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Lessons Learned in Managing National Laboratory Supply Chains

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Laboratory technician in Nigeria preparing materials for a training.

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Laboratory services are an essential part of a country's public health system in supporting the delivery of quality health services. Because of the growing recognition and agreement about the importance and value of laboratory support services in the treatment of HIV and AIDS, tuberculosis (TB), and malaria, there have been greater global attention and resources for strengthening the laboratory system within public health systems in limited-resource settings. Training of staff and improving infrastructure are often considered priorities in strengthening laboratory services, yet without the availability of commodities these strategies will fall short of achieving desired outcomes.

Quality laboratory services require infrastructure (facilities and functioning equipment); adequate, well-trained laboratory personnel; and a sufficient supply of commodities (reagents, consumables, and durables). Because commodities are critical in the provision of laboratory services, ensuring their availability can also strengthen other aspects of the laboratory system. When basic testing services cannot be provided because laboratory commodities are not available, both client confidence and staff motivation are reduced. Supply chain strengthening is an essential and often overlooked intervention to strengthening overall laboratory services. This document will highlight some of the key lessons learned by the USAID | DELIVER PROJECT in strengthening laboratory logistics systems and implementing good supply chain practices to the laboratory setting.

1. Strengthen the National Laboratory Logistics System Using a Comprehensive Rather Than Disease-Specific Approach

The call to strengthen laboratory services has stemmed from the needs of disease-based programs (such as HIV, malaria, and TB programs) that rely on laboratories for screening, diagnosis, monitoring, and surveillance. In most situations, programs do not

have the mandate to strengthen the entire laboratory supply chain; therefore, vertical supply chains have been established for the required laboratory commodities so that the testing services required by these programs are available.

However, this approach leads to increased complexity in the management of these commodities. Multiple supply chains that serve a laboratory may each require different ordering, reporting, and receiving procedures.

To the laboratory technician, a hematology test for a patient who is HIV positive is no different from that for a patient with a negative status. To manage commodities only for testing HIV positive patients is unrealistic, because of the overlaps in services. Experiences in other areas of the health system confirm the impracticality of separating commodities based on the patient's disease status. For example, in the absence of essential medicines, antibiotics procured specifically to treat opportunistic infections in HIV-positive patients will be used to treat HIV-negative individuals.

Focusing on the logistics system for specific programs that lead to multiple supply chains is contradictory to the day-to-day running of the laboratory. At the facility level, a comprehensive menu of tests is provided. Some of these tests are disease-specific but many, such as hematology and biochemistry, are general tests to diagnose and monitor a range of health conditions. Therefore, operationally it is not possible to separate supplies for one program from another; the commodities, like the testing services, are cross cutting. Taking a holistic approach and applying interventions to the entire laboratory system, rather than only to laboratory testing areas that support disease-based programs, will yield stronger laboratory systems.

2. Situate the Laboratory Supply Chain within the Larger Laboratory Management Structure and Service Model

Supply chains for laboratory commodities are part of a larger laboratory framework, specifically the management structure and the service model. These elements of the laboratory system must be understood and defined in relation to the others. Supply chain interventions cannot be working in isolation from other laboratory system strengthening activities if testing services are to improve and if the supply chain is to function. When undertaking supply chain strengthening activities, consideration must be given to the following areas, all of which have supply chain implications:

- management practices
- policies and protocols
- financing
- quality assurance programs
- available infrastructure
- overall organization of the laboratory network.

An assessment of the laboratory system in **Ghana** originally focused on the laboratory services required to support the scale up of the antiretroviral therapy (ART) program. However, the assessment identified that the TB and malaria programs also needed a reliable supply chain to support these programs and manage the laboratory commodities for testing. One of the recommendations of the ART-focused assessment was that a logistics system be designed that could eventually accommodate all laboratory commodities for all public health programs. Initially, the system would accommodate HIV, TB, and malaria laboratory commodities and other commodities could be included. The system that was designed reached across the entire MOH laboratory system (including HIV, TB, and malaria), simplifying commodity information management for laboratory staff, improving decision making for regular full supply of these essential laboratory items and ultimately ensuring adequate clinical care for all clients.

It is often necessary to address some of these other elements when designing a supply chain intervention. For example, weak organizational and management structures will hinder the successful implementation of the logistics system. During the system design process, organizational levels of the system should be defined and capacity should be built at the supervisory level to support the laboratory staff in their activities.

3. Assess Laboratory System as an Initial Step to Help Prioritize Interventions

Before any intervention to strengthen the logistics system for laboratory services can be implemented, it is essential to first understand the current status of the laboratory logistics system, management structure, and service model, as well as the context in which the supply chain functions. A basic understanding of the environment and the existing challenges in commodity management will highlight the appropriate interventions to strengthen the laboratory system.

In most countries, there is limited information and a lack of standard protocols for laboratory services. An understanding of the general operational and managerial aspects of laboratory services, as listed in the previous lesson, must be established.

By understanding the current status and country context, it is possible to identify and prioritize the most appropriate activities to strengthen the supply chain and the laboratory system. In each country, the interventions required and the times and means of implementing them will differ. For example, an assessment in Malawi found a variety of equipment and techniques used within the country and identified the need for a standardization workshop before proceeding with any other supply chain interventions. In contrast, an assessment in Ghana showed that equipment was adequately standardized throughout the country and staff could proceed to design the logistics system without first conducting a standardization workshop.

An assessment in **Malawi**, conducted in collaboration with the MOH and using the *Assessment Tool for Laboratory Services*, identified a number of issues and recommendations ranging from policy to quality assurance to supply chain management. All the recommendations were essential for strengthening the supply chain and more broadly the entire laboratory system. This assessment then was used to prioritize and advocate for the activities required to strengthen the system. For example, one of the findings was the variety of techniques and equipment used throughout Malawi to perform the basic list of testing services. This information was used to successfully advocate for the introduction of a standardization policy.

As national laboratory logistics systems are virtually nonexistent and laboratory personnel's experiences with such systems are limited, assessments are critical for advocacy and to sensitize stakeholders to the need for a standard national logistics system. The evaluation is used to highlight the strengths and weaknesses of the current procedures, identify and prioritize supply chain interventions within the context of laboratory quality management practices, and provide a baseline for ongoing monitoring and evaluation.

In 2006, the USAID | DELIVER PROJECT developed the *Assessment Tool for Laboratory Services* (*ATLAS*), which to date is one of the few tools that focuses specifically on assessing laboratory services in limited-resource settings. The *ATLAS* assesses all aspects of laboratory services, including management practices, capacity, and services, in addition to the supply chains.

4. Standardization Is a Prerequisite to Improving Laboratory Systems and Reducing Complexity in the Supply Chain

Standardization is a critical early policy intervention in strengthening laboratory supply chains because it helps to rationalize and streamline the total number of commodities; this has important supply chain implications, particularly for logistics system design and quantification. Standardization offers many benefits to managing the supply chain of commodities and equipment, and also benefits the overall quality management of laboratory services. Standardization is not a supply chain intervention, but rather a policy intervention with supply chain implications.

Standardization, as defined in the context of supply chains, is the setting of test menus, techniques, equipment, and operating procedures for each level of the system.

In a nonstandardized system, different laboratories within the same system (and often within the same level) tend to use different techniques and equipment to perform the same tests. By creating uniformity and standards across the laboratory system, the national program can take a public health approach to managing the laboratory system and make decisions that will benefit the majority of the population. Standardization allows the establishment of a network of laboratories that have a set of standards by which quality of service can be compared and human and financial resources can be effectively allocated.

In **Zambia**, standardization led to a reduction in the number of laboratory products to be managed on a day-to-day basis. This in turn has increased stock availability from 30% to 98% at the central level, thereby improving the central warehouse's ability to resupply laboratories throughout the country. By focusing on a smaller, more manageable number of commodities, the Government of Zambia was able to focus on making the standard list of commodities available through the quantification, procurement, and resource mobilization process. Standardization enables rational decision making in product selection, forecasting, quantification, and procurement.

Standardization should precede a number of logistics interventions, including logistics system design and implementation, quantification, and procurement. When different equipment and techniques are used throughout the system, an extensive list of products is required to accommodate all of the different methods and equipment being used for testing throughout the country. This large number of products (which may range in the thousands) is unmanageable through the same national supply chain. In Kenya, standardization reduced the number of commodities managed in the system from about 3,000 products to about 300 products. By reducing the number of types of products used in the national laboratory network, it is possible to create a national supply chain that can monitor and manage an adequate supply of commodities.

The supply chain benefits of standardization are directly related to the reduced number of products that must be managed. As a result, rational decision making in product selection, forecasting, quantification, and procurement can occur. Because a larger volume of fewer products will be procured, rather than a small volume of a wide variety of products, the program can more effectively negotiate prices and service contracts. A lack of standardization means that quantification and procurement of reagents and consumables must occur at a local level rather than at a national level. The country will then not benefit from the economies of scale, the ability to allocate resources rationally, and many other supply chain benefits.

Standardization is equally essential for designing a national logistics system. Without standardization, the number of products that must flow through the logistics system, and therefore must be tracked and recorded, becomes unmanageable for staff at all levels. Imagine, for example, the central level having to stock and resupply a large number of commodities to different facilities at all levels of the system. Reducing the number of products, as described in Zambia, increases the availability of products and eases the burden of collecting important information to guide decision making.

The USAID | DELIVER PROJECT has identified and documented a number of lessons regarding standardization planning and implementation in the document *Standardization: Lessons Learned and Practical Approaches.*

5. Conduct National Quantifications Using Multiple Data Sources

A national quantification is the process of determining the quantity of each commodity needed for laboratories to provide testing services over a future period. Predicting future requirements allows rational allocation of limited resources to maximize the benefits for both providers and users of the system. The managers of the laboratory system are then in a position to identify the gaps and overlaps in funding and address these issues with donors and partners to ensure that the services are equitable and appropriate. Even though quantification requires a significant investment of time and resources, the benefits associated with advocacy and planning outweigh these costs.

Access to quality data is critical to guide the quantification. Supply chain managers must find ways to use the data available to achieve as accurate a forecast as possible. When data are not available or are incomplete, supply chain managers must make assumptions about the data.

A number of data types can be used to conduct a quantification: consumption, services, demographic, or morbidity data; for more information, refer to the USAID | DELIVER PROJECT's document *Quantification of Health Commodities: A Guide to Forecasting and Supply Planning for Procurement.* Consumption refers to the amount of each product actually used at the bench. In most situations, consumption data are not readily available. Services data refers to the number of tests performed at the bench and provides a realistic picture of the capacity and capabilities on the ground. Both services and consumption data are historical and are valuable in quantification if past trends are likely to occur in the future. If a program is planning to enhance scaling-up efforts or introduce new programs, other information should be used in combination with historical data to make assumptions about future changes. Historical data also have limitations if the services were interrupted by stockouts or equipment breakdowns.

Demographic and morbidity data are population based and usually are derived from epidemiological surveys. Significant assumptions must be made to move from population-based data to number of predicted tests to quantities of specific products required; therefore, these data tend to lead to an overestimation in forecasted consumption. However, demographic and morbidity data are useful in building assumptions regarding future changes to service and can be used in conjunction with historical services or consumption data to build new assumptions. Demographic and morbidity data are also useful if the quantification is focusing on only one disease category, such as CD4 count tests for HIV-positive patients.

When quantifying commodities needed for laboratory services, particularly when quantifying the needs for the entire national laboratory service, a combination of data sources will strengthen the accuracy of the forecast. The ability to conduct an accurate national quantification for all laboratory commodities will be important to strengthen laboratory services in limited-resource settings.

6. Purposefully Design a National Logistics System for Laboratories

Historically, laboratory logistics systems have been underfunded, piecemeal, and fragmented. Low-resource countries rarely have a national laboratory logistics system that is specifically designed to support the flow of commodities for laboratories. Instead, laboratory commodities either flow through the system designed for pharmaceuticals, moving through central medical stores to lower-level facilities, or the commodities are procured locally by the individual laboratory. In many laboratories, commodities are sourced using both systems.

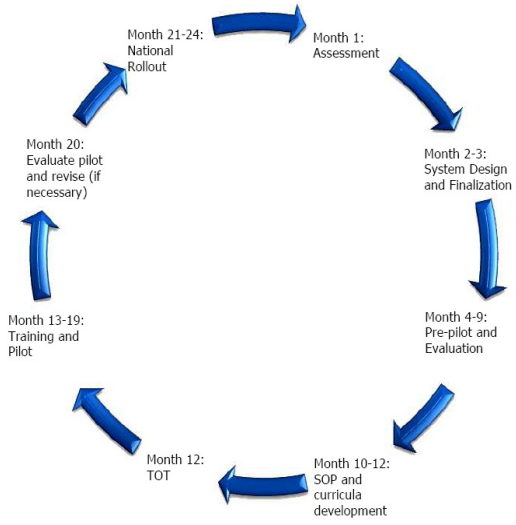
In **Zambia**, extra steps such as pre-piloting and piloting were included in implementation to build confidence and get support of all stakeholders for the new system. When designing and implementing a laboratory logistics system supply chain, managers must be aware of the idiosyncrasies of national laboratory systems if they are to have success.

The introduction of disease-specific programs with related laboratory service requirements has further complicated the situation. When certain programs or initiatives are introduced that require laboratory services, such as polymerase chain reaction (PCR) for early infant diagnosis, often a parallel supply chain is set up for those commodities that flow directly from the program to the laboratory, bypassing central medical stores and the other levels of the system. As a result, there is a lack of uniformity in terms of managing laboratory commodities within one laboratory and across the network. All laboratory assessments conducted by the USAID | DELIVER PROJECT to date have highlighted the need for a uniform national logistics system as a priority intervention.

The purpose of a logistics system is to move laboratory commodities in an orderly and timely fashion to the places where they are needed, by implementing standardized procedures for collecting information and distributing products that maximize the use of resources and minimize the ordering and reporting burden on laboratory staff. To improve availability of laboratory commodities at all levels of the system, it is essential that a system is purposefully designed to specifically manage laboratory commodities.

The process of designing and implementing a laboratory logistics system can be more resource-intensive than for other commodity categories, such as antiretroviral drugs. The number and variety of the products included in the system, and the fact that the users of the system generally have little previous experience with logistics, increases the complexity. Figure 1 shows the timeline from assessment through rollout. In one country, this process took 24 months.

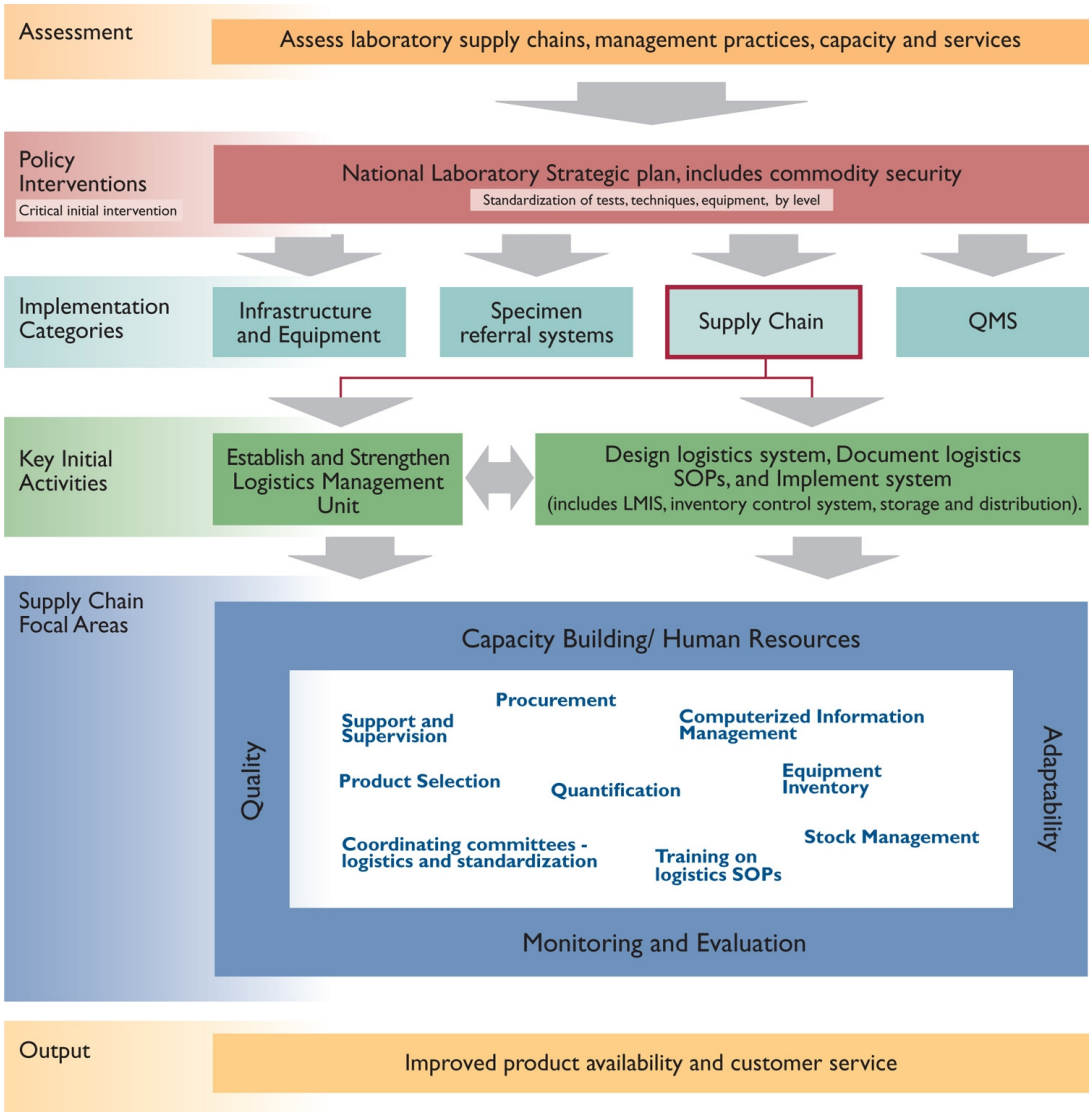
Figure 1. Laboratory Logistics System Design/Implementation Process in One Country



In the approach to designing a logistics system for laboratory commodities, whether integrated with existing supply chains or established as a stand-alone logistics system, it is important to consider elements that are unique to laboratory commodities, including the context of laboratory services and unique product and program characteristics.

- **Context –** In most limited-resource settings, national laboratory logistics systems have been absent, and laboratory staff and stakeholders do not have much experience or knowledge of logistics. Training laboratory staff in logistics and engaging with stakeholders will be essential parts of the logistics system design and implementation. Logistics systems should be designed with consideration to the laboratory management structure and service model.
- **Product –** Laboratory commodities have many unique properties compared to pharmaceuticals. If the quality and integrity of these products is to be maintained throughout the supply chain, then careful considerations need to be taken. For example, the shelf life of laboratory commodities varies greatly from product to product, ranging from 3 to more than 60 months. Special distribution mechanisms may need to be implemented to accommodate the very-short-shelf-life products. Laboratory products also come in varying preparations and pack sizes. When designing report forms careful consideration must be given to the unit of measure used for reporting so as to keep it simple.
- **Program –** Professionally trained laboratory personnel are taught to be detailed and precise, and in designing a system they tend to design forms that record usage down to the last gram of a powder or the last milliliter of a liquid. This level of detail can hinder rather than enhance the system, as it can be cumbersome and create reporting fatigue.

Figure 2. Strengthening Laboratory Systems through Investments in Supply Chains



Conclusion

The lessons described here have been identified by the USAID | DELIVER PROJECT as critical and essential considerations for strengthening the laboratory supply chain. However, other interventions are required that focus on the larger laboratory framework. Figure 2 illustrates the range of implementation categories that are components of a laboratory system and have supply chain implications. The equipment and infrastructure, specimen referral systems, and quality management systems indicated in this diagram must be strengthened in conjunction with supply chain interventions.

Laboratory supply chains require the same components that are required for other health commodities, but the uniqueness of laboratory services and commodities must be recognized when implementing good supply chain practices in the laboratory setting.

For more information on strengthening laboratory logistics systems, refer to the following guides:

1. USAID | DELIVER PROJECT, Task Order 1. 2009. *Laboratory Logistics Handbook: A Guide to Designing and Managing Laboratory Logistics Systems.* Arlington, Va.: USAID | DELIVER PROJECT, Task Order 1
2. USAID | DELIVER PROJECT, Task Order 1. 2009. *Assessment Tool for Laboratory Services.* Arlington, Va.: USAID | DELIVER PROJECT, Task Order 1.
3. USAID | DELIVER PROJECT, Task Order 1. 2009. *Laboratory Standardization: Lessons Learned and Practical Approaches.* Arlington, Va.: USAID | DELIVER PROJECT, Task Order 1
4. USAID | DELIVER PROJECT, Task Order 1. 2009. *Planning and Implementing a Logistics System Design Activity.* Arlington, Va.: USAID | DELIVER PROJECT, Task Order 1.
5. 5. *USAID* | DELIVER PROJECT, Task Order 1. 2008. *Quantification of Health Commodities: A Guide to Forecasting and Supply Planning for Procurement.* Arlington, Va.: USAID | DELIVER PROJECT, Task Order 1.

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