
Regional Distribution Hubs for HIV/AIDS Drug Supply in Africa:

A Cost-Benefit Analysis

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EXECUTIVE SUMMARY

There are about 9.7 million people in the world in need of antiretroviral (ARV) treatment for HIV/AIDS. Less than 3 million of them had access to it at the end of 2007, despite continued efforts of the global HIV/AIDS healthcare community. Africa is the region of the world most affected by the HIV/AIDS pandemic, with the Sub-Saharan Africa representing 67% of people living with HIV infection and 72% of AIDS deaths in 2007. One of the main causes of this dire situation is the lack of an effective and efficient antiretroviral supply chain.

Historically, viral infections and HIV/AIDS prevention, care, and treatment programs in Africa relied on intermittent direct shipments of bulky quantities of ARVs, HIV test kits, and other indispensable provisions, frequently enough to supply more than six months of demand consumption. By pre-positioning strategic stock of these items regionally, and by moving smaller, and more frequent shipments to consumer countries, programs such as those developed by the Supply Chain Management System (SCMS), have ensured a rapid response to HIV/AIDS program needs.

This thesis focused on investigating the economic and operational impacts of using a regional distribution center for HIV/AIDS drug supply in Africa, rather than relying on intermittent direct shipments of bulky quantities of ARVs. Using SCMS's Regional Distribution Center (RDC) located in Centurion, South Africa, as a case study, total operational cost and quantifiable benefits of utilizing a distribution hub for HIV/AIDS drug supply in Africa were identified.

The main performance measures addressed in this study are the response time, the total cost of operations, and service level:

- **Response time:** Defined as the time from the point the client countries place an order until the time the order is received, response time diminution contributes to reducing inventory investment requirements, supports the development of agile operations, and reduces the probability of spoilage and product expiration while in transit.
- **Total cost of operations:** Defined as the sum of the transportation and inventory related costs, the main difference between intermittent direct shipments and an RDC approach relies on the different proportions of ocean, air, and truck shipments and consequent safety stock requirements.

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- **Service level:** Measured as the percentage of on-time delivery, this allows for the development of responsive operations needed to support delivery activities in many countries where the lack of access to treatment constitutes a matter of life or death.

This thesis demonstrated that as the service level offered to end-customers approaches 100%, the difference in the average inventory held in a system with RDCs or with direct shipments to countries becomes larger, with much lower inventory required in the system with RDCs. In addition, the potential reduction in response time in a system with RDCs depends on the Cycle Service Level maintained, since the time to fulfill an order placed by regional countries is mainly given by the inventory availability at the RDC. Finally, there are observable potential savings related to transportation cost that could further reduce the extent of the additional cost. Clearly, there are economic and operational benefits of utilizing regional distribution hubs for HIV/AIDS drug supply in Africa. Using PEPFAR's Regional Distribution Center in South Africa as an example, we showed that the use of RDCs leads to:

- Consistent **cost advantages** in regard to the system's inventory requirements.
- **Shorter response time** since the lead-time assumes shorter values than those obtained through a direct shipment model.
- **Reduced transportation costs** and reduced overall system uncertainty.

By implementing activities oriented toward reducing transportation-related costs and overall system uncertainty and by expanding the usage of RDCs for the delivery of additional medications and related commodities - such as Malaria drugs - there are many opportunities to improve operational processes in drug distribution. However, the viability of increasing the utilization of such regional distribution centers for other supplemental drugs raises questions like who will sustain the cost of holding such levels of pre-positioned inventory in the long run. In spite of such considerations, RDCs offer an effective and efficient way to improve the ARV supply chain and assuage the HIV/AIDS pandemic in Sub-Saharan Africa.