Using Last Mile Distribution to Increase Access to Health Commodities

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Abstract

Last Mile delivery presents a unique challenge in making health commodities available in the developing world. This guide, designed for in-country practitioners and decisionmakers, uses a range of real world examples to support selection and design of last mile distribution approaches which respond to specific challenges.

Cover photo: At a remote clinic in Mozambique, health care staff members receive regular deliveries of vaccines and related consumables through a vendor-managed approach. VillageReach 2003.

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Acknowledgments

The *last mile* represents a critical challenge in ensuring access to health commodities at the service delivery point.

Good family planning, treatment of illness, and other health services all depend on availability of health commodities for the end user or patient. When a patient travels to a health clinic or hospital and cannot receive services because his or her commodity isn't there, it represents a failure of the health system—unplanned pregnancies, prolonged illness, and unnecessary death.

In Mozambique, delivery trucks travel from the province store to remote facilities under the Dedicated Logistics System (DLS). VillageReach 2004.

Bringing health commodities to the point of service delivery and making sure they reach the *last mile* are critical links in the logistics systems that support product availability (see box 1). In different developing countries, the last mile of product delivery may involve different processes, different strategies, and different modes of transportation. In some places, it might involve deliveries to urban hospitals by truck, while in others it might require use of ox-drawn carts through flooded fields to an isolated clinic. In some places, the health worker at the service delivery point (SDP) decides when to place and retrieve an order for commodities; in others, the SDP might receive regular predetermined deliveries.

But the last mile is not simply about the physical delivery of commodities. At the same time that products flow toward the end user, logistics data need to flow in the reverse direction. Program planners at the administrative level need to know how much of each health commodity is being consumed in order to plan for procurement and to decide how much to provide to each SDP during the next delivery cycle. This flow of logistics information is crucial to supporting product availability for the patient user. However, the last mile often presents unique challenges in making this planning possible: SDP workers may not have access to communication technology, may have limited training for collecting data and making calculations, and, most significantly, typically must balance data collection and reporting with their main job requirement of attending to patients.

In all contexts, the last mile represents a critical stage in the effort to make commodities available and to achieve health objectives. Design of the systems and processes that make last mile delivery happen must address local challenges and must use available resources. Challenges might include limited funds, geographic isolation of facilities, and limited staffing. Resources might take the form of ministerial support, finances, information systems, human resources, and local infrastructure.

This guide provides country planners and system designers with an overview of how six developing-country health systems have addressed particular challenges related to last mile distribution, as well as the resources they've needed to implement and sustain those systems. It is designed to help country planners consider the design or redesign of distribution systems that cover the last mile by answering the following questions:

- What are potential approaches for addressing particular challenges in last mile delivery?
- What resources are required for doing so?
- To what degree can components of a given approach be adapted for other contexts?

> **Box 1. The Six Rights**
>
> The RIGHT goods
> in the RIGHT quantities
> in the RIGHT condition
>
> delivered …
>
> to the RIGHT place
> at the RIGHT time
> for the RIGHT cost.

Where Is the Last Mile?

The last mile, or last 10 kilometers, is the final delivery leg to the point of service delivery or retail sale. It exists in any context that involves a physical flow of products to the point where end users can access them.

For a soft drink distributor, the last mile is the distributor's delivery of bottled drinks from the warehouse to the restaurants and shops that sell those drinks to the final consumer. In this example, last mile distribution includes the packing of deliveries to retail locations according to their orders and then the physical transportation of those orders until the retailer receives them (see box 2).

In the private sector, the last mile presents a number of unique distribution challenges. Although shipment from manufacturer to warehouse in national or international settings often takes advantage of the large volumes involved by building truck-load or container-load shipments, last mile delivery typically involves much smaller volumes going to numerous destinations in greater frequency. This required breakdown of commodity volumes from the warehouse to the end customer leads to inherently lower efficiencies of scale and is simply harder to coordinate across numerous customers and shipments.

For the soft drink distributor, inbound shipments of ingredients and consumables might come on large, full truck-load shipments that occur relatively infrequently, leading to low shipment costs per kilogram of material. But the outbound shipment of finished product to retail customers will be for smaller volumes to numerous customers, leading to higher shipment costs for the same volume of product.

In the context of developing-country public health, the last mile may take different forms, depending on the design of the health system, but it always involves commodities reaching the SDP. Most commonly, the last mile is envisaged as the shipments of health commodities from the district level down to the SDPs. In some countries, however, SDPs may receive their products directly from the national-level warehouse, making the last mile the link between the national and service delivery levels.

In developing countries, the last mile often includes going *off road* to reach geographically isolated facilities in difficult terrains, with little access to communication infrastructure. A unique aspect of the last mile in developing countries is that road infrastructure typically worsens as one travels farther from the point of resupply.

Some public health systems also include community health workers (CHWs), who distribute health commodities to the end user at the village level, which is below the health-center level. Depending on the design of the health system, the true "last" mile may be the link between the health center and the CHW. However, the primary focus of this guide is on the distribution of health commodities to the SDP.

Box 2. The Last Mile Links

In many public health systems, the true *last mile* includes the link between the service delivery point (SDP) and the community health worker (CHW). However, in almost every instance, CHWs collect their products from the SDP and, in some cases, are treated (from a logistics standpoint) like a patient at the SDP. The frequency and method for their resupply depend on the inventory control system established.

Different approaches for this process are documented in Hasselberg and Byington's *Supply Chain Models and Considerations for Community-Based Distribution Programs: A Program Manager's Guide (2010).*

What Logistics Activities Occur within the Last Mile?

The logistics cycle in figure 1 depicts the activities and supporting systems that must take place to ensure product availability for health services. Those activities occur in various forms at all levels of the logistics system, but the last mile involves a simplified cycle of activities to support resupply to SDPs, including transportation, data collection, quantification, and procurement (resupply calculation and order placement). Key support systems—
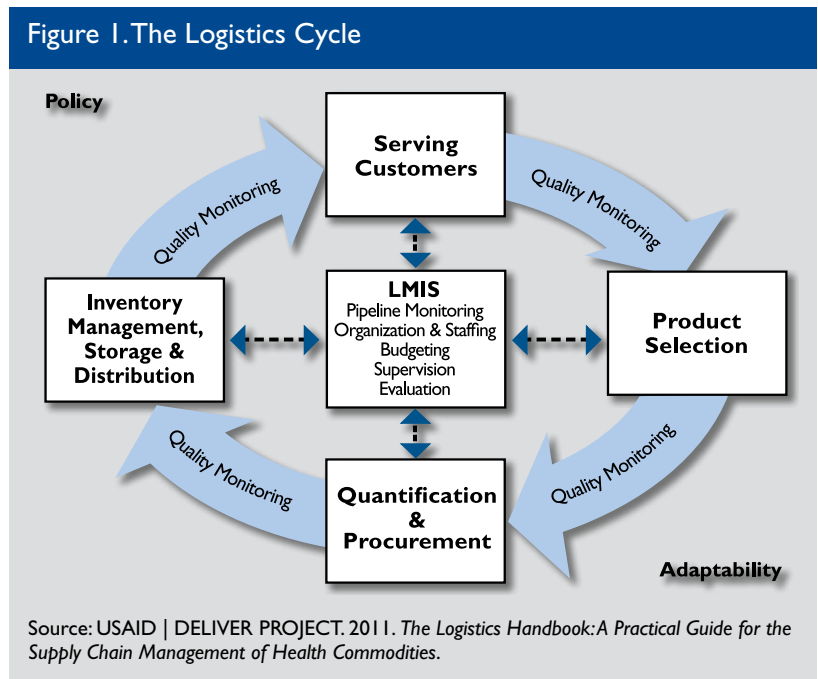
including information management, monitoring and supervision, and supply chain structure—help sustain the successful completion of the activities.

Distribution models, although traditionally focused on physical transportation, can also directly support the information flow and larger logistics support systems. Figure 2 shows the cycle of activities and support systems that are part of all last mile distribution models and can serve as points of modification for system planners and managers to consider for performance improvement. The distribution models presented in this guide all addressed those activities in different ways.

Figure 1. The Logistics Cycle

Source: USAID | DELIVER PROJECT. 2011. *The Logistics Handbook: A Practical Guide for the Supply Chain Management of Health Commodities.*

Activities

The activities described in the boxes of figure 2 drive the physical and information flows that comprise last mile logistics. Each of the activities is critical to ensure product availability at the SDP, and each can be modified to improve performance.

Transportation

The products must be physically transported to the SDP. Transportation can take place as a direct delivery from the resupply point or as a pickup organized by the SDP worker. Before supplies are dispensed to the end patient, SDP and other health logistics workers must store the products using good warehousing practices.

Data Collection and Resupply Calculation

Last mile distribution models can help ensure that useful, high-quality logistics data are captured and made visible to administrative-level personnel. To support this activity, SDP workers must track logistics data points—such as stock on hand, amount consumed over time, and losses and adjustments—in order to capture logistics activity at their facility. This tracking may require the use of electronic communication technology, dedicated personnel, or effective training for SDP personnel in order to support good logistics decisionmaking.

For SDPs, the next resupply amount for each product must be determined and the order must be processed and approved. In push systems, this determination will be made by the supplying entity at a level above the SDP, but in pull systems, the SDP will calculate and decide on the resupply amount. Placing or initiating an order takes the place of *procurement* for SDPs.

Figure 2. The Logistics Cycle at the Last Mile

Source: USAID | DELIVER PROJECT. 2011.
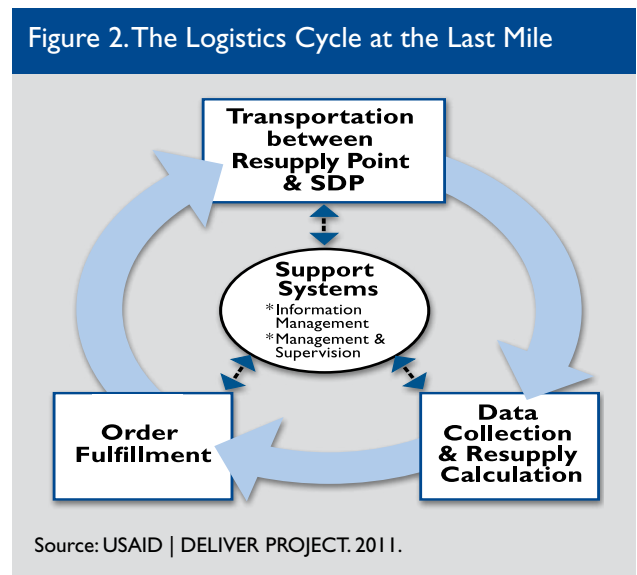
Order Fulfillment

Once resupply calculations have been completed for each SDP, the resupplying facility must process each order, pick the required commodities from the storage area, and prepare the orders to be transported. Even in systems in which the SDP worker picks up the order, the supplying facility must properly document and remove the products from storage as part of the resupply transaction.

Support Systems

At the center of figure 2 are the systems that support the specific activities of the logistics model. At the last mile, information systems, monitoring and supervision, and supply chain network design are of particular importance for ensuring product availability at the SDP.

Information Management

Although logistics management information system (LMIS) designs can vary widely, the SDP is the only point from which true consumption data can be captured. For this reason, it plays a vital role in most LMISs as the originating point for logistics information before it proceeds upward toward system partners and decisionmakers at various levels. The design of the LMIS, the exact information that is required and the information technology infrastructure that is available to SDP workers can affect the amount of time they spend on this activity, as well as the quality of information that passes through the LMIS. Although design of the LMIS often takes place independent of distribution system design, the distribution model can help support the long-term viability and quality of the LMIS.

Monitoring and Supervision

Proper adherence to procedures and feedback from the service delivery level require institutionalized monitoring and supervision of SDP workers. This supervision is required for making sure that data are properly collected, resupply processes are followed, commodities are properly stored, and SDP workers are motivated to perform all their tasks.

Addressing Challenges at the Last Mile

In addition to the challenges common to last mile delivery in all settings, the activities that support last mile delivery in the developing-country public health context must account for limited resources—in the form of the following:

- staff shortages and low salaries
- limited capital to cover distribution operating costs
- limited transportation, power, and communication infrastructure.

Those resource limitations affect the distribution system's capacity to complete the required logistics cycle activities. For example, an SDP worker may serve so many patients that he or she can't complete consumption reports. Or, if facilities are required to pick up their products, the facilities may be forced to wait until a shared vehicle is available. The design and execution of the activities and support systems listed earlier will vary according to environmental needs and resources available and can have significant implications for the performance of the supply chain.

This guide summarizes six last mile logistics models that have proved successful at increasing product availability at the SDP, and it details the varying ways in which the critical activities and support systems have been implemented to improve efficiency and performance in resource-limited settings.

Table 1: Model Descriptions

MODEL	LOCATION	COMMODITIES	DESCRIPTION
Dedicated Logistics System (DLS)	Cabo Delgado and Niassa provinces, Mozambique	Vaccines and related supplies, rapid diagnostic tests	The DLS transports vaccines, vaccine supplies, and rapid diagnostic tests from provincial warehouses to district hospitals and health centers in two provinces of Mozambique. Two additional provinces are scheduled to transition to the DLS in 2011. Dedicated province-level staff members manage the DLS and are responsible for delivering the commodities, collecting stock and consumption data from the SDPs, and providing supportive supervision to the health center staff about proper vaccine storage.
Delivery Team Topping Up (DTTU)	Zimbabwe	Reproductive health commodities, preventing mother-to-child transmission products, and rapid test kits	The DTTU delivers reproductive health commodities directly from the national level to the SDP throughout Zimbabwe. Coordination, management, and operation of DTTU are provided by the USAID	DELIVER PROJECT and the Zimbabwe National Family Planning Council. In this two-tiered system, commodities are packed at the national level (in two warehouses in Harare and Masvingo) and delivered to the SDPs. Once there, the delivery team records consumption data and *tops up* the facility by issuing the appropriate amount of stock.
Drug revolving fund—essential medicines	Kano State, Nigeria	Essential medicines	Kano State operates a drug revolving fund (DRF) that was initially capitalized and is technically supported by the Department for International Development Partnership for Transforming Health Systems Phase II (PATHS2) program. In Nigeria, essential medicine distribution systems are primarily the responsibility of state governments and sometimes local government authorities. In this model, the Drug and Medical Consumable Supply Agency (DMCSA), under the Kano State Ministry of Health (MOH) manages the forecasting and procurement of essential medicines for the DRF and operates a warehouse in Kano Municipality. Secondary hospitals and primary health care centers that have joined, and have been capitalized under the DRF, come directly to the DMCSA warehouse to place and receive orders for resupply. Information and funds also flow between SDPs and the DMCSA.
Essential Medicine Logistics Improvement Program (EMLIP)	Zambia (select districts)	Essential medicines	Zambia is in the process of a national roll out of a new distribution system for essential medicines, which will be managed by the MOH and Medical Stores Limited (MSL). In the new program, health facilities send reports on medicine consumption to the district, where the information is reviewed, approved, and sent to MSL. MSL packs the orders in sealed packages for each facility and delivers the orders to the district, which, in turn, arranges for distribution of the orders to the SDP either through delivery or pickup.
Integrated Logistics System (ILS)	Tanzania	Essential medicines, reproductive health supplies, malaria commodities	The ILS serves all public health facilities in Tanzania. The ILS is managed by the Medical Stores Department (MSD), a semi-autonomous department of the Ministry of Health and Social Welfare (MOHSW). SDPs submit quarterly orders to the district, which compiles them and submits them to the appropriate zonal MSD. Orders are packed by the MSD and delivered to the district, which is then responsible for ensuring that the orders reach the SDPs. Orders include logistics data, such as stock on hand, consumption, and wastage. Hospitals submit their orders directly to the appropriate zonal MSD without passing through the district. The MOHSW oversees and supervises the system.
Rural Extension Program, operated by APROFAM (*Asociación Pro Bienestar de la Familia*)	Guatemala	Family planning	The MOH contracted APROFAM, a local nongovernmental organization (NGO), to distribute family planning products to rural clinics, community promoters, and other NGO clinics. APROFAM manages the overall system and outsources the transport component to a private company. Clinicians and community promoters report stock on hand, consumption, and commodity requirements through an Internet connection or mobile device to an Enterprise Resource Planning application, which APROFAM uses to dispatch the orders.

The following models are included and summarized in table 1:

- Mozambique's Dedicated Logistics System (DLS)
- Zimbabwe's Delivery Team Topping Up (DTTU)
- essential medicine distribution in Kano State, Nigeria
- Zambia's Essential Medicine Logistics Improvement Program (EMLIP)
- Tanzania's Integrated Logistics System (ILS)
- Guatemala's Rural Extension Program, operated by *Asociación Pro Bienestar de la Familia* (APROFAM).

This guide will examine in more detail how the six models have approached the core activities and support systems needed for effective last mile distribution. Each model has its own unique approach to each activity and system, and the approaches create a continuum of options for other countries to consider when designing new methods of addressing last mile distribution challenges. Each model chose its approach on the basis of the supporting environment, the resources available, the structure of the health system, and the overall logistics design for the country as a whole.

The continuums represented next are not hierarchical; the goal is not for each model to move up the continuum. Instead, they show the variety of options that successful last mile models have used to ensure product availability and system efficiency, and they seek to encourage other logistics system designers to consider the variety of options on this continuum table when designing effective last mile systems.
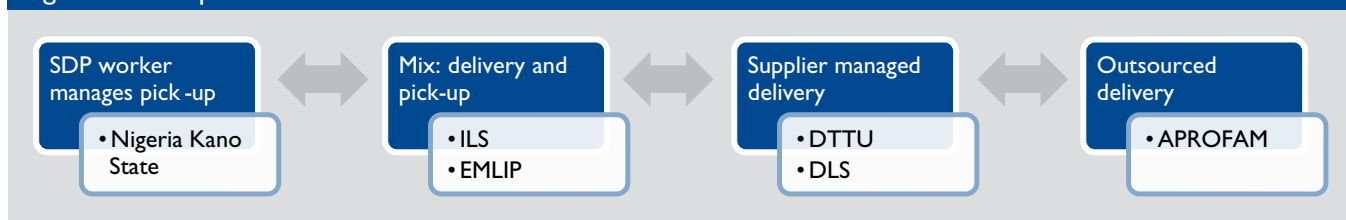
Approaches for Last Mile Distribution

Transportation

Transportation design can greatly affect the performance of the last mile logistics distribution system. Developing-country health programs often have limited funds for investment and for the operational costs of using vehicles for distribution, including vehicle purchase, maintenance and repairs, fuel, and driver salaries. Additionally, a lack of funds and know-how for proper maintenance and safe vehicle operations can lead to higher long-term costs in the form of reduced vehicle working life. Difficult environments can make facilities physically inaccessible and can increase wear and tear on vehicles, especially if they are ill-suited for the terrain in which they operate. Opportunity costs of transportation may also occur if health workers must travel long distances to collect commodities, especially if they are forced to close their facility to do so.

The six models included in this review represent a variety of approaches to the design of transportation systems, given the identified challenges and resource limitations. The models vary with the degrees of operational management, delivery routing, timing, and cost. Management of the models ranged from outsourcing of all transportation activities in Guatemala to facility-managed transportation with a cost recovery approach in Nigeria. Figure 3 illustrates the spectrum of transportation models according to the responsibility for operations of the distribution system.

Figure 3. Transportation Models

SDP worker manages pick-up	Mix: delivery and pick-up	Supplier managed delivery	Outsourced delivery
• Nigeria Kano State	• ILS • EMLIP	• DTTU • DLS	• APROFAM

Facility-managed transport—SDP worker picks up commodities

In Kano State, Nigeria, the SDPs are primarily responsible for the physical distribution of commodities using facility-owned vehicles that are shared between programs. The distribution occurs on an ad hoc basis, and the markup on the cost recovery element is designed so that it covers operating costs. Facility-managed distribution is often ineffective because of a lack of transport options at the SDP to pick up orders. By introducing a cost recovery element to encourage SDPs to ensure product availability and to provide financial resources that can be used for transport, this model has helped overcome the usual barriers to facility-managed distribution.

Mixture of supplier- and facility-managed transport

Both the ILS in Tanzania and the EMLIP in Zambia support direct delivery from the central or zonal medical stores to the district level using dedicated transport owned by a parastatal medical stores department. From there, districts are officially responsible for delivery to the facilities; although in some cases where transport is unavailable, the facilities must collect their commodities.

A pilot project in Tanzania is currently under way to implement direct delivery to the facilities similar to that in DLS and DTTU. The cycle of delivery varies slightly with facilities under EMLIP, with some facilities receiving commodities once a month, or once every two months, or once each quarter, under ILS. ILS also has a cost recovery element to support the transportation costs. The Medical Stores Department charges per delivery to the facility out of its Ministry of Health (MOH) budget.

Because the SDPs may not have adequate resources to pick up commodities, this model should be used only when the districts are appropriately resourced and have a dedicated person responsible for ensuring quick and reliable delivery from the district to the SDP.

Supplier-managed transport—resupplying facility delivers commodities to SDP

Both the DTTU in Zimbabwe and the DLS in Mozambique deliver commodities directly to the SDP through a centralized transport system (see box 3). The DTTU in Zimbabwe is similar to the APROFAM model in that dedicated trucks and personnel are used to distribute commodities. However, the implementing partner manages the system, including vehicle procurement, maintenance, drivers, and fuel. Transport for the DLS in Mozambique is managed by the Provincial Departments of Health on behalf of the districts and SDPs. The DTTU required significant investment by program donors to procure vehicles for the quarterly distribution to the SDPs. The DLS in Mozambique also required some initial investment from donors to support the procurement of additional vehicles, but the operational costs for distribution are included in MOH budgets.

This model is often seen as more resource intensive, although assessments by both DTTU and the DLS show that the overall costs of running the system are not higher than other models. And both systems have been found to

> **Box 3. Dedicated versus Nondedicated Vehicles**
>
> The DLS uses rugged pick-up trucks, many of which were already owned by the province and are used for other health programs. This shared use decreases barriers to entry for provinces wanting to transition to the DLS model, but it can also lead to scheduling conflicts or overuse of vehicles.
>
> DTTU uses seven-ton trucks purchased specifically for DTTU and limits their usage to delivery. Because the DTTU delivers bulky reproductive health commodities and serves every health facility in the country, larger dedicated vehicles were necessary. Having dedicated trucks means more reliable transport options, but they can also increase the resource investments needed to start and maintain the system.
>
> Both options can be effective, and the decision about dedicated versus nondedicated trucks is one that should be based on local terrain, available resources, and delivery requirements.

decrease stockouts and to improve logistics performance, thus making the overall cost-effectiveness higher than the previous distribution systems. Although the initial investments in transport may seem high, data show that the long-term performance gains of dedicated logistics systems are significant enough to justify the investment.

Outsourced delivery

In Guatemala, the MOH contracted APROFAM to distribute family planning products to rural clinics and other nongovernmental organizations (NGOs). APROFAM subcontracted the physical transport of the commodities to an external, private transport service company that manages the distribution, vehicle procurement, fuel, and maintenance for all delivery activities. Commodities are delivered directly to the SDP monthly.
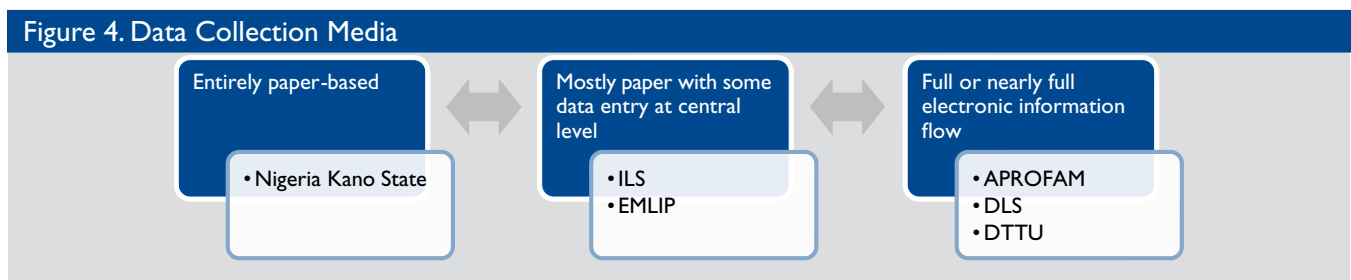
This model can be very effective in that transport logistics are handled externally, thereby removing the burden from the health and administrative staff members. It can also be resource intensive, and it requires good vetting and management of the outsourced contractors to ensure that they meet performance goals. Structural or political barriers to outsourcing can also exist in some environments.

> Tradeoff: Distribution system designers must choose between (a) transportation strategies that incur up-front investment and capacity building but make better use of health worker time and have greater reliability or (b) strategies that incur less direct investment cost but push the logistics burden of product pickup to health workers.

Data Collection and Resupply Calculation—Information System Infrastructure

Nearly every model examined had some form of functioning LMIS, although the information flow between the SDP and the LMIS varied. Data collection from the SDP; data entry into the LMIS; use of data to inform the resupply calculation; and the overall function of the LMIS varied, depending on the system capabilities and available resources. In each model, consumption data and information regarding stock on hand are collected from the SDP, but the data's usefulness in decisionmaking varies between models and LMISs.

Figure 4 shows the continuum of data collection media used, ranging from a complete paper-based system to a complete electronic systems, with most models having a mixture of paper and electronic data collection and processing.

Figure 4. Data Collection Media

Entirely paper-based	Mostly paper with some data entry at central level	Full or nearly full electronic information flow
• Nigeria Kano State	• ILS • EMLIP	• APROFAM • DLS • DTTU

Entirely paper-based

Currently, Kano State, Nigeria, uses no electronic information system; information flow is only through paper forms. Pharmacy staff members at the SDP collect the data, and information is exchanged at the point of requisition. Because each facility is responsible for collecting its goods at the point of requisition, a paper-based system allows the facility managers to procure the necessary commodities directly from the distribution point in locations, with limited or no access to electronic systems.

An entirely paper-based system severely limits the administrators' ability to forecast the needs at higher levels because accurate consumption data are not readily available from the SDPs. Although paper-based systems avoid the need for software development and implementation, they have the potential to be expensive in the long run through printing and data entry labor costs.

Primarily paper with some data entry at the central level

Both the ILS in Tanzania and the EMLIP in Zambia use a mixture of paper-based forms for data collection and electronic information management systems for data processing. In each model, health workers collect data at the SDP using paper forms. Although neither model has computerized information flow all the way from the SDP for management or assessment of the distribution system, the ILS is piloting a new short message service (SMS) system, called ILSGateway ,that will allow health workers in the pilot districts to provide some information about reproductive health commodity stock levels and orders through SMS to improve data visibility at the central level.

In Zambia, data are entered into Supply Chain Manager (SCMgr) software at the Logistics Management Unit from stock status reports sent from the SDP. SCMgr provides automated calculation for fulfilling requisitions, and it tracks inventory levels and consumption trends over time.

These models have used existing technologies and simple programs to function within the current paper-based systems without making a significant investment in information systems.

Full or nearly full electronic information flow

The DLS and the DTTU models manage an electronic flow of logistics data from the SDP to the central level. Although the DLS data collection physically takes place on paper forms from the SDP, the data are entered into LMIS by dedicated personnel for use and decisionmaking following the delivery visit.

Both the DLS and DTTU have shown significant improvements in information availability from the SDP, and the use of data for decisionmaking has also improved. However, in both models, the LMIS was created specifically for the distribution model, and both have dedicated computers for the systems' use. Similar to the transportation models, these models might be viewed as investment heavy, because they require the development of new systems or contextualization of existing open source systems.
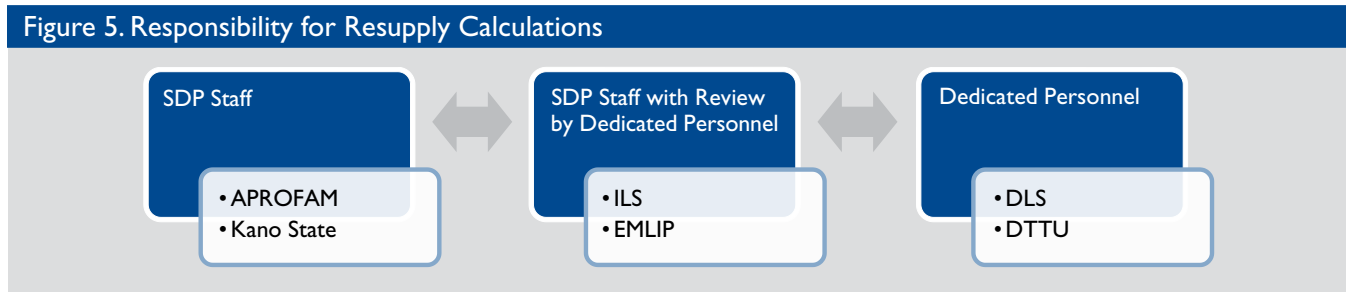
The APROFAM model also uses an electronic ordering system, called Exactus, in which the data are collected and entered by the SDP staff. Health workers can order supplies directly from the central warehouse using this information system. Full electronic flow allows visibility of real-time data from the SDP.

This type of model requires an environment with good connectivity options and a commitment to invest in technology at the SDP. For full electronic information flow, dedicated hardware at the SDP, Internet connectivity, and a reliable energy source will also likely be necessary. Because of such requirements, this system is not always an option in low-resource environments.

> **Tradeoff:** Development of electronic systems will likely require external technical assistance and will depend on communications infrastructure, but they can provide greater real-time data visibility for all partners involved. Supply chain managers will need to balance the choice of an information system medium between their requirements and what is feasible, given available resources. The DTTU balances this tradeoff for the commodities it delivers by bringing the electronic connection to the SDP during delivery runs.

Data Collection and Resupply Calculation—Work Assignments

Correctly and accurately managing data collection and resupply calculations are critical to ensuring that commodities are available at the SDP. Responsibility for those activities varied from health workers at the SDP to dedicated logistics personnel, with some models having dedicated personnel oversee the process. Figure 5 depicts the continuum of responsibility for resupply calculations.

Figure 5. Responsibility for Resupply Calculations

SDP Staff
- APROFAM
- Kano State

SDP Staff with Review by Dedicated Personnel
- ILS
- EMLIP

Dedicated Personnel
- DLS
- DTTU

SDP staff

In the Kano State and APROFAM programs, staff members at the SDP do the resupply calculation. In those models, training and ongoing supervision of the health workers in resupply calculation methods are necessary to ensure accuracy. In both models, errors were reported that, at times, resulted in inadequate levels of stock at the SDP. Automated resupply calculations, oversight by dedicated personnel, or both could help prevent errors.

SDP staff with review by dedicated personnel

In the ILS and EMLIP models, staff members at the SDP also perform the resupply calculation, but it is validated and entered into an electronic system by dedicated personnel at a higher level. Under ILS, the facility-in-charge sends to the district the data about opening balance, amount received during the period, loss and adjustments, closing balance, estimated consumption, quantity needed, and quantity requested for each of the commodities. At the district level, this information is reviewed and amended or approved by a dedicated logistics position, usually the district pharmacist, and feedback is given to the SDP for process improvement.

In Zambia's EMLIP, data on consumption from the SDP are sent to the district commodity planner, who reviews them for accuracy. After review, the data are sent to the Logistics Management Unit where they are entered into SCMgr, which then automates the resupply calculation.

Dedicated personnel

In the DTTU and DLS models, resupply calculation is done exclusively by dedicated logistics personnel. In both models, the resupply calculation is done at the point of delivery, in keeping with data collected at the SDP, and the logistics personnel are specifically trained in the calculation methods of their respective systems. The calculation can also be partially automated in the LMIS.

Management of the resupply calculation by dedicated personnel can result in significant improvements in calculations and thus product availability. However, using dedicated personnel requires an additional human resource investment and the establishment of a new cadre of human resources supporting the health sector. In both models, the delivery personnel are responsible for collecting and entering data from the SDP, thus shifting logistics tasks away from SDP workers.

> **Tradeoff:** System designers will have to choose between creating and training dedicated staff members or training the existing staff. Both the DLS and DTTU models require dedicated personnel to oversee the resupply calculation, which can mean creating a new position in the health system or adding duties to a position that already exists. In environments with low human resource capacity, training a few dedicated personnel to oversee the resupply functions can help improve the accuracy of resupply calculations without requiring significant investments in training all health staff members.

Restructuring personnel and creating new roles in a government system can be difficult because of the limited resources available for human resources in the health sector in many countries. Although using existing personnel for this function is feasible, it can result in work overload for those individuals. Moreover, logistics tasks may be deprioritized as a result of limited time.
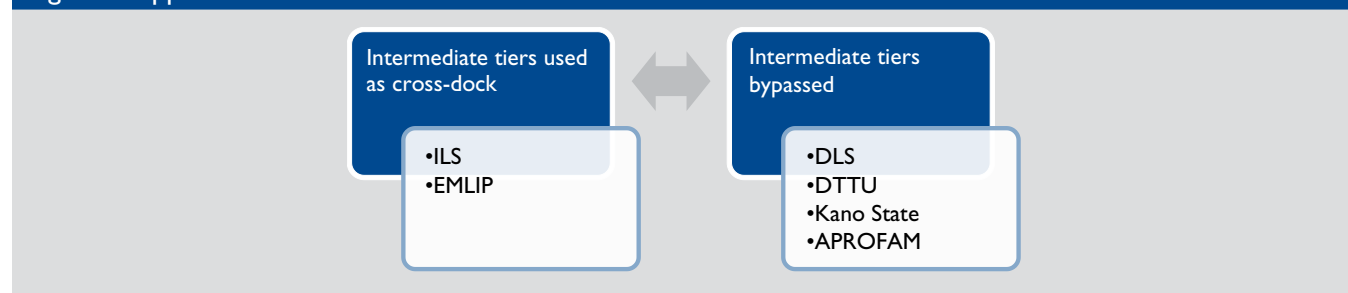
Order Fulfillment

Designers of last mile delivery systems may ask, "How many tiers should our delivery system use?" or "Which administrative level should hold stock and manage order fulfillment to the SDPs?" Order fulfillment for SDPs can involve significant labor to process, pick, and pack orders for individual facilities, depending on the number of facilities and the order frequency.

A traditional approach to order fulfillment is to have each administrative tier in the MOH hold stock of commodities and manage resupply to the next lowest facility. This approach may lead to inefficiencies by having multiple tiers going through the same processes of storing, picking, and packing commodities. Additionally, health management staff members at the lower administrative tiers face many of the same resource limitations encountered at the SDP—too many logistics activities assigned to too few and under-resourced staff members— thereby increasing the chance for failure and low performance.

The last mile models surveyed took more innovative approaches to this distribution component and fell into two categories: (a) those that managed order fulfillment at a higher, central level and completely bypassed the intermediate district (or equivalent) tier and (b) those that processed SDP orders at a higher level but used the district as a *cross-dock* facility (see figure 6).

Figure 6. Approaches for Order Fulfillment

Intermediate tiers used as cross-dock	Intermediate tiers bypassed
•ILS •EMLIP	•DLS •DTTU •Kano State •APROFAM

Intermediate tiers used as a cross-dock

A cross-docking facility is one in which commodities are not stored but are passed through for routing to their final destination. Under the ILS and EMLIP models, the districts act as cross-docking facilities for both data from the SDP and commodities from the central-level medical stores. In both systems, the commodities are packed at

the central-level medical store for individual SDPs and are delivered to the district from the medical store. The district is then responsible either for delivering the goods to the SDP or for coordinating the collection.

These models reduce the complexity of having multiple layers involved in order fulfillment and reduce the districts' administrative burden. This approach still requires vehicles at the district that are capable of coordinating deliveries or resources at the health facilities for goods collection.

Intermediate tiers bypassed

Most of the models surveyed were two-tiered systems in which SDPs receive their commodities directly from the central warehouse. In the DLS, DTTU, and APROFAM models, commodities are delivered directly, while in Kano State, health facilities collect their goods directly from the central level. Even among these two-tiered systems, there are variations in the timing of distributions, largely depending on the SDPs' distance from the central level and the storage capacity at health facilities.

In the DLS, every SDP is visited monthly; whereas in the DTTU, each SDP is visited quarterly (see also box 4). Furthermore, models vary on whether they are *top up* systems or packaged deliveries.

The DTTU and DLS systems are essentially moving warehouses where the delivery teams top up SDPs according to their consumption and stock levels. In the APROFAM model, the medical stores pack orders for individual facilities on the basis of information entered into the ordering system. Each of the models reduces the complexity of the supply chain by reducing the number of tiers or steps through which commodities and information must pass.

> **Box 4. DTTU System**
>
> The DTTU system is a form of vendor-managed inventory in which the resupply calculation and order fulfillment take place at the SDP during the delivery visit.
>
> The delivery team processes and fills orders from stock carried in the delivery truck, which serves as a *mobile warehouse*. This approach greatly reduces order lead time and condenses the steps in the distribution cycle.

The desire to include all administrative tiers in distribution comes from an assumption that the organization of distribution should reflect the general administrative oversight structure. However, administrative control over lower facilities can take place through other mechanisms, and numerous efficiencies can be gained by rationalizing the number of tiers involved in distribution. With fewer tiers, the resources needed for effective order fulfillment can be focused on fewer facilities, and the reduced safety stock requirements can lead to lower inventory expenses.

> **Tradeoff:** System designers must choose between having resupply points close to the SDP (often reducing transportation cost) or concentrating order fulfillment capacity at fewer facilities, which lowers operating costs and reduces safety stock requirements. In many developing-country settings, the locations of facilities are predetermined, and the system designer must choose between (a) having many tiers responsible for product storage and order fulfillment or (b) reducing the logistics burden on resource-poor administrative tiers and increasing the level of investment for higher-level facilities.
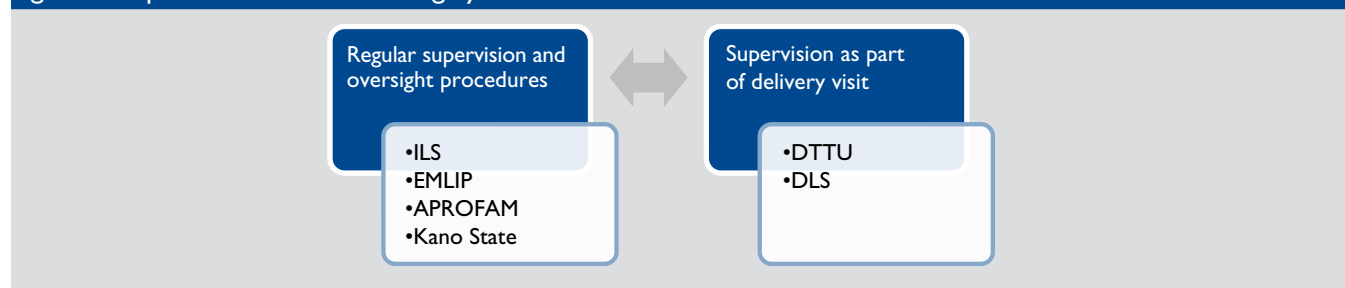
Supervision and Monitoring

Health systems require monitoring and supervision to ensure that SDP personnel properly adhere to clinical and logistics procedures. This activity can include on-the-job training to refresh skills or checklists to make sure key areas are addressed. Proper supervision requires an administrative staff member to physically visit SDPs, which

can be time intensive if there are many facilities or if transport is unavailable. Although, in many instances, supervision and distribution are handled by separate administrative units, some distribution models have combined those functions as a way to improve efficiency and to help ensure that both tasks occur regularly.

Nearly all the models had a supervision and monitoring system in place; however, the models varied significantly on the responsibility for, consistency of, and approach to supervision. For example, most of the models have specified individuals or offices responsible for supervising the distribution system and monitoring performance, yet the supervision activities are not conducted consistently in all models.

Figure 7. Supervision and Monitoring System

Regular supervision and oversight procedures	Supervision as part of delivery visit
•ILS •EMLIP •APROFAM •Kano State	•DTTU •DLS

Supervision of logistics as part of regular supervision and oversight procedures

In most models, supervision of logistics tasks is integrated into other supervision visits conducted by the MOH staff at the SDP. Under the ILS model, the Ministry of Health and Social Welfare (MOHSW) is responsible for conducting supervision visits with logistics as a part of that visit's agenda.

In most models where logistics supervision is part of regular procedures, consistent supervision has been identified as a critical gap that needs to be addressed. Even in models where site visits are conducted by dedicated logistics personnel for oversight of SDP logistics tasks—including stock management and resupply calculations, such as in Guatemala and Kano State— the visits were described as ad hoc and too infrequent. These models use the existing administrative structures and attempt to incorporate supervision of logistics tasks into regular visits. However, this type of system can result in ad hoc visits with a long list of topics to cover in a single visit, and logistics is often deprioritized.

> **Box 5. DTTU System**
>
> In some states in Nigeria, the family-planning program uses resupply meetings to validate data and resupply calculations. Although those meetings require SDP staff members to find transport to their resupply point, the meetings combine commodity transportation, data collection, and resupply process supervision into a single regular meeting.

In some country settings, an implementing partner conducts regular logistics monitoring and supervision activities as part of its operating scope and to ensure adherence to standard operating procedures (SOPs) for commodity resupply (see also box 5).

Supervision of logistics as part of delivery cycle

The DLS and DTTU models take advantage of the deliveries by including supervision visits with the delivery. Because dedicated logistics personnel routinely visit SDPs, they can provide supervision and guidance during those visits. These models have resulted in significantly more reliable and frequent logistics supervision visits at the SDP. Without dedicated personnel routinely visiting SDPs (using dedicated vehicles), this degree of supervision would not be possible.

Additional Considerations

In addition to selecting a last mile delivery strategy based on estimated benefits and costs, several important considerations should also be addressed:

Which Strategy Is Best?

The last mile strategies presented in this guide offer a wide range of potential design options for delivering products to the SDP and for ensuring that logistics data are captured and communicated from there. Each strategy presents options for achieving high levels of product availability, potentially reducing total costs and improving data and resupply calculation accuracy.

These strategies can inform distribution system design discussions by providing an overview of how various programs have accomplished the basic last mile delivery activities. Ultimately, choosing the right strategy is about finding an approach that can potentially achieve the best delivery results while addressing local challenges and using available resources. Ideal strategies achieve high levels of success while using resources efficiently, but the exact priority level between the two objectives is the prerogative of local stakeholders.

Program planners should consider the following questions for their own context when beginning a last mile distribution system design:

> **Box 6. Long-Term Operating Costs**
>
> Once operational, a last mile distribution system will incur ongoing operating costs. To keep the system running, a funding source will have to be identified to support the costs. In some cases, a semi-autonomous parastatal unit manages distribution and charges the Ministry of Health (MOH) or a donor partner on the basis of agreed to rates. In other instances, the MOH or donor partner manages distribution operations more directly and provides budgets for operating expenses.
>
> In a few settings, such as Kano State's Drug Revolving Fund, patients of the health system pay set prices for products. This set price includes markups for each facility to use to cover distribution expenses. Costing studies should be conducted to ensure that markups on user fees or other funding mechanisms adequately cover distribution expenses.
>
> This funding should cover supporting operations, such as monitoring and supervision, as well as physical infrastructure maintenance and replacement in order to maintain long-term performance.

- What are the scope and objectives for distribution?
  - Which commodities need to be distributed, in what quantities, and with what potential frequency?
  - Is resupply amount based on routinely calculated consumption?
  - What is the geographic scope for distribution?

- What are the current challenges for last mile distribution?
- What are the resource limitations at SDPs and other administrative tiers? What are the particular challenges associated with the terrain?
- What resources might be available for—
  - third-party contract management?
  - training and support for dedicated personnel?
  - infrastructure procurement, maintenance, and replacement?

- What other last mile distribution systems, operated by other partners or health programs, are already in place in the country and can be expanded or adapted to serve the current objectives?

Potentially, there should be several feasible model design options, and picking the best among them should be a matter of deciding which has the best potential for success on the basis of—

- Potential benefits
- Potential short-term implementation and long-term operating resource requirements (direct, indirect, and opportunity costs) (see box 6)

  Designers of distribution systems should be aware of opportunity costs, as well as direct, up-front costs Some approaches, such as requiring SDP staff members to pick up orders, do not present large up-front costs for implementation but present significant opportunity costs in the form of health worker time and salaries being spent on logistics activities instead of serving patients.

- The local operating environment (How will this strategy interact with other existing programs? What will the local culture support?).

Beyond stakeholder-driven collaborative discussion, one option in deciding between a few potential distribution system strategies is to develop and conduct a phased-implementation approach. This approach involves implementing the short-list of last mile strategies in a sample area and monitoring the outcomes.

Another option for strategy selection is to use a supply chain network analysis software tool to create simulation scenarios. This approach involves building a baseline scenario that usually depicts the current operations for comparison and then building, simulating, and comparing outcomes of various strategies. This approach has the advantage of identifying the best strategies without the costs and time involved in an actual pilot program. However, it can't capture certain human resource issues, such as difficulties in completing reports on time.

Can More Than One Strategy Be Used?

This guide has not presented the various models separately and on their own terms, but instead in terms of their approach to particular distribution system design questions. Users of this guide should follow a similar process by deciding how their system should answer the design questions, rather than seeking simply to adapt another country's model. Users may eventually choose elements of several different models to achieve their objectives and may choose to operate multiple strategies at once.

Supply chain segmentation is an approach used by numerous large retailers in the developed world to create groupings of their products and the customers they serve. Such groupings are based on shared logistics characteristics (for example, high versus low turnover products, large versus small customers) in order to identify distribution strategies that cater to those particular groups. In this way, retailers develop parallel distribution strategies that are based on logistics characteristics (for example, by making more frequent deliveries for high-turnover products).

In the developing-country public health context, distribution systems tend to be fragmented around vertical health programs, although increasingly there is pressure to combine or integrate the programs. Supply chain segmentation allows system designers to create several distribution strategies for the increasingly large and varied sets of products and facilities while still achieving the efficiency improvements pursued through product and service integration. Typically, large retailers develop two to three distribution streams in a segmented approach, but the total number of different strategies used should depend on the organization's capacity to operate parallel processes and the range of product and customer types managed.

Figure 8. Supply Chain Segmentation Example

	FACILITIES	
PRODUCTS	**Hospitals**	**Clinics**
"A" Products		Vendor-Managed Approach
"B" Products	Monthly Deliveries	

In figure 8, system designers have chosen to focus a relatively resource-intensive, vendor-managed approach on higher-priority products going to clinics with a relatively low human resource capacity. For lower-priority products and all products going to well-staffed hospitals, a monthly order and delivery strategy has been selected. For more information on segmentation, please refer to USAID | DELIVER PROJECT, *Nigeria: Segmentation of the Supply Chain for Essential Medicines* (2009).

Next Steps after Model Identification

For most of the models presented in this guide, the next steps for implementation included the following:

- designing SOPs for each level of staff involved
- designing a training manual
- training the trainers and rolling out training to ensure that each relevant staff member receives proper training on new procedures.

This approach incurs salary expenses for trainers, as well as facilitation expenses for each training session.

> In Zambia, the Ministry of Health approved a study phase to compare the effect on product availability of two different versions of the new distribution model with the older model. This study phase involved a sample of districts in the country, for which the most successful model will soon be rolled out.

In some cases, however, the need for design and roll out of training can be reduced. Contracting service providers removes some of the need to train public servants on system operations by quickly bringing distribution know-how from the private or NGO sectors. The MOH must then focus on effective contract management and must hold the contractor to agreed performance standards.

Implementation may also include a research and evaluation element, depending on the interest and requirements of stakeholders, to test and prove potential benefits and to identify potential design changes. This step can also be achieved through a limited-scale *phased approach* before national roll out. For the Dedicated Logistics System in Mozambique, the implementing partner VillageReach conducted a rigorous costing study to measure the cost effectiveness of the new model compared to the former system in order to justify continued expansion of the program.

> Guatemala's Rural Health Extension Program involved use of a contracted NGO and a subcontracted private transportation carrier to manage distribution, meaning that SOPs did not need to be designed for them.

Roll out of training should also include allocation of resources for evaluating the new system, as well as ongoing supervision and quality monitoring. Program managers should ensure that personnel are following proper procedures and that those procedures are improving system performance.

Once implemented, a last mile distribution system that effectively transports commodities to the SDP, collects essential logistics data and makes them available to program managers, and processes SDP orders can help achieve the six rights (see box 1) and can minimize the burden of logistics activities on health workers.

Additional Resources

The following resources can provide additional information and are accessible at http://deliver.jsi.com:

Cuninghame, Christopher, Gary Forster, and Chris Saunders. 2010. *Transport Management: A Self-Learning Guide for Local Transport Managers of Public Health Services.* Arlington, Va.: USAID | DELIVER PROJECT, Task Order 1. This self-learning guide provides extensive direction and tools for good fleet maintenance practices.

Program for Appropriate Technology in Health and World Health Organization. 2009. "Standard Operating Procedures." In *Procurement Capacity Toolkit*, 649–52. Available at http://www.path.org/projects/ procurement-toolkit.php. This chapter provides an overview of general considerations and approaches to developing standard operating procedures in any context.

USAID | DELIVER PROJECT, Task Order 1. 2009. *Planning and Implementing a Logistics System Design Activity.* Arlington, Va.: USAID | DELIVER PROJECT, Task Order 1.

USAID | DELIVER PROJECT, Task Order 1. 2010. *Quick Reference: Logistics System Design and Implementation.* Arlington, Va.: USAID | DELIVER PROJECT, Task Order 1. These two guides lay out the necessary steps to plan and implement a system design. Although they are focused on system design for inventory control processes, many stages could be adapted for design of a distribution system.

USAID | DELIVER PROJECT, Task Order 1. 2010. *Transport Assessment Tool.* Arlington, Va.: USAID | DELIVER PROJECT, Task Order 1. This tool can help health programs determine their current capacity and areas for improvement related to transportation.

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Hasselberg, Erin, and Julia Byington. 2010. *Supply Chain Models and Considerations for Community-Based Distribution Programs: A Program Manager's Guide.* Arlington, Va.: Reproductive Health Supplies Coalition.

MIT-Zaragoza International Logistics Program. 2011. *Framework on Distribution Outsourcing in Government-Run Distribution Systems.* Zaragoza, Spain: MIT-Zaragoza.

Sarley, David, Elaine Baruwa, and Marie Tien. 2010. *Zimbabwe: Supply Chain Costing of Health Commodities.* Arlington, Va.: USAID| DELIVER PROJECT, Task Order 1.

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VillageReach. 2009. *Comparison of Costs Incurred in Dedicated and Diffused Vaccine Logistics Systems.* Seattle, Wa.: VillageReach.

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