

Integrating the supply chains of vaccines and other health commodities

This document examines the benefits, challenges, and rationale for integrating vaccine supply chains with the supply chains of other health commodities. It provides agencies, donors, decision-makers, and partners with a brief overview of supply chain integration and lessons learned during project Optimize's demonstration activities in Senegal and Tunisia.

WHY INTEGRATE SUPPLY CHAINS?

For historical reasons, most disease control programs in low- and middle-income countries, including immunization programs, manage and operate independent supply chain systems, which all strive to provide an uninterrupted supply of health commodities to target populations.

These vertically managed disease control programs operate separately from the primary health care supply system, which is managed by the central pharmaceutical and medical stores. Each disease-specific program owns the physical infrastructure for storing and transporting health products within the health system. Although disease-specific health programs and their vertical supply systems have been an efficient way to meet disease control priorities and objectives, many, like the immunization program, are under increasing pressures to manage larger volumes of higher-value products from the national to service-delivery levels. Immunization supply chains in particular will require significant investments before they will be ready to handle increased volume of new and more-bulky and -expensive vaccines. Recent analyses in more than 50 low- and middle-income countries discovered that none had logistics systems that met the internationally recognized World Health Organization (WHO) criteria of effective vaccine management (WHO unpublished data, 2013). This research further highlights chronic and enduring challenges of stock management, vaccine distribution, and overall inefficiencies of immunization supply chain and logistics systems. Separate research has suggested that without addressing these challenges, vaccine supply chain systems will be a bottleneck to new vaccine introduction.

As immunization supply chains struggle to meet current and upcoming challenges, the lines are being blurred between vaccines and other health commodities. Historically, vaccines were the only set of health products requiring a cold chain, and hence, a vertical supply chain was justified. Today, a number of pharmaceutical products now require controlled temperature storage, such as some antiretrovirals and antibiotics—hence opportunities for supply chain integration.

That said, integration is not a panacea. Supply chain integration is a major structural undertaking that can be very difficult but also very effective in the long term. By moving from vertically managed programs toward horizontally integrated systems, public health programs may be able to improve both efficiency and effectiveness as long as the right steps to integrate are taken. Depending on where, when, and how it takes place, the following benefits may accrue from increased horizontal integration when successfully implemented:

- **Increased economies of scale** using infrastructure, equipment, and human resources at full capacity and selling or relocating unneeded warehousing facilities, vehicles, and refrigerators elsewhere in the health system.
- **Increased flexibility and adaptability** to enable expansion of products and growth of the network through a clear, segmented framework of operations.

- **Improved efficiency** through better use of existing resources, streamlined delivery routes, and specialization of supply chain professionals.
- **Improved performance** of supply chains and disease control programs.

WHAT TO INTEGRATE?

Deciding what to integrate is not a trivial question. The chances of successfully integrating multiple supply chains will hinge on ensuring that this question has been adequately considered. To make choices about what to integrate, several useful frameworks have been developed to conceptualize integration and differentiate between physical integration of products and integration of supply chain management processes.

Products versus processes. In the context of vaccine supply systems, there are several possible functions that can be integrated with other health commodity supply chains. These functions include forecasting, procurement, orders, storage, transport, and information systems. Of these functions, two (storage and transport) involve the integration of physical products, whereas the others involve the integration of supply chain management processes. This brief focuses primarily on efforts to combine physical products during storage and transport, which necessarily also includes enhanced coordination and information sharing between programs. Within the physical integration of products, the notion of segmentation is raised.

Full integration versus segmented integration. Full integration occurs when all products in a formerly disease-specific supply chain are integrated with other public-sector health commodities in one pharmaceutical or medical supply chain. While the concept of full integration is quite simple, in practice

it can be difficult to successfully implement, particularly at the national level where the volume of health products is quite large and the ordering cycles vary. Segmented integration is an alternative approach where products are grouped according to specific characteristics or program needs and handled accordingly. For example, some programs may decide to integrate all the products that respond to the populations needs (for example, integrating a basic package of health commodities for the most underserved populations). Other programs may integrate products that have similar characteristics, such as temperature requirements. Thus, segmentation is the process of grouping commodities with similar product and customer characteristics and managing an integrated supply chain according to these shared requirements. Table 1 shows the many ways in which health products can be segmented to create more rational supply chain groupings.



Optimize's work on integration focused primarily on combining products from multiple programs during transport and storage.
Photo: Fatou Kandé

Table 1.

MOST COMMON LOGISTICS CRITERIA FOR SEGMENTING PUBLIC HEALTH SUPPLY CHAINS (Lovell, 2005)	Customer characteristics	Product characteristics
	Geography, seasonable accessibility, demand variability, number of products required by particular customer groups, order size.	Shelf life, handling requirements (i.e., cold chain), volume (size) of and demand for each product, lead time variability, value.

FULL PRODUCT AND PROCESS INTEGRATION IN NEPAL

In 1993, the Government of Nepal decided to integrate all logistics activities of the Ministry of Health into a single entity—the Logistics Management Division. A new logistics management information system provided the key to integration, as it enabled all program managers to track their health commodities without having to manage day-to-day storage, transport, and deliveries. By 2005, vaccination coverage in Nepal had increased 300% over 1993 coverage levels. Health commodities and supplies are now more reliably available and the quality of health services has improved, particularly among underserved, marginalized populations (Lamichhane, 2008). Although these improvements cannot be exclusively attributed to integration, they do prove that integration did not reduce the effectiveness of the national immunization program and may have, in fact, added to the efficiency of the program.

WHERE TO INTEGRATE?

A country's approach to supply chain integration will depend on where the products are being stored and distributed at each level in the system. Integration does not necessarily need to be done in the same fashion for all segments of the end-to-end supply chain. Different degrees of integration can be envisioned at different levels, and this will largely depend on the country context and situation. Generally, it is easier to integrate at lower levels (district or service levels) than at higher levels (national or regional levels). It is also generally easier to integrate products than processes, and it is less complex to attempt segmented integration before full integration. Nonetheless, there are exceptions to these rules, and some countries have integrated processes and all products from national to peripheral levels with success.

At the lower levels of the supply chain, full integration of all public-sector health products, as well as supply chain processes, becomes easier because health products will converge naturally at these levels and, therefore, the amount of products to manage is reduced. For this reason, countries may find it easier to begin their integration efforts by focusing on physical integration at storage points at the sub-district level and transport from regions to districts or districts to health centers. Process integration is also feasible at this level.

HOW TO INTEGRATE

Integration is not a straightforward process and can present many challenges relating to coordination between programs, overburdened staff, complex funding channels, new lines of authority, and new procedures. Before deciding whether and how to proceed, an analysis of the country context—including the current state of supply chain performance, standard operating procedures (SOPs), bottlenecks, and change management capacities—should be undertaken. The risks and time involved in integration need to be balanced against the program- and disease-specific goals and the anticipated demands on the programs. Once an initial assessment has been completed showing the current context of the supply chain, partners can follow a number of steps to develop and implement an integration strategy. The following steps were modified from a more comprehensive document on integration from the USAID | DELIVER Project (Allain, 2010).

1. DEFINE SUPPLY CHAIN GOALS AND GET BUY-IN FROM STAKEHOLDERS AT THE HIGHEST LEVELS.

Before engaging in a discussion of what to integrate and where, it is important to first understand the objectives and the perceived risks of integrating the supply and distribution of different groups of public health products. Do country stakeholders share a common vision for what integration will look like? Is the concept of integration appealing to all participants? What is the scope of the integration effort and what metrics will be used to measure progress?



Reaching a common understanding of goals and objectives is critical to a successful integration effort. Photo: WHO

It is also important to secure political support for integration. Is the leadership between programs supportive of integration? Is there a champion to push the project forward? Managers of vertical programs may oppose integration, fearing the loss of control over their prerogatives and resources. Advocacy efforts can address these concerns and are best implemented at the start of the integration process. Sometimes it is possible to overcome challenges related to program coordination by having the central medical store act as a parastatal agency that can be the nexus of coordination among all the programs that keep their products at the central medical store.

2. CREATE SUPPLY CHAIN SEGMENTS (IF USING A SEGMENTED APPROACH).

Based on the characteristics of customers and products listed in Table 1, determine how health products might be segmented to best meet the specific needs and constraints of the country's health system. What are the trade-offs between different segmentation choices? How much segmentation is necessary to achieve objectives without adding unnecessary complexity to the logistics system?

3. IDENTIFY SERVICE OBJECTIVES AND STANDARD OPERATING PROCEDURES FOR EACH SEGMENT.

Service objectives describe the goals of each segment of the supply chain and the indicators that will be used to measure progress toward those goals (i.e., stockouts, delivery lead times, response times, and costs). Service objectives are not complete without clearly described policies or SOPs that describe the physical flow of products, information, and money. When SOPs are defined and agreed upon between partners, then the concept of integration can be translated into action. Questions during this phase might include:

- Are funding and costing changes considered? Segmentation will shift the cost burden from one group to another. While the overall costs are reduced and efficiencies gained, the component costs and work efforts will increase for some groups.
- Can sufficient portions of the financing of different health programs be budgeted to run a single, integrated supply system for these health products?
- How will people be affected by integration and how are they likely to respond? Are roles and responsibilities clearly defined? Are there territory issues that must be addressed?

4. DEVELOP AN IMPLEMENTATION STRATEGY, INCLUDING A PLAN FOR EVALUATION AND POTENTIAL SCALE-UP.

An implementation strategy is a plan that describes how the newly integrated system will function, elaborating on changes in reporting requirements, new procedures and schedules, roles and responsibilities, and a communications plan for managing the change. When developing the implementation strategy, it may be important to consider whether mechanisms for coordination will need to be created or strengthened. In some cases new committees or oversight bodies can be formed, offices can be moved physically closer, information can be more readily shared, and/or meetings can be planned for regular coordination.

LESSONS FROM INTEGRATION DEMONSTRATIONS IN SENEGAL AND TUNISIA

Between 2009 and 2012, project Optimize, a collaboration between WHO and PATH, worked with the ministries of health in Senegal and Tunisia to document and demonstrate efforts to integrate vaccine products with other health commodities at both national and subnational levels. See Table 2 below for a summary of these demonstration projects.

In Senegal, the immunization program attempted full product integration at the national level. The immunization program transferred the functions of vaccine receiving, storage, and distribution to the national pharmaceutical distribution center (called PNA).



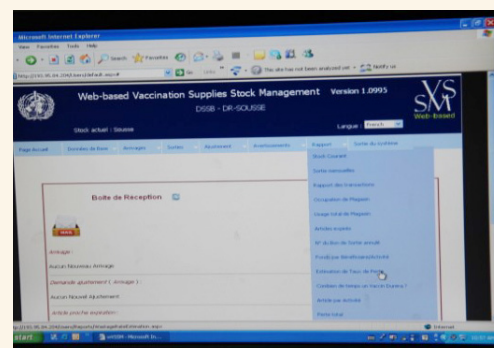
Malaria bednets, condoms, and oxytocin were integrated with vaccines in moving warehouses in the Saint Louis region, Senegal. Photo: PATH

Additionally, in the region of Saint Louis, the immunization program transferred responsibility for vaccine storage from the regional vaccine store to the regional medical store. From there, two delivery trucks, called moving warehouses, were employed to transport vaccines and other health products monthly to more than 100 health centers and posts, bypassing district warehouses and saving health personnel time spent collecting vaccines from higher-level stores. The moving warehouses were equipped with computer equipment and software to track stock levels and consumption and with staff to provide technical assistance and supportive supervision while replenishing stock.

In Tunisia, the immunization program also transferred responsibilities for receiving, storage, and transport from the national vaccine store to the central pharmacy. However, in this case, vaccines were segmented and stored with other temperature-sensitive products in the central pharmacy and then transported by the central pharmacy from the central store to regions.

An open-source, web-based stock management software tool, wVSSM, was adopted to allow vaccine managers to track vaccine stock at national and regional levels.

In five demonstration regions in Tunisia, all cold, controlled-temperature, and dry health products were warehoused together (full product integration) and grouped for delivery by efficient route planning from regional to district stores and on to health centers. Between the district and health service level, the vehicle used to transport vaccines and health products also transported staff for supervisory visits.



Vaccine managers in Tunisia were able to track vaccine stock in real time using a web-based stock management software tool. Photo: WHO/Ramzi Ouichi

Table 2.

CHARACTERISTICS OF INTEGRATION EFFORTS IN OPTIMIZE-SUPPORTED DEMONSTRATION PROJECTS	Level	Senegal	Tunisia
	National level to regional level	Functions of vaccine receiving, storage, and transport were transferred from the national immunization program to the central pharmacy. Here, vaccine products were integrated with all health products (full integration of products) .	Functions of vaccine receiving, storage, and transport were transferred from the national immunization program to the central pharmacy. Here, vaccines were integrated with other temperature-sensitive products (segmented integration of products) .
	Regional level to district level	At the regional level, vaccines were fully integrated with other health commodities and stored in the regional pharmacy. Moving warehouses were deployed to transport vaccine supplies and reproductive health products directly to health centers, bypassing the district vaccine store.	At the regional level, vaccines were stored with other temperature-sensitive products at the regional pharmaceutical store. Vaccines were transported to the district stores along with other temperature-sensitive products from the regional level.
	District level to service level		At the district store, vaccine products were fully integrated with all pharmaceuticals. At this level, a dedicated logistics system was used to transport all health commodities to the service level. This included some elements of process integration (supervision and service delivery).

“The integration has brought the different services closer together; it has enabled better exchange and dialogue... With the integration we all have better understanding of the status of stocks; we know what happens and to what end.”

Pharmacist,
national level,
Senegal

OUTCOMES OF INTEGRATION

Since the integration efforts in both countries were monitored for only a period of one year at the beginning of the integration process, neither produced conclusive results that the supply system for vaccines had improved after integration. In cases where improvements were noted, it was impossible to establish an association to integration versus many other factors involved in the demonstration projects. Qualitative results do indicate a high level of acceptance of integration and a willingness to continue with the effort into the future.

KEY CHALLENGES

Both Senegal and Tunisia faced major challenges in their efforts to integrate vaccines with other health care commodities. Below are challenges that were either common to both countries or are likely to be challenges in other countries attempting integration.

Resistance between stakeholders leading to delays. In both countries, integration called for changes to practices and roles that had been in place for more than 30 years, and there was resistance by some stakeholders. An advocacy and communication plan in Senegal helped to alleviate apprehensions and concerns as well as mobilize and channel efforts to implement the project. The advocacy effort was important to attaining the Agreement for the Integration of Vaccines in the PNA Supply System in October 2010 and its renewal in June 2012.

In Tunisia, nearly two years of meetings and negotiations were necessary to come to an agreement on principles and rules of engagement (partially due to changes in staff after the Arab Spring). As a result, the demonstration was monitored for a period of only one year, making it difficult to draw conclusions. In addition, because of vaccine supply and procurement issues, including national vaccine stockouts unrelated to the demonstration, the supply network from the national to the regional level was never fully implemented. However, analysis of data from the subnational level suggests that the physical integration of vaccines and other health commodities during deliveries from regional and district levels is feasible and may bring important efficiencies to the supply chain system.

Human resource capacity. Human resource capacity represented another challenge, particularly in Senegal. Staff from the central pharmacy were assigned new responsibilities for vaccine cold chain management and were already extremely busy with pharmaceutical supply chain management. As a result, their training and coaching extended beyond the one-year period originally specified. The lesson learned was that strengthening the capacity of existing staff and recruiting new staff requires planning, resources, and sufficient time for training and follow-up.

Flow of funds. A major challenge in Senegal was the difficulty in ensuring that PNA was paid for their services. For the duration of the demonstration, the immunization program was reluctant to transfer funds to the PNA in exchange for services that were valuable but difficult to quantify. The immunization program felt that by transferring funds, they were also transferring a great deal of responsibility and control.

Almost all interviewees in both countries said the intervention should continue based on the belief that the new system would improve the vaccine supply chain, increase efficiency, and lower overall costs.

KEY SUCCESS FACTORS

Although integration has been challenging in both countries, certain factors were instrumental in making integration happen and have led to improvements in key vaccine management indicators. These include:

Baseline assessment. The Effective Vaccine Management assessment was extremely useful in both countries to stimulate discussion on the need for system changes.

“This intervention should be continued on a permanent basis because this procedure has many advantages. The work has become more efficient, with more rigorous inventory management and control of the cold chain as well as modernization of the vaccination program.”

Regional immunization manager, Tunisia

Formal agreement. A formal memorandum of understanding between the major stakeholders proved essential to maintain focus and define the rules of engagement.

SOPs. Developing a comprehensive set of SOPs to articulate each process, task, and specific roles, responsibilities, and accountability proved essential.

Process and mechanisms for collaboration. It was helpful to establish an agreed process for review, validation, and formal endorsement of key decisions and operational documents, including SOPs and the memorandum of understanding. In both countries, a working group for integration was established to oversee the integration effort and agree on work plans, timelines, roles, and responsibilities.

Participatory approach. Supply chain integration required many discussions with administrative authorities and health committees at regional and district levels. A participatory approach was taken to promote stakeholder acceptability and support of the moving warehouse; this approach paid off in the long run.

Documenting success along the way. It was only after evidence of successful vaccine deliveries within an integrated supply chain system that other health programs started to include and integrate their health products.

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Lovell A, Saw R, Stimson J. Product value-density: managing diversity through supply chain segmentation. *International Journal of Logistics Management*. 2005;16(1):142–158.

FINDING MORE INFORMATION

Integration of vaccine supply chains with other health product supply chains: a framework for decision-making.
<http://tinyurl.com/mqbgmys>

Optimize: Senegal report.

<http://www.path.org/publications/detail.php?i=2272>

Optimize: Tunisia report.

<http://www.path.org/publications/detail.php?i=2292>

PATH <http://sites.path.org/vpsse/optimize>

World Health Organization

http://www.who.int/immunization_delivery/optimize/en/index.html