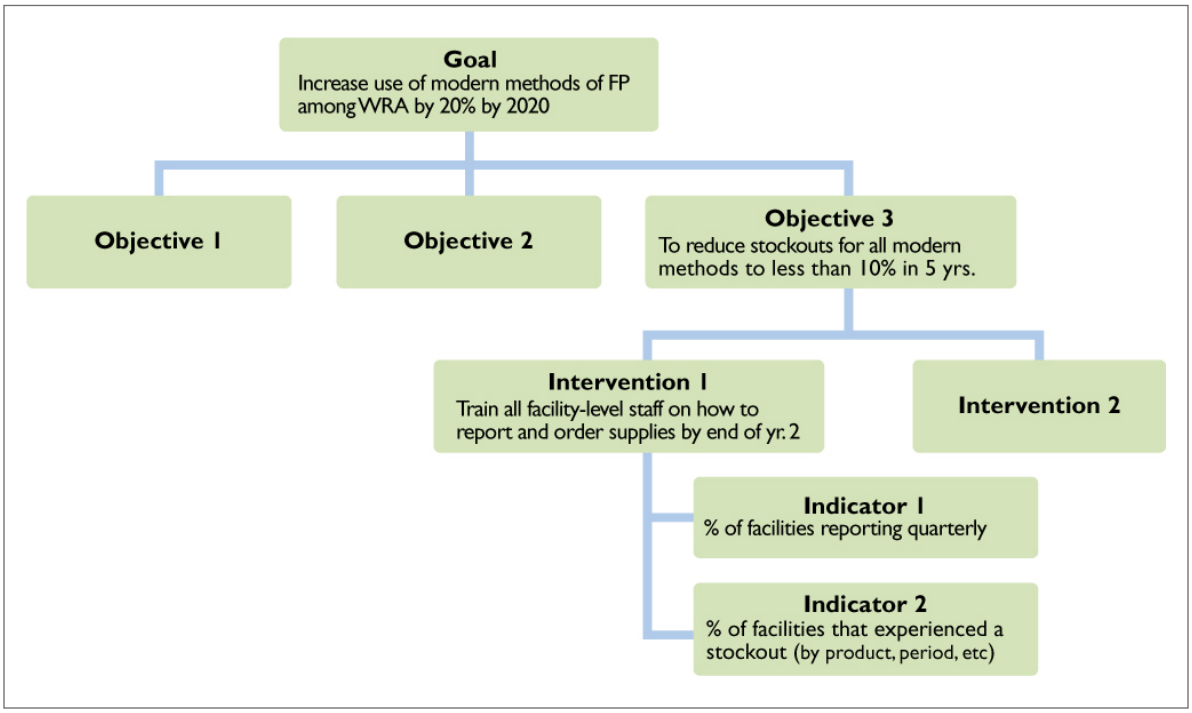
Reporting requirements and frequency of data collection: Describes reporting requirements at all levels of the system, both internal and external to the program; including the frequency of data collection, and providing feedback and reporting results.

Person(s) responsible: Lists the person(s) or organization(s) responsible for implementing each intervention and monitoring its success.

Resource and capacity requirements: Defines the human, financial, or capital resources and capacity required to carry out the M&E plan.

In summary, figure 9-2 illustrates the relationship between goals, objectives, interventions, and indicators; and offers an example of each. The examples are specifically related to strengthening the supply chain. Many other objectives could be developed to achieve the goal noted, and many interventions could be planned to achieve the objectives.

Figure 9-2: Relationship between Goals, Objectives, Interventions, and Indicators



9.3 Indicators for M&E of Supply Chains

The indicators most programs select to be measured provide evidence of achievement of interventions and results and progress toward objectives and goals. Indicators can measure different aspects of a program and should reflect issues that are considered a priority for the program. The data required to calculate the selected indicators can be collected using both quantitative and qualitative data collection methods. Quantitative data involves the collection of *objective,* verifiable data—usually a numeric value or percentage. Qualitative data can often provide a more in-depth view of certain measurements, although it is more *subjective* because it is usually collected through interviews, focus groups, or personal experiences that reflect individuals' perceptions or interpretations.

The data can be collected and presented in many forms, such as—

- dichotomous [divided into two parts] (yes/no)
- numeric (number of people trained in…)
- percentage (percentage of facilities with stockouts)
- ordinal (on a scale of 1–5, …)
- composite (quality indices, Contraceptive Security Index)
- qualitative (key informants' opinions regarding…).

The indicators can be further categorized by their purpose:

inputs. Set of resources—human, financial, and capital—needed to implement a program/activity

processes/activities. Set of interventions that use inputs to achieve objectives and desired results

outputs. *Results* obtained at the *program* level

outcomes. *Results* obtained at the *population* level following interventions (i.e., what changed as a result of the activities)

impact. *Results* that reflect the long-term or ultimate outcomes at the *population* level.

Most programs measure their achievements through their outputs and outcomes at both the program level and the population level. Programs primarily want to evaluate the outputs and outcomes that result from their interventions. *Outputs* are a direct result of program interventions. *Outcomes* are population-based and can be divided into intermediate and long-term (impact); for example, changes in the contraceptive prevalence rate (CPR) as an intermediate outcome and the total fertility rate (TFR) as a long-term outcome (impact). However, as part of routine monitoring, and to ensure that programs are on the right track, programs can and should be measured with all levels of indicators.

Impact is the most difficult to measure because it can take years to achieve and it is often difficult to establish a causal link between one specific program and the desired result (e.g., decrease in fertility rate). There could be multiple programs and other factors that could also contribute to the outcome (e.g., increase in women's education level, improved socioeconomic conditions, interventions implemented by other programs).

Like objectives, indicators must also be SMART: *specific, measurable, appropriate, realistic, and time-bound*. Indicators should also be *precise*, so they can be reproduced the same way, by different people or for different programs; and *consistent*, so they can be reliably measured over time.

What if reliable data are not available?

If reliable data on direct measures are not available, you can use appropriate proxy indicators to monitor program progress. Proxy measures are indirect measures that are linked to the result by one or more assumptions. For example, in supply chain management, the number of people trained in supply chain management can serve as a proxy for the increased capacity of logistics personnel, if their capacity cannot easily be measured. Product availability on the day of a health facility site visit can serve as a proxy for overall product availability, over a period of time, at health facilities where records—such as stock cards or ledger books—are not available.

The program's goals, objectives, and interventions should be considered when developing indicators, including the information that needs to be collected in order to assess them. Many different indicators can be used to measure progress—it is important to focus on those that would be useful for a specific program because some are more relevant than others. Some examples of key supply chain output indicators include the percentage of—

- facilities that had a stockout (during a defined time period, for a specific product or set of products)
- inventory expired or damaged
- facilities reporting/submitting complete reports/submitting reports on schedule
- facilities that keep accurate logistics data for inventory management
- orders that were filled as requested (order fill rate)
- the number of personnel trained in supply chain management.

To continue learning about how to measure the performance of your supply chain, refer to *Measuring Supply Chain Performance: Guide to Key Performance Indicators for Public Health Managers* at—http://deliver.jsi.com/dlvr_content/resources/allpubs/guidelines/MeasSCPerf.pdf

You can use many other useful measures for monitoring and evaluating supply chain performance for both the public and private sector health programs.

9.4 Data Collection Methodologies

To collect the data to report on M&E indicators for supply chain management, logistics and M&E personnel will first need to define the data collection approach. The approach selected depends on the purpose of the M&E. Again, activities can be categorized into two types—

monitoring. The routine collection and analysis of measurements or indicators to determine ongoing progress toward objectives. If the logistics management information or supervision system is designed correctly, you should be able to easily obtain the information you need.

evaluation. A comparison of objectives with accomplishments and how the objectives were achieved, which involves a more formal and structured system assessment and requires extensive planning.

With both monitoring and evaluation, it is important to build in processes for quality assurance for the data collected during these exercises. Quality control checks are vital to ensure the data collected is accurate and complete.

Routine monitoring

As noted above, monitoring activities require systems (e.g., LMIS or supervision systems) to provide a reliable source of routine data that can be rapidly processed and analyzed for program management and for providing feedback. See chapter 2 for detailed information about reporting through an LMIS. These reports are most useful when the data reported are complete, accurate, and timely. They should include logistics data critical for operational decisionmaking and for monitoring progress toward meeting program objectives. However, do not include extraneous data that does not serve a specific purpose, or will not be used.

While using LMIS data for routine monitoring is cost-effective and efficient, it is also important to note that there are certain limitations. A limited number of data points are collected through an LMIS; which, in turn, limits the number of indicators that can be monitored over time using these data. In addition, certain indicators cannot be calculated through LMIS data. Some require a direct observation or site visit, such as assessing storage conditions or comparing LMIS records to a physical inventory. Using LMIS data for monitoring also depends on the quality and completeness of the data submitted.

Another option for monitoring supply chain performance is through supervision, which is most useful when it is routine, structured, and constructive. Supervision for monitoring supply chain performance should focus specifically on supply chain activities and functions. Both qualitative and quantitative data can be collected during supervision to inform decisions at the higher levels, or to calculate indicators to monitor progress toward meeting program objectives. Supervision visits are also an opportunity to reinforce knowledge and skills using specific on-the-job training and mentoring.

Supervision checklist in Malawi

The Ministry of Health and Population in Malawi uses an integrated supervision checklist to guide supervisors during their visits to all levels of the health delivery system. The monthly drug management section includes questions such as the following:

- Are bin cards correctly filled?
- Are stock cards used for the control of stocks?
- Are expired drugs on the shelf?
- Do staff verify orders received against orders placed?
- Are monthly stock counts done?

Periodic evaluation

A supply chain assessment or evaluation can verify whether program interventions have been completed (or are in progress) and whether they are resulting in progress toward the program's objectives. As with routine monitoring, the data collected should not include extraneous data that does not serve a specific purpose, or will not be used.

Evaluation is done less frequently than monitoring; the findings are used for broader program-level decisionmaking and periodic results reporting to program managers, funders, and other stakeholders. Individual indicators can inform whether the supply chain is performing well, but they may not describe why performance is good or bad. Therefore, to evaluate supply chain performance, you should collect a combination of quantitative and qualitative data. A facility-based survey is usually required to get a thorough understanding of how the supply chain is performing, from top to bottom. However, you should complement this with a thorough review of program documentation and reports, as well as key informant interviews at different levels in the system; and across different functions, including the stakeholders perspective. At the central level, this includes collecting additional information about the program as a whole by meeting with senior program personnel: the director of family planning, preventive health services, HIV and AIDS prevention or reproductive health; the central warehouse manager; and the program's logistics manager.

What happens during an evaluation of a supply chain?

- The entire system's strengths and weaknesses, commodity availability, and other key logistics indicators are assessed.
- Assessment results are presented to senior managers and policymakers.
- Recommendations for reducing or eliminating weaknesses are presented.
- An implementation plan with specific steps, based on the recommendations, is proposed.

When preparing for an evaluation exercise or assessment activity, you must do extensive planning and take the following steps:

- Determine what you want to learn from your assessment.
- Identify the data and indicators that will give you those answers.
- Design your assessment and develop the methodology to collect the data for your indicators:
  - Confirm resources for assessment (financial and human).
  - Design or adapt an assessment tool.
  - Determine the size of your assessment team.
  - Determine the length of time to conduct your assessment.
  - Train data collectors on the application of the tool.
  - Pilot test your tool and methodology.
  - Schedule site visits and/or key informant interviews.

- To collect data, conduct site visits and/or key informant interviews, as well as a thorough review of program documentation.
- Analyze data and calculate indicators.
- Write a draft report of your findings and recommendations.
- Present your findings and recommendations.
- Finalize report and disseminate.
- Prepare an implementation plan with your counterparts and other stakeholders.

This brief overview lists the preparations required if you do an impact assessment to evaluate supply chain performance. As noted, ideally, evaluators will collect a mix of quantitative and qualitative data for a complete picture of strengths and weaknesses that can be used to provide feedback, report results, and mobilize resources (financial, human, capital, etc.); and, ultimately, to improve program management and system performance.

Overview of an assessment in Uganda

Following the roll out of a new tuberculosis drugs logistics system, the National Tuberculosis and Leprosy Program (NTLP) in Uganda using the following steps to conduct an assessment when they evaluated the performance of the new system:

- Used the following goals to set objectives for the assessment: (1) to develop a general snapshot of how the system is operating, (2) to identify strengths and weaknesses, and (3) to develop recommendations for system improvement.
- Focused on the following logistics topics to achieve the assessment goals: Organization & Staffing, LMIS, Procurement, Inventory Control Procedures, Warehousing & Storage, Transport & Distribution, Organization Support for Logistics, Product Use, and Finance & Donor Coordination.
- Selected the LSAT as the best methodology to collect the necessary data from the central level; revised the tool, as appropriate.
- Developed a facility-level data collection tool and identified 10 districts for the assessment to ensure representative geographic coverage; scheduled site visits with the help of district-level staff.
- Organized a data collection team of 20 people, including staff from different levels of several stakeholder organizations.
- During a two-day workshop, trained data collectors on the application of the tool.
- Conducted 51 site visits and interviewed 63 people.
- Compiled and analyzed data within the district teams.
- During a two-day technical workshop, presented district-specific findings to full group.
- Finalized findings after incorporating feedback.
- Shared findings at STOP TB partnership meeting.

9.5 Data Collection Tools

After you determine the data collection approach—as well as the purpose, logistics, and M&E personnel—you will need to select a tool(s) for collecting the data. As noted above, because monitoring and evaluation often involves different data collection approaches, they frequently require different types of data collection tools—qualitative or quantitative (or a combination)—for routine monitoring or periodic evaluation. The data collection tool is used to gather the data required to report on the indicators selected for monitoring or evaluating system performance, depending on the approach selected.

You can select the tool from among the existing tools that have been tested, validated, and applied in similar situations; or the logistics and M&E personnel may decide to tailor an existing tool to meet their needs, or even design a new tool. It should be noted, however, that designing new data collection tools is an extensive process that requires testing and validation. It may be more appropriate and feasible to use an existing tool, or to adapt an existing tool to meet the program's specific needs.

Examples of data collection tools

The *Logistics System Assessment Tool* (LSAT) is one example of a qualitative data collection tool. It is both a diagnostic and monitoring tool, and can be used to evaluate an entire national supply chain and the system's environment. Staff analyze the collated information to identify strengths, weaknesses, and opportunities for further inquiry and/or appropriate interventions.

The *Logistics Indicator Assessment Tool* (LIAT), a quantitative data collection instrument, is used to conduct a facility-based survey to assess health commodity supply chain performance and commodity availability at health facilities. You can use the LIAT to monitor the performance of certain processes involved in the logistics management of health commodities, over time, to evaluate certain outcomes of supply chain interventions, to conduct on-going supervision and performance monitoring, and to monitor commodity availability.

Adapting the LIAT in Tanzania

Prior to rolling out the integrated logistics system (ILS) nationwide, Tanzania's Ministry of Health and Social Welfare (MOHSW) conducted an assessment of the ILS' ability to improve commodity availability. To conduct this assessment, the MOHSW adapted the Logistics Indicator Assessment Tool (LIAT) to include the following commodities: essential medicines, contraceptives, drugs for sexually transmitted infection, HIV test kits, antiretroviral drugs, and antimalarials. The assessment results gave managers the evidence they needed to address weaknesses and to build on the strengths of the system.

Users can adapt both tools to assess supply chain performance for any category of health commodities and for any level of the supply chain—from the central level to the service level.

Many other tools can be used or adapted for this purpose. For example, in addition to these two tools specific to supply chain management, the *Strategic Pathway for Reproductive Health Commodity Security* (SPARHCS) offers a comprehensive process and evaluation tool to assess reproductive health commodity security (RHCS), including supply chain management. The SPARHCS tool is primarily qualitative.

Continuous improvement

As shown in figure 9-1, monitoring and evaluation (M&E) plays a continuous role in supply chain management and system strengthening, and it encourages continuous improvement activities. For example, storage is one element of the logistics cycle that often needs continuous improvement. During urgent situations, nonessential items are often stored *temporarily* in storage spaces, only to be forgotten later. Expired, damaged, or unusable products are often separated from other supplies, but they may not be destroyed or sent up to higher levels for destruction as quickly as they should be. It is important for warehouse managers to continuously examine the stocks in their warehouses and determine how to best use the space. Warehouse managers should ensure that they follow first-to expire, first-out (FEFO). Check to see that fire equipment is up-to-date, look for signs of pest infiltration, and eliminate any hazardous situations or conditions. By maintaining a constant watch on the storage space, managers can eliminate lengthy and time-consuming annual *revitalizations* or clean-up days, while maintaining the high quality of the products they handle.

In addition to storage, continuous improvement also helps maintain effective transportation. Monitoring the key performance indicators (KPIs) regularly would help transportation managers to ensure that vehicle routes and schedules serve customer needs, while making the best use of current resources.

Another example, the *Assessment Tool for Laboratory Services* (ATLAS), a data gathering tool, was developed to assess laboratory services and logistics. The ATLAS is also a diagnostic and monitoring tool that you can use to do a baseline survey, to complete an annual assessment, or to include as an integral part of the work planning process. The ATLAS is primarily a qualitative tool with a small sample quantitative facility survey of available commodities and equipment. To outline recommendations for system strengthening interventions, you can use analyze the information collected using the ATLAS to identify strengths and weaknesses.

To continue learning about how to measure the performance of your supply chain, go to *Measuring Supply Chain Performance: Guide to Key Performance Indicators for Public Health Managers at*—http://deliver.jsi.com/dlvr_content/resources/allpubs/guidelines/MeasSCPerf.pdf

9.6 Providing Feedback and Reporting Results

After you have collected data, either through routine monitoring or periodic evaluation, it must be processed and cleaned to become useable information. With qualitative data, trends and themes can be summarized and indicator values can be calculated and summarized. This information can then be analyzed to interpret findings, to commend logistics personnel on system strengths, and to make recommendations to improve weaknesses. The recommendations should be based directly on the findings and should not extend outside those findings.

These results and recommendations are used to develop a program workplan with an accompanying M&E plan—as outlined above—and for monitoring progress toward achieving objectives for programs with workplans that are already underway. The other primary use for M&E data is to provide feedback within the levels of the supply chain, and for reporting results to stakeholders—one of the main reasons for having an M&E plan and system in place.

As described in chapter 2 on the LMIS, routine feedback reports are regularly produced as part of the LMIS, and they are generated through routine monitoring. Feedback reports can help managers make operational decisions, monitor the performance of the system, and manage the system overall. These reports are sent to all levels of the supply chain down to the facility level; at the central level, they can be shared with program managers or donors, if the program is externally funded. For examples of feedback reports, see chapter 2.

Feedback report in Bangladesh

The Directorate General of Family Planning in Bangladesh provides regular feedback to regional warehouse supply officers through the Family Planning Monthly Logistics Report. In addition to presenting the stock status of each warehouse, this monthly report recommends action that each supply officer should take to bring their respective stock to a satisfactory level. To encourage better performance, the report also ranks warehouses by their months of stock.

Chapter Summary

In this chapter, you learned the following:

1. Collecting M&E data enables program managers to provide feedback to staff throughout the supply chain to improve system performance, to report results to funders and other stakeholders, and to justify the need for additional resources, when appropriate.
2. M&E is done to improve program management and logistics system performance, which is critical for ensuring commodity security.
3. Steps in developing an M&E plan include—
   - conducting an assessment and using findings to develop recommendations
   - developing goals and objectives for the program's workplan
   - identifying and prioritizing interventions for achieving goals and objectives
   - developing indicators that can highlight whether interventions, objectives, and goals have been achieved.
4. Recommendations should define the problem, state the consequences of the problem, suggest a course of action to solve the problem, identify who should take action on the recommendations, identify the resources required, identify the expected timeframe, list the expected outputs, and list the expected and outcomes.
5. Objectives and indicators must be SMART (specific, measurable, appropriate, realistic, and time-bound).
6. An M&E work plan should contain the following:
   - Introduction
   - Description of program
   - Monitoring plan
   - Evaluation plan
   - Indicators
   - Data sources
   - Data collection and management tools
   - Reporting requirements and frequency of data collection
   - Persons responsible
   - Resource and capacity requirements.
7. Indicators provide evidence that interventions and results have been achieved and progress has been made toward objectives and goals. They can be calculated by using quantitative or qualitative data.
8. Data can be collected during routine monitoring, using systems that include the LMIS, or a supervision system that provides a reliable source of routine data. Data can also be collected using a periodic evaluation, which is done less frequently than monitoring. Data can also be collected to determine how the supply chain is performing top to bottom, from central-level interviews to facility-based surveys.
9. Tools that can be used for M&E for supply chain management include the LSAT, the LIAT, and the ATLAS.
10. Feedback reports provide information to stakeholders up and down the supply chain; which can help managers make operational decisions and monitor the performance of the system. They can also help lower-level personnel learn how the system is working at their level, motivate them to improve performance, and indicate any problems in the reports or the stock levels.

Objectives

In this chapter, you will learn the following:

- overall context and process for designing a logistics system for managing health products
- basic considerations and guidelines for designing a logistics system
- technical aspects related to system design and implications of design choices.

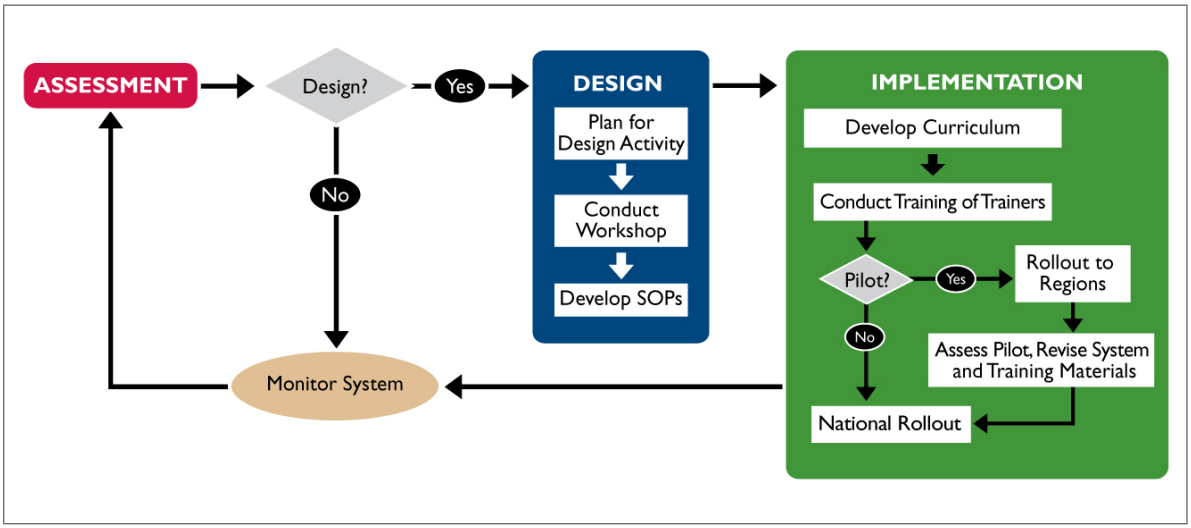
Note: In this chapter, the term *system design* indicates both designing a new system and redesigning an existing system. You would *design* a system if there was no existing system and one was needed, or *redesign* an existing system that needed improvements or changes. In both design and redesign activities, the steps and considerations for designing (or redesigning) the system are almost the same.

10.1 Logistics System Design Process

In virtually all health programs, products move from one place to another. The way the products move may not be rational, the quantities of products that move may not be based on actual data, or the methods used to move the products may not be standard. The purpose of designing a logistics system is to standardize the flow of commodities and information.

The technical design of a logistics system is one part of a larger process (see figure 10-1). The overall process begins with an assessment to determine whether the six rights are being met and if the logistics system needs to be designed/redesigned (see chapter 9 on monitoring and evaluation for more information on how to conduct assessments). After you make your decision, then you plan and conduct the design activity. System managers should develop standard operating procedures (SOPs) to document design decisions and to use as a job reference. As part of the implementation, curriculum is developed based on the SOPs, and the system is rolled out, usually using a training-of-trainers (TOT) approach. After the system is implemented, you will need to continually monitor the system to ensure that the improvements are having the intended impact.

Figure 10-1: Logistics System Design Process



Steps in designing the logistics system

Each step in the process is described below, including key questions that must be addressed at each step. Additional guidance and tips related to the technical aspects of the logistics system design are also provided.

1. Complete an assessment and determine the need for design.

Your first step should be to conduct a formal or informal assessment to identify system strengths and weaknesses and to determine whether you need to design a logistics system, or redesign certain aspects of an existing system. In most cases, a lack of logistics procedures and tools and poor functionality is obvious; however, an assessment is still necessary to inform the design of the new system. Designing (and implementing) a system requires significant resources, both time and financial; therefore, *if it's not broken, don't fix it.*

Before beginning a system design, you need to understand the context in which the system operates/will operate. This enables you to understand what you can and cannot include in your system. For example, if the government requires you to use a certain form, then do not spend your time designing a different form that would serve the same purpose.

Questions that will help you understand the context include—

- What is the MOH vision for the supply chain for health commodities? What are the MOH goals, objectives, and requirements for the system design or performance?
- What is the current situation for commodity management? Does a system already exist, or is there no system at all?
- If you are working within an existing structure (especially for a redesign), can certain elements be changed or modified? What, if anything, must be used as is? Do you have the option to propose or create a new structure?
- What products are involved? How many? Do you need to consider any product-specific requirements?
- What are the number, type, and location of the facilities that will be managing the products?
- Will any government regulations impact the system design?
- What is the structure of the MOH? What is the structure of the health care system?
- What is the availability of human resources at each level in the system?
- What financial resources are available for on-going system operations costs?

These types of issues must be clearly understood before you begin the design process. You do not want to spend time designing a system that will not be acceptable to the stakeholders.

You can use these tools to assess the system:

- Logistics Indicators Assessment Tool (LIAT)
- Logistics System Assessment Tool (LSAT)
- Assessment Tool for Laboratory Service (ATLAS)

See chapter 9 for more information.

Determining the need to redesign the logistics system

A country had a high rate of stockouts throughout the health system. One idea to address the problem was to redesign the existing logistics system. After an assessment activity, however, it was determined that the main cause of the stockouts was the country's lack of financial resources to procure enough products to meet client demand. In this case, the logistics system delivered all the products the country procured to the clients. The real problem was that too few products were being procured. Designing a new logistics system would not have been an effective use of time or resources.

After you determine that the logistics system (or lack of a logistics system) is the cause of an existing problem, then it is time to design a system; if not, continue to monitor the system using the process in figure 10.1.

Important questions at this stage include—

- How did you arrive at the decision to begin a system design (or redesign)?
- What system are you being asked to design?

2. Plan and conduct the system design activity.

You should conduct the system design in an organized and participatory manner, preferably during a workshop. Perhaps most critical to the success of the design is identifying the appropriate people to participate in the design process. The system should be designed, at least in part, by the customers of the system—everyone involved in implementing the system, as well as those who will contribute resources to operating the system. Designers should come from every level of the system: ministry officials and other partners at the central level, as well as personnel from intermediary levels (region, district) and health centers. To achieve the goal of implementing the system, you must engage the users of the system in the design process. Typically, a system design requires about 15 to 20 participants; the workshop should last approximately five days.

In some cases, it can be appropriate for a small group of people to do a preliminary design, and then present options for the design to a larger group of stakeholders.

Types of participants in a system design workshop

- Program-level staff: logistics officers, data managers, monitoring and evaluation staff, clinical staff
- Central-level staff: procurement officers, pharmacy or laboratory division of the MOH
- Warehouse or storekeepers: from central-, medium-, and lowest-level stores
- Health providers: from all facilities that store the commodities, such as hospitals, health centers, and dispensaries.

After you identify the members of the system design team, you will need to address other issues:

- What format will you use for the design activity—a series of focus groups, one large workshop, or a combination of the two?
- When and where will you conduct the system design activity? What arrangements do you need to make?
- How much of the design will you complete during the actual activity?
- How many or which elements of the system design will you finish after the activity?

During a typical system design workshop, you will make decisions about all the major technical components of the system, specifically the LMIS, ICS, and storage and distribution. Basic elements covered in the design activity include the following:

Review basic logistics principles. Start with a review of basic logistics principles; this will ensure that all members of the design team have a common understanding of the logistics principles they will apply during the design activity, and they will have a common vocabulary. After logistics basics, give participants time to apply their new knowledge in describing their own system.

Agree on system parameters and boundaries. This includes reaching an understanding on any already existing elements that could be opportunities for the new or redesigned system, parameters that can or cannot be changed, and any other parameters that need to be considered during the design process.

Design the pipeline. Ensure that the pipeline shows the levels in the system and the flow of information and commodities.

Design the LMIS. Ensure that the LMIS includes drafts of all records and reports, including feedback reports already in the system. The design of the LMIS is integrally linked to the design of the ICS. After deciding on the ICS, it is important for you to go back to the LMIS that was designed and ensure that the two aspects of the system still work well together.

Design the ICS. The ICS should include max-min stock levels, emergency order points, and review periods for each level in the system. You should decide on which levels in the pipeline will requisition (pull) and which will allocate (push) products. To assist in this design, you should do some analysis of typical lead time in advance using key informant interviews and a review of stock cards and transaction records.

Identify storage and distribution requirements. Ensure that the storage and distribution recommendations conform to the suggested LMIS and ICS.

Identify roles and responsibilities. Ensure that everyone involved in the health system has clearly defined roles and responsibilities.

Develop an implementation plan. The workshop design team should provide input about the appropriate timing for implementation, as well as the required preparations. The implementation plan should consider the points noted in step 3 below.

Undoubtedly, outstanding issues will not be resolved during the workshop. Document these and follow up, as appropriate. If any issues might prevent the system from working, you must highlight and address them.

As part of the design step, you should develop an SOP manual that documents all the steps in the system. It should be drafted immediately after the system has been designed. After the SOPs are developed, they are reviewed by stakeholders, changes are made, and final approval is sought. This approval process involves convening stakeholder meetings to ensure the approval of all stakeholders; the ministry of health should own and endorse this document.

For more information, go to the USAID | DELIVER PROJECT's *Quick Reference: Logistics System Design and Implementation*.

3. Implement the system.

Implementing a logistics system is a dynamic process that requires ongoing training, monitoring, and evaluation. The success of a system design is defined by how effective and efficient the system is in practice. No matter how well it is designed, the system will fail without a well-planned, properly resourced implementation plan. To maintain the momentum created in the workshop, the implementation phase should begin immediately after the system design is complete. An implementation plan includes key activities, timelines, and roles and responsibilities. It should also include answers for the following questions:

- What model of training will be used?
- How many sites need to be trained? How many individuals need to be trained?
- How many trainings, in total, are needed?
- How will the trainings be scheduled (i.e., what region/district/state/province should you start with)?
- Who will conduct the trainings?
- Will the system be implemented *all at once* or through a pilot/phase-in period?
- What resources are needed to implement the system (new LMIS forms, computers, training of staff, etc.)?

Steps in implementing the system include the following:

1. *Develop training materials.* Using adult learning methods, these materials are designed to teach the staff how to use the SOP manual and job aids; and how to use the corresponding forms to order, monitor, and manage their health commodities.
2. *Training-of-trainers (TOT).* The TOT teaches the participants how to apply adult learning theory to train health facility staff in how to order, monitor, and manage health commodities according to the SOP manual. Printing of materials and forms must be done prior to this stage, because the official forms must be used during the trainings. The group that completes the TOT is responsible for training the rest of the appropriate staff.
3. *Roll-out trainings.* After the TOT is complete, the trainers should develop a schedule to train all relevant staff during a specific number of weeks or months.
4. *Mop-up trainings or other OJT training activities*. After the system has been rolled out, be prepared to continue training staff. New staff are constantly being hired; they will need to be trained and other staff will need refresher trainings. You can include these training as part of an annual workshop, or ongoing OJT, to ensure that the system continues to function. In addition, you should incorporate technical information on managing the system into the routine supervision of the logistics personnel.
5. *Monitor the system.* A logistics system is dynamic and needs to be flexible to accommodate changes that occur within the program or system. Continuous quality monitoring, re-evaluation, and improvements to the system must be fixed processes. To ensure that the system can be adapted to accommodate changes with minimal disruptions to the supply chain, early identification of issues or changes is essential. You should note:

    - How is the system performing?
    - What problems or issues that arise need to be resolved?
    - Is the problem or issue a fault of the system design, or a fault in implementation or operations?
    - How can problems be resolved?
    - What resources are available to adjust the system?

Should the system be piloted?

There are advantages and disadvantages for including a pilot. Pilots can be extremely helpful in ensuring that the newly designed system works well before it is rolled out to the entire country. However, pilots increase immediate costs and delay national implementation. To properly evaluate the pilot, it is important to manage it for two to four reporting and ordering cycles.

10.2 System Design Elements

When designing or redesigning a system, the key elements to evaluate are: the overall pipeline, LMIS, ICS, storage and distribution, and roles and responsibilities. Many of these components have been described in detail in previous chapters. This section describes specific design considerations for each element.

Pipeline: Flow of commodities and information

One of the first steps in the design process is to draft an overall pipeline, i.e., the system through which the commodities will flow down from the upper levels to the clients and the information will flow throughout the system. In general, the fewer the number of steps in the resupply process and the fewer levels in the pipeline, the better. The movement of commodities down through the system should be based on good commodity management practices, not political or other considerations. However, if you are working in the context of an existing system, the flow of commodities must take into account any elements that you cannot change; even if, from a commodity management perspective, the resulting flow is not the most efficient.

Shortening the pipeline in Ghana

In Ghana, the government specifically instructed the system design team to find the most efficient system, without tying them to the existing structure. Thus, the district-level distribution facilities—which in the past were resupply points based on the country's political boundaries—were removed from the distribution system. This shortened the overall pipeline and resulted in overall efficiencies in the system as a whole. While the district level is no longer part of the product pipeline, it does remain part of the information system; and district managers play a part in supervision and monitoring.

Logistics Management Information System (LMIS)

When you design a logistics system, you must collect the right data that are needed to make logistics decisions and you must get that data to the people making those decisions. Furthermore, you do not want people spending their valuable time collecting and reporting information that will *not* be used for making decisions.

As discussed in chapter 2, you know that the system will require the following types of records:

- *Stockkeeping records* keep information about products in storage (collect stock on hand and losses and adjustments data).
- *Transaction records* keep information about products being moved through the system.
- *Consumption records* keep information about products being consumed or used (collect consumption data). If consumption records will not be used, system designers must ensure that consumption data is collected and reported up the system.

In addition to the records used to collect logistics data, the LMIS must also receive summary reports to report consumption, stock on hand, and losses data to the higher levels of the system. The LMIS should also produce one or more feedback reports, which will communicate information up and down the supply chain—from facilities through to central-level stakeholders.

Some of these records and forms may already be available; if so, you need to verify that they can be used *as is*. Other records and forms may exist but they may need to be revised. And, you may need to create new records or forms for the first time.

When designing the LMIS, you should consider the following points:

- What data are needed for commodity management?
- What records and reports are needed for commodity management?
- What unit of measure should be used (tablet, piece, bottle, etc.)?
- How will consumption data be collected (on a consumption record?)?
- Who at the facility level will be responsible for reporting data?
- At what frequency should logistics data be reported to higher level(s)?
- How will the report/order get to the higher level(s)?
- Where should reports and requisition forms be sent? What department, division, or unit needs to receive the report or requisition? What will they do with the reports and/or requisitions they receive?
- What approvals, if any, are required for the resupply process?
- Should some or all the commodity names be preprinted on LMIS forms?
- Can any elements of the LMIS be automated? If so, which ones? If using automation, how will information be transmitted from one level to the next?

Review all LMIS forms currently in use in the country to see if the forms that you need already exist.

- Can they be used as they are?
- Do they need revision?
- Do any new or missing LMIS forms need to be designed?

After the initial LMIS is designed, you can create a map of the flow of information, indicating which LMIS forms are used at each level of the pipeline, where the forms move, and who is involved in the flow of information. Verify that the flow of information supports logistics decisionmaking.

Inventory control system (ICS)

When designing a logistics system, the type of max-min inventory control system that you choose will dictate how and when commodities will be resupplied throughout the system. The ICS and the related max-min stock levels for the commodities will also have a direct impact on the resources needed to implement the system, including *what* resources will be needed (storage capacity, vehicles, human resources, time), as well as *when* and *where* these resources will be needed and *how* they are used. The type of max-min system you choose will also dictate some of the LMIS requirements.

A number of factors should be considered when you select an inventory control system and when you define the details of that system. As described in chapter 4, considerations include—

- What type of max-min inventory control system works best for your program (i.e., forced ordering, continuous review, or standard)?
- At each level of the system—
  - What is the longest lead time for resupplying commodities to the next level down?
  - How often should the level be resupplied with commodities (review period)?

  - What is the estimated safety stock level?
  - What is your calculated minimum stock level?
  - What is your calculated maximum stock level?
  - What is the longest lead time for an emergency order? What is the corresponding emergency order point?
  - Will the system use delivery or pick-up to get the products from the supplier to the recipient?

- Based on the expected lead times, review periods, and safety stock levels, is the total length of the in-country pipeline too long for the product with the shortest shelf life? Can it be shortened?
- Who should determine the resupply quantities at each level of the pipeline (allocation/push or requisition/pull)?
- Can one ICS serve all products, or are different systems needed, depending on the characteristics of the products or geographical diversity of the country?
- Can the budget support the quantities of commodities that are required to maintain the established max-min stock levels?

After you design the initial ICS, map the flow of commodities throughout your pipeline, including the max-min stock levels. Ensure that the overall length of the total pipeline does not exceed the shelf life of the products managed by the system. You should also verify that the lead time, safety stock, and review period stock levels are correctly calculated for the max-min stock levels.

Storage and distribution

The inventory control system that you choose for your system will dictate the volume of commodities that will be stored and distributed through your supply chain. If you have shorter review periods, then the storage space needs will decrease, but the transportation needs will increase because you will be moving smaller quantities of products through the system more often. If you have longer review periods, then the storage capacity requirements will increase, as will the amount of money being tied up in inventory; you will need larger vehicles to move larger volumes of stock, although deliveries will not occur as often.

As detailed in chapter 8, when determining your storage and distribution resource requirements, you should consider the following elements:

- For each storage facility at each level, consider the following questions:
  - Do you have sufficient storage space?
  - Do you have cold chain storage capacity, if required?
  - Do you have a sufficient number of staff? Are these staff skilled in commodity management?
  - What role will warehouse staff have in reports/data management (i.e., processing orders, picking, packing labeling, loading supplies on trucks, etc.)?

- How will commodities move from higher levels to lower levels (i.e., distribution or pick-up system)?
- Are vehicles available to distribute or pick up commodities between each level of the system?

Storage space requirements must be determined for each facility, at each level, of the system; facilities must have the storage capacity to store up to the maximum stock level set for that level. Transportation resources must be available at whichever level is responsible for physically moving the products: thus, higher-level facilities will need vehicles if they are to deliver commodities to the lower levels; lower-level facilities will need vehicles if they are to pick up commodities from the resupply facility at the higher level.

Roles and Responsibilities

After an initial system design is drafted, make a list of each position that will be involved in the logistics system; identify the various roles and responsibilities for each person, by level, if possible (i.e., start with all staff at the facility level that have logistics responsibilities, then move up the system, level by level, to the central level). You will need to clarify the skill set needed to fulfill those responsibilities and to ensure that all roles and responsibilities needed to operate the logistics system are assigned to a specific job title or job function.

For the LMIS, specifically, roles and responsibilities will include those related to—

- collecting logistics data
- reporting logistics data
- aggregating logistics data, if applicable
- analyzing logistics data, including quality check
- managing computerized data management system, if applicable
- generating and disseminating feedback reports.

For ICS, specifically, roles and responsibilities will include those related to—

- determining resupply quantities
- approving resupply quantities
- conducting physical inventories
- monitoring stock levels.

For storage and distribution, specifically, roles and responsibilities will include those related to—

- receiving orders from the lower level
- physically receiving the products at the storage facility
- processing commodity orders (picking, packing)
- maintaining adequate storage conditions
- maintaining cold chain equipment, if applicable
- processing emergency orders, if applicable
- scheduling commodity deliveries, if applicable
- monitoring storage capacity
- maintaining vehicles in working order.

In addition to the specific areas mentioned above, roles and responsibilities should also be defined in other areas:

- monitoring logistics system performance (for example, stockout rates and reporting rates)
- supervision and on-the-job training
- production and distribution of logistics tools (forms, records, reports)
- role of program staff (family planning, HIV and AIDS, malaria, etc.) in monitoring commodity availability and supporting the logistics system.

After you assign the roles and responsibilities, double-check your lists to ensure that the roles and responsibilities are assigned logically, all functions within the logistics system have been assigned appropriately, and there is no redundancy.

10.3 Other Design Considerations

In addition to the key elements described in section 10.2, there are a few general considerations that you should think about when preparing for and undertaking a system design activity. Discussing these concerns with key stakeholders can help you select the most appropriate design options, based on the country's characteristics, the products being managed, and the type of health programs served by the system.

System design is a process

The system design process outlined above is iterative: you will need to verify each technical decision, made at any point during the design activity, with the other elements that have already been proposed. For example, if you decide early in the process to have a push system, and later decide to add another level to the pipeline, you will need to reassess the decision to use a push system in order to ensure that the push system can still function with the additional level in the pipeline. If you design the LMIS forms, and then later change the max-min stock levels, you will need to revisit the LMIS forms to ensure that the forms reflect the new max-min stock levels.

The last step in the design process is to look at the system as a whole and verify that all parts of the system will work and interact, as designed. Any potential problems will need to be addressed through additional redesign and before the system is (fully) implemented.

System design is based on assumptions

Every time you make a decision about an element of the logistics system, the decision is based on certain assumptions. If you design a pull system, then your assumption is that people at the lower levels can be trained to calculate their order quantities correctly. Therefore, if you implement a pull system when you know that people cannot be trained, then the system will not work as designed. Similarly, if you design a system based on a lead time of two weeks; but you know that, in the past, orders were rarely processed in less than a month, then the system will not work because you are basing the lead time on a false assumption.

As you go through the system design process, it is critical to document the assumptions that you make and to verify that the assumptions are reasonable; in other words, the design element has a good chance of succeeding when the system is implemented. You can increase your likelihood of success by verifying your assumptions and designing the system based on how you *know* the system will actually be put into practice, and not based on what you *think* (or hope) will happen.

What products? What systems?

When designing a logistics system, you must outline the scope of the system, including the products that will be part of the system. Historically, there have been program-specific logistics systems, such as family planning, malaria, HIV and AIDS, etc. Many countries have been moving toward merging the management of some or all logistics functions for different commodity categories. The most common is to merge the functions of storage and distribution.

When determining what commodities should be included in what systems, it is helpful to conduct a segmentation analysis. Segmentation is the process of reviewing and analyzing product and customer (facility) characteristics to identify commonalities, then organizing the supply chain to best respond to customer needs or product requirements.

Commodity characteristics include—

shelf life. Short shelf life products need to move quickly through the system and require low max-min stock levels.

temperature sensitivity. Cold chain products require appropriate storage and distribution throughout the system. Capacity for cold chain storage will also factor into the determination of max-min stock levels.

pack size and units. Large pack sizes of products will require you to lower the max-min stock levels, and may impact the frequency of reporting/ordering. Imagine a liquid that is packaged in a 20 liter bottle, but a facility only uses 1 liter per month. In a forced ordering system, the facility would be ordering up to the max at the end of every reporting period, even though it takes a considerable amount of time to get through one unit.

fast moving or slow moving or seasonal demand. Consumption can vary across products and across facilities. If malaria is endemic in only part of the country, this could influence your decision to manage those products differently in different parts of the country. In addition, if antimalarials are only needed at certain times of the year, this could indicate that a product should be managed differently (continuous review rather than forced ordering, for example).

Customer characteristics may include—

demand variability. This is the frequency of use for a specific product, at different periods of time. Because of their needs at a particular time of year, customers may have seasonal demand, high demand, or low demand. This may be related to disease patterns. For example, products needed for outbreak diseases, such as cholera, may not be needed by all facilities, at all times.

communication and distance to resupply. Urban health facilities and regional hospitals usually have reasonable communications and access to transport, allowing for easier distribution of products. A rural health facility, on the other hand, may have very poor communication and fewer transport options. Urban health facilities may be resupplied more frequently, with smaller quantities; compared to rural health facilities that are supplied less frequently, but with greater quantities.

seasonal accessibility. Some health facilities are difficult to access during the rainy season because of the poor road networks that support them. As a result, rainy season deliveries may be in greater quantities and occur less frequently.

storage space. You should consider storage capacity of facilities when determining the max-min stock levels.

level of the health system. Not all health commodities are needed by all facilities. Often dictated by the national essential medicines list (EML), certain diseases are treated at different levels in the system. For example, all health facilities in the system may receive broad spectrum antibiotics; however, second line or salvage antiretroviral treatment may only be distributed at the higher level (district, province) facilities.

Regardless of how many segments are created, all segments are coordinated from a single supply chain strategy framework and; wherever possible, share resources like warehousing, information systems, and transport. Thus, the segments might collect the same data and report the data on similar forms, but some might be managed through a shorter pipeline with different max-min stock levels, or with shorter review periods.

In-house resources or outsourcing

Another consideration in the overall design of the logistics system is the choice to directly manage logistics functions, or to outsource them to a third party through a contract mechanism. For example, rather than operate and maintain a fleet of vehicles and drivers, a transportation company can be hired to transport the commodities from the supplier to the recipient (e.g., from the regional warehouse to the district warehouses in the region). One advantage to outsourcing is that functions are assigned to companies that specialize in that particular function. A perceived disadvantage to outsourcing is that you have less direct control over that logistics function.

Outsourcing can take many forms and involve all or only some commodity management functions. The MOH in different countries have used various models, including—

MOH contracts with an in-country commodity management firm. The MOH provides funding for the commodities; the private firm manages all aspects of the supply chain—from quantification and procurement, to delivery to the health centers, including management of the LMIS.

MOH contracts with an in-country private warehouse/distribution company to store and distribute health commodities. The MOH procures commodities; the private firm physically manages them. The MOH instructs the company on what quantities to deliver to which facilities; the private firm picks, packs, and transports the commodities to the facilities. For example, in Zambia, a private contractor manages the parastatal Medical Stores Limited, which provides storage and distribution for all essential medicines to all public sector facilities.

MOH contracts with a transportation company to distribute products from government-managed warehouses. The government facility obtains and stores the products, and picks and packs the orders. The private company transports the products to the health facilities. For example, in Bangladesh, the Directorate General of Family Planning outsourced 80 percent of the transportation of family planning commodities to the private sector.

MOH purchases products from local wholesalers. The MOH determines what it needs; the private company procures the commodities and delivers them to the MOH. The MOH manages and distributes the commodities through government-run facilities and transportation networks.

Outsourcing can be done using many other models. The exact model a country or program chooses will depend on the country- and program-specific options and requirements. If outsourcing is used, the contract must specify performance criteria and benchmarks. Even if certain functions of the supply chain are outsourced to private or other third-party organization, oversight is still required to ensure that the organization is performing its role adequately, managing performance-based contracts, and fulfilling its designated function(s) within the overall system.

For more information on outsourcing, go to the USAID | DELIVER PROJECT's *Emerging Trends in Supply Chain Management: Outsourcing Public Health Logistics in Developing Countries.*

Effective and efficient logistics system

You know that the purpose of your logistics system is to provide good customer service by ensuring the six rights and ensuring that commodities are available. You should design your logistics system to achieve these goals. When you design your logistics system, you want to ensure that the system is as effective and as efficient as possible. If your logistics system is *effective*, it will produce the results that you want: products will be available when and where your customers need them. If your logistics system is *efficient*, then you can achieve your purpose with a minimum use of resources; including money, time, and effort.

For example, a logistics system can be very *effective,* but it is *inefficient* if products reach their destination at a high cost, or through a great deal of effort. On the other hand, a logistics system may be *efficient*, but it is not *effective* if warehouse staff process a large number of orders in a short time, but make many mistakes. Your goal is to design an effective system that is as efficient as possible.

One challenge in designing a logistics system is to determine the resources that will be required at which levels of the system and to achieve what purpose. Imagine a situation where the system designers decide that district pharmacies will pick up their commodities from the region because the regional warehouses do not have enough vehicles or drivers available to manage delivery routes. However, if districts do not have the vehicle and manpower needed to pick up their commodity orders, then the products will not move from the region to the district. Someone must provide the resources for the products to move between the levels of the system.

When designing and implementing a logistics system that will achieve the six rights and ensure customer service, an ultimate goal should be to minimize the overall cost of commodity management, not to push financial responsibility further down the system—unless the lower-level facilities have the resources needed.

Table 10-1 summarizes some of the implications related to various design decisions. When designing the logistics system, the system designers should select the options that are best for the country, based on the characteristics of the country, the commodities being managed, and the type of health programs served by the system.

Table 10-1: Summary of Implications of System Design Decisions

DESIGN CHOICE/DECISION	IMPLICATIONS
Shorter review period (e.g., monthly)	Reports filled out more often; vehicles have more frequent schedule; service personnel take time away from client consultations more often; or dedicated logistics personnel are available to do the frequent reporting and related tasks (physical inventory, etc.); have lower max-min stock levels; less storage required, less potential waste, fewer funds tied up in inventory.
Longer review period (e.g., quarterly)	Reports filled out less often; higher max-min stock levels; more funding tied up in inventory; more space needed for storage; larger vehicles needed for commodity transport; have system capacity to manage larger quantities of products; relatively stable consumption rates.
Requisition (push) system	Lower-level personnel must submit reports to enable the higher-level personnel to accurately determine resupply requirements; the more facilities at the lower level, the more time required at the higher level to determine resupply requirements; higher-level personnel will make decisions based on actual data and will not need to ration or dump products.
Allocation (pull) system	Lower-level staff need time to calculate reorder quantities, which means less time for serving clients (if service personnel perform logistics responsibilities); lower-level staff can be trained to do the calculations; fewer staff at lower level means less time to train all staff.
Higher-level facility delivers commodities to lower level	Lower-level staff can focus on serving customers and not on collecting goods; higher-level facilities have vehicles and related resources (fuel, drivers) available for commodity deliveries when needed; vehicles are not taken for other more important purposes.
Lower-level facilities pick up commodities from supplier	Lower-level facilities have vehicles and related resources (fuel, drivers) available for commodity pickups when they are needed; vehicles not taken for other more important purposes; resupply facility will be open for business when the facility vehicle arrives.
In-house management of system component (e.g., transportation)	Government/MOH has resources needed to procure vehicles and maintain vehicles in good working order; drivers are available; vehicles are available when needed for transport of commodities; staff has skills to develop and implement a schedule.
Management of system component outsourced to a contractor (e.g., transportation)	In-house personnel must be available to monitor contractor performance and take corrective action, as needed; skills exist for developing a service-based contract.
Collect and report actual dispensed-to-user data	Service providers accurately maintain dispensing registers for all products; service providers report data for aggregation; service providers spend time managing data instead of serving clients; collection of consumption data within the facility can be time-consuming, especially if many wards/units use the same products.
Use of lowest-level issues data as a proxy for consumption	All required data is located in the facility storeroom; accurate issues data is available from one level up from the SDP; facility staff do not spend time completing dispensing registers, or aggregating data from registers for LMIS report.

Chapter Summary

In this chapter, you learned the following:

1. The steps in the system design process are to do the following:

- Complete an assessment and identify the need to design/redesign a system.
- Plan and conduct the system design activity.
- Implement the system.
- Monitor the system.

2. Key elements of a system design include the—

- pipeline (the flow of commodities and information)
- LMIS (for more information, see chapter 2)
- inventory control system (for more information, see chapter 4)
- storage and distribution (for more information, see chapter 8)
- defined roles and responsibilities.

3. Important decisions/steps taken during the design of a system include—

- Which products will be managed in which systems?
- Should you directly manage the logistics functions or outsource them to a third party through a contract mechanism?
- After drafting the design, look at the system as a whole and verify that all parts will work together and interact, as designed. Address any potential problems through redesign before the system is fully implemented.
- Document your assumptions and verify that they are reasonable to increase the system's likelihood of success.

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