Costs of Multiplicity in Public Health Supply Chains in Burundi

By Jeet N. Shah & Trevor N. Thomas
Thesis Advisor: Dr. Jarrod Goentzel

**Summary:** This project performed an assessment of the costs of multiplicity in the public health supply chains in Burundi in the context of proposed structural reform from a province-based to a district-based system. The study demonstrated that significant cost-savings and improved service levels can be realized with better transportation and inventory management practices.

**KEY INSIGHTS**

1. Operating in a delivery mode of distribution instead of the current pick-up mode would provide significant cost-savings.
2. Delayed reimbursements are slowing the cash flow through the public health system and drastically limiting the ability to maintain adequate levels of inventory.
3. Transitioning to district-based system would increase transportation costs as well as inventory costs in the system.

**Introduction**

Many African countries obtain external support from multiple non-governmental organizations (NGOs) to supply and distribute medical supplies. Lack of transportation infrastructure, increasing rates of infection with communicable illnesses such as HIV/AIDS, Malaria and Tuberculosis, and high costs of drugs and health supplies necessitate these external dependencies. In some cases, multiple parties providing similar in-country medical supply functions can inhibit the supply of drugs to patients due to inefficiencies resulting from redundancy. These inefficiencies or costs of multiplicity often reduce service to patients and inflate the total cost of public health supply operations in Africa.

This study quantifies the costs of multiplicity in transportation, and inventory management and proposes recommendations that could decrease these and other supply chain costs in the context of a proposed health sector structural reform.

Partnering with the Ministry of Health (MOH) of the Republic of Burundi, the United Kingdom’s Department for International Development (DFID), and the World Health Organization (WHO), in-country interviews were held with managers at each tier of the supply chain as well as with managers of external programs (NGOS). Additionally, data was...
gathered through surveys to cost distribution operations.

**Background - Burundi Public Health Sector**

Burundi’s health sector is characterized by multiplicity. The complexity of interactions between public and external organizations leads to inefficient replenishment and transportation practices. Recognizing inefficiency in supply chain operations, The Republic of Burundi’s MOH has proposed a reform of its Primary Distribution System that would change its structure and distribution strategy from a centralized structure to a decentralized structure. The existing and proposed structures are shown in figures 1 and 2 below. The implications of this change on supply chain costs are analyzed in depth.

**Analysis:**

The analysis consisted of creating a cost model to determine transportation costs between the first two tiers of the supply chain, and qualitatively analyzing the effect different supply chain structures would have on inventory. The transportation cost model determined costs per kilometer if drugs were picked up or delivered from the central store. The inventory analysis compared the effects of inventory level, service, and risk-pooling between scenarios.

**Transportation**

Based on the analysis of transportation costs, we found that total annual costs in the current system (with BPSs as the intermediate stocking point) were lower than in the reformed system (with BDSs as the intermediate stocking point) for a given mode of operation. Further, the total annual costs in the delivery mode were lower than the costs in the pick-up mode for a given system structure. A summary of the costs for the 4 different scenarios considered is presented in Table 1 below. It is evident that a delivery mode of operation with the current system structure is the most cost efficient option in terms of total annual transportation costs. The table also shows the percentage change in total annual costs from the base case, which is the current system operating in pick-up mode.

**Table 1.** Total annual transportation costs for the current and reformed system operating in pick-up and delivery modes.

<table>
<thead>
<tr>
<th>System</th>
<th>Current</th>
<th>Reformed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mode</td>
<td>Pickup</td>
<td>Delivery</td>
</tr>
<tr>
<td>Distance (km)</td>
<td>15,288</td>
<td>8,040</td>
</tr>
<tr>
<td>Total Duration (days)</td>
<td>124</td>
<td>56</td>
</tr>
<tr>
<td>Transport Costs (F Bu)</td>
<td>15,604,462</td>
<td>8,206,428</td>
</tr>
<tr>
<td>Per diem Cost (F Bu)</td>
<td>4,060,000</td>
<td>1,960,000</td>
</tr>
<tr>
<td>Total Annual Costs (F Bu)</td>
<td>19,664,462</td>
<td>10,166,428</td>
</tr>
<tr>
<td>% Change</td>
<td>0%</td>
<td>-48%</td>
</tr>
</tbody>
</table>

A comparison of the total annual transportation costs is graphically illustrated in Figure 2 below.
Inventory and Other Considerations

Interviews and surveys were used to analyze the effects of the proposed supply chain changes on system inventory. It was found that system inventory levels would change considerably depending on the structure, and mode of delivery. Derivatives of inventory such the ability to pool inventory risk, service levels at different tiers, and supply chain responsiveness would also change depending on the structure.

The effects of changes in cash flow, asset utilization and other managerial points of interest were also considered for the existing and proposed supply chain structures. Expediting reimbursements would increase the cash flow through the supply chain, and sharing assets between different programs could reduce capital expenditures. This analysis suggested that changes in management could have a stronger effect on reducing costs than changes in supply chain structure.

Conclusions

This study quantifies the costs of multiplicity in transportation and identifies costs in inventory management in Burundi’s public health supply chain. In-country interviews, and surveys were used to gather qualitative and quantitative information about Burundi’s public health supply chain’s costs. Using the existing supply chain structure with a delivery strategy may provide the most benefit of all the scenarios considered in the reform. Additionally, changes in inventory, asset, and cash flow management could provide further benefits in supply chain efficiency.

Recommendations for Burundi

The goal of our research has been to understand and analyze distribution in the public health supply chain in Burundi with the intent of assessing the costs of multiplicity and generating insights to help mitigate these costs. The structure of the current system is the result of evolution of the supply chain through some challenging and chaotic times. There is now, a compelling opportunity, to redesign the flow of materials, information and finances in public health system to significantly improve health care delivery for the people of Burundi. We discuss a few specific changes that will improve the availability and affordability of care through the public health system in Burundi. Based on the analysis and conclusions from our research, we propose the following recommendations for consideration:

1. Transition to delivery mode of distribution from CAMEBU to intermediate stocking points
2. Share assets including vehicles and warehouses between CAMEBU and vertical programs to improve utilization and reduce costs
3. Accelerate cash flow through the system to strengthen CAMEBUs financial ability to procure and stock adequate quantities of drugs and supplies
4. Perform thorough due diligence to ensure benefits outweigh the higher costs to justify transition to a district-based system.
5. Develop data collection plan to improve transparency and to facilitate better monitoring and evaluation of the public health system.