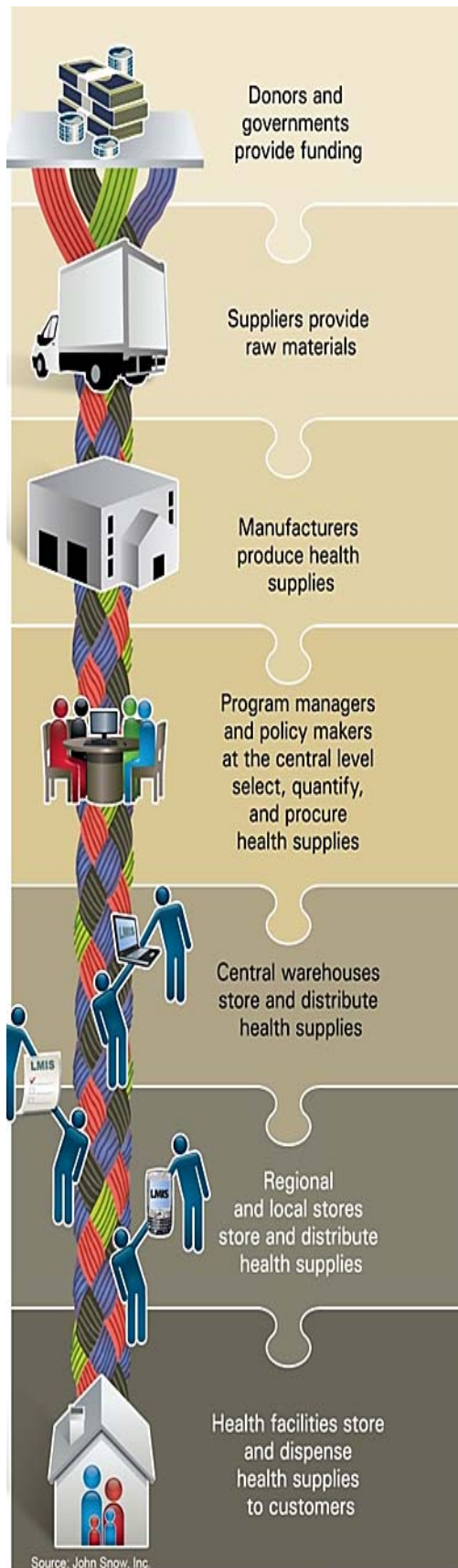


Technical Report

“Last Mile” Supply Chains for Neglected Tropical Disease Control Programs

A Landscape Analysis

January 2015



Health Logistics

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About JSI

John Snow, Inc. (JSI) is a U.S.-based health care consulting firm committed to improving the health of individuals and communities worldwide. Our multidisciplinary staff works in partnership with host-country experts, organizations, and governments to make quality, accessible health care a reality for children, women, and men around the world. JSI's headquarters are in Boston, Massachusetts, with U.S. offices in Washington, D.C.; Atlanta, Georgia; Burlington, Vermont; Concord, New Hampshire; Denver, Colorado; Providence, Rhode Island; and San Francisco, California. JSI also maintains offices in more than 40 countries throughout the developing world.



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Acronyms

| | |
|--------|--|
| CDD | Community Drug Distributor |
| CMS | Central Medical Store |
| DHMT | District Health Management Team |
| FLHW | Frontline Health Worker |
| JAP | Joint Application Process |
| JSI | John Snow, Inc. |
| LMIS | Logistics Management Information System |
| MDA | Mass Drug Administration |
| MOH | Ministry of Health |
| NGO | Non-Governmental Organization |
| NTD | Neglected Tropical Disease |
| NTDCP | Neglected Tropical Disease Control Program |
| NTDD | Neglected Tropical Disease Drugs |
| NTDSCF | Neglected Tropical Disease Supply Chain Forum |
| PCT | Preventive Chemotherapy |
| SCM | Supply Chain Management |
| SOP | Standard Operating Procedure |
| STH | Soil-Transmitted Helminthes |
| USAID | United States Agency for International Development |
| WHO | World Health Organization |

Glossary

Co-endemic: Diseases regularly found to be prevalent in the same geographic area and among similar populations.

Community Drug Distributors (CDD): Community level volunteers responsible for distributing the NTD drugs during Mass Drug Administrations (MDAs).

Elimination: “Reduction to zero of the incidence of a specified disease in a defined geographical area as a result of deliberate efforts; continued intervention measures are required.” (Centers for Disease Control and Prevention)

Eradication: “Permanent reduction to zero of the worldwide incidence of infection caused by a specific agent as a result of deliberate efforts; intervention measures are no longer needed.” (Centers for Disease Control and Prevention)

First Mile: The management, storage, and distribution of NTD drugs from the point of manufacture to receipt by the Ministry of Health in-country.

Forecasting: A step in the quantification process in which data are used to estimate the quantity of each product that will be dispensed or used during a given time period.

Last Mile: The management, storage and distribution of NTD drugs from the point of receipt by the Ministry of Health in-country to the final distribution to clients at the community level.

Logistics Management Information System (LMIS): A system for collecting, organizing and reporting commodity data that allows managers to make logistics system decisions.

London Declaration on Neglected Tropical Diseases: A collaborative disease eradication program launched January 30, 2012.

Mass Drug Administration (MDA): The administration of drugs to entire populations during a set period of time regardless of disease status often used as preventive chemotherapy.

Neglected Tropical Diseases (NTD): A group of tropical infections which are especially endemic in low-income populations in developing regions of Africa, Asia, and the Americas. Different organizations define the set of diseases differently. Generally, 17 diseases are included: buruli ulcer; chagas disease; dengue; dracunculiasis (guinea worm); echinococcosis; foodborne trematodiasis; human African trypanosomiasis (sleeping sickness); visceral leishmaniasis (black fever); leprosy; lymphatic filariasis (elephantiasis); onchocerciasis (river blindness); rabies; schistosomiasis; soil-transmitted helminthes; taeniasis/cysticercosis; trachoma; and yaws (endemic treponematoses). This paper will refer to all 17 diseases when addressing the ongoing broad policy commitments and initiatives; however, this study

focuses on the following five diseases: lymphatic filariasis (elephantiasis); onchocerciasis (river blindness); schistosomiasis; soil-transmitted helminthes; and trachoma.

Neglected Tropical Disease Supply Chain Forum (NTDSCF): A global coordination mechanism to ramp up and strengthen first mile delivery strategies.

Preventive Chemotherapy: Treatment of persons at high risk who have no signs or symptoms of NTDs to prevent them from contracting the NTD.

Push System: A logistics system in which products are allocated to the lower-level facility, and decisions are made by a higher-level facility.

Reverse Logistics: The process in which unused, expired, or spoiled goods are returned from lower-level to higher-level facilities for proper disposal.

Service Integration: A process by which multiple health services associated with distinct health programs are merged so that clients receive these services at the same place and time.

Supply Chain Integration: A process by which linkages are developed between various actors, levels, and functions within a given supply chain to maximize client service.

Vertical Program: Health programs that are managed distinctly from others and are focused on one specific disease or set of health priorities.

Executive Summary

This research was conducted to synthesize what is known about the strengths and weaknesses of last mile neglected tropical disease (NTD) supply chains, and to consider the applicability of contemporary commercial supply chain practices to NTD supply chain efforts. Research methods included a literature review, key informant interviews, NTD control program supply chain assessments in three countries, and benchmarking and segmentation analyses.

Integrated neglected tropical disease control programs (NTDCP) and the in-country supply chains that serve them are relatively new phenomena. In the past decade, the global NTD community has secured commitments for, and improvements to, the coordination and donation of neglected tropical disease drugs (NTDD), and has successfully expanded integrated NTDCPs worldwide. This focus on improving first mile processes, namely increasing production and donations to cover the needs of country programs and optimizing production, shipment, and packaging processes and procedures, has overshadowed the understanding and improvement of how NTDD are managed once delivered to countries. Where studies have been conducted, conclusions regarding last mile supply chain efficiency, drug availability, and wastage are confounded by the scarcity of solid logistics management information system (LMIS) data. Furthermore, many of the available studies are from single disease programs; the body of work on integrated NTDCP supply chains is limited.

Review of available documentation regarding last mile supply chains for the five core preventive chemotherapy NTDs highlights two schools of thought. The first is that in-country supply chains for NTDD are constrained by fragmentation, resulting in multiple and often ad hoc supply chains that do not utilize current standard operating procedures used for other essential medicines. This school of thought advocates full integration of NTDD into the standard central medical stores (CMS) and district pharmaceutical management processes. The alternative view is that last mile supply chains for NTDD are solely the responsibility of the Ministry of Health (MOH) in each country and are adequate for ensuring full supply, and that external initiatives to bolster supply chain effectiveness risk undermining the success of current arrangements and ownership by national programs.

This analysis indicates that the nuanced requirements of mass drug administration (MDA) campaign supply chains are not always met by the capacities of MOH commodity distribution systems designed for routine supply programs, and that support to NTDCP in-country supply chains need not undermine national ownership. While the flexible supply chain solutions adapted by NTDCPs have, in many cases, been notably effective in ensuring full supply at the community level during campaigns, the ad hoc nature of these supply chains often suffer constraints in design, capacity, and sustainability—even within the relatively short temporal framework of NTDCPs. The research also reinforces previously identified challenges in human resource capacity development and motivation, health system strengthening, and health system funding that impact annual NTD campaigns and the supply chains that support them.

The primary risks to effective and efficient management of NTDD are:

- lack of CMS and district pharmacy staff orientation to campaign drug supply needs;
- temporary (ad hoc) supply chain solutions for storage, transport, and management of NTDD that are subject to change and disruption, and threaten realization of control and elimination goals;
- non-integrated (multiple) supply chains for only four-six NTDD, which increases costs and complicates NTDD management;
- limited access to supply chain expertise;
- weak LMIS data recording and reporting by volunteers and health facility staff;
- lack of volunteer motivation;
- lack of reverse logistics resulting in loss and wastage of NTDD; and
- minimal resources for NTD drug handling at all levels.

Benchmarking and segmentation are commercial sector supply chain techniques that were analyzed as part of this research to assess their potential relevance to improving NTD supply chain performance. Benchmarking is used to evaluate financial and/or functional performance levels against well-performing peer groups and identify areas of underperformance, while segmentation is used to determine the right mix of supply chain policies for delivery of a diverse set of products.

Field-based analysis indicates that data and indicator limitations, as well as methodological and programmatic constraints associated with using non-NTD data for NTD benchmark purposes, impact the ability to engage in effective benchmarking. As such, investment in additional resources for NTD benchmarking is not recommended until more appropriate benchmark data sets for NTD supply chains are available. Application of segmentation analysis demonstrated that it is a useful tool to help determine whether it is feasible or appropriate to integrate all or part of NTD supply chains into existing public health supply chain systems. While any segmentation exercise must carefully analyze the logical and practical feasibility of transitioning operations responsibility, there appear to be viable opportunities for NTD supply chains to integrate with bednet, nutrition, and immunization campaigns.

In conclusion, while first mile efforts have contributed to significant expansion of integrated NTD control programs worldwide, last mile NTD supply chains suffer constraints that will hinder achievement of WHO Roadmap goals for control and elimination of NTDs.

Introduction

Neglected tropical disease control programs (NTDCPs) have been called a global health “best buy” with cost estimates as low as US\$ 0.50 per person/per year for the drugs needed to treat and prevent five core diseases (Science Daily 2013). Few public health initiatives have seen as much attention to drug supply as neglected tropical disease (NTD) control programming, and attention to first mile efforts to secure donations of neglected tropical disease drugs (NTDD) and improve coordination of drug delivery to countries in need has contributed to significant expansion of integrated NTD control programs worldwide. At the same time, improvement of NTD drug management at the country level (the last mile) has been relatively neglected.

Where supply chain studies have been conducted, conclusions about last mile supply chain efficiency, drug availability and wastage are confounded by the scarcity of solid logistics management information system (LMIS) data. Furthermore, many of the available studies are from single disease programs; the body of work assessing integrated NTDCP supply chains is very small. The Bill & Melinda Gates Foundation is supporting John Snow Inc. (JSI) to conduct a supply chain literature review and in-country assessments to identify central themes impacting the effectiveness of last mile NTD supply chains.

Neglected tropical disease drugs (NTDD) become the property and responsibility of national NTDCPs once drugs are received in-country, but assuring full availability of medicines for each campaign can be challenging in low resource settings. If national control programs are not able to ensure timely delivery and adequate quantities of drugs to the communities and individuals that need them, the quest to control and eliminate NTDs through mass drug administration is compromised.

This report first discusses the current status of first mile NTD supply chains—the management, storage, and distribution of NTDD from the point of manufacture to receipt by the Ministry of Health (MOH) in-country—to provide context. Then, the report identifies challenges, lessons, and opportunities for last mile NTD supply chains—management, storage and distribution of NTDD from the point of receipt by the MOH to the final distribution to target populations in the community— drawing from a literature review, key informant interviews, and NTD supply chain country assessments. Finally, the report summarizes analyses undertaken to consider the applicability of contemporary commercial sector supply chain segmentation and benchmarking to NTD supply chains. The final product of JSI’s work will be Development Plans that present recommendations for optimization of last mile NTD supply chains in order to achieve disease control and elimination goals.

Purpose

While there have been limited NTD supply chain assessments to date, there has not been a review that summarizes those assessments. The primary purpose of this document is to present a synthesis of important lessons learned regarding strengths and challenges for last mile NTD supply chains, through a literature review, expert interviews, supply chain benchmarking and segmentation analyses and three project-specific country assessments conducted in Malawi, Tanzania and Ghana.

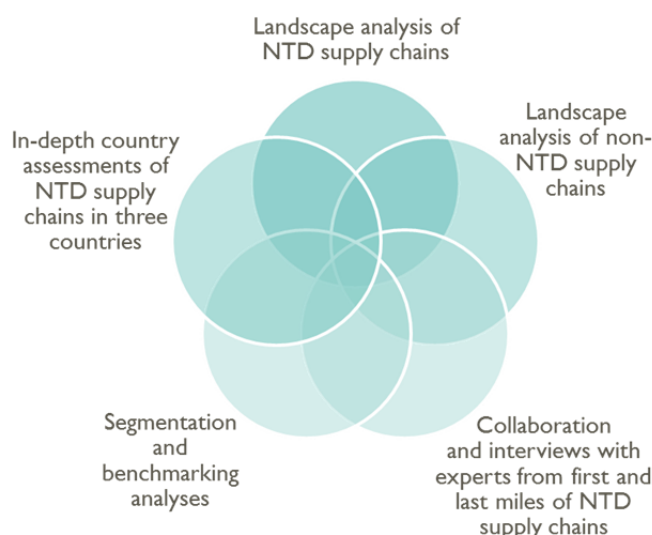
Audience

This document is intended for all members of the NTD community interested in improving NTDD availability. This includes MOHs, non-governmental organizations (NGOs), multilateral and bilateral donors, commercial pharmaceutical corporations, private donors and other NTD leaders and partners who want to strengthen, expand, and sustain NTD achievements.

Methodology

Research findings derive from the activities and outputs presented in Figure 1. Researchers conducted a literature review that included research reported in peer-reviewed journals as well as implementation experience from partner reports, donor-commissioned reports, and other grey literature. Researchers also conducted key informant interviews focusing on experts' experience with NTDCPs and last mile supply chains, and conducted segmentation and benchmarking analyses to highlight practices and knowledge that might inform future support to NTDCP supply chains. Finally, researchers engaged in NTDCP supply chain assessments in Malawi, Tanzania and Ghana to provide in-depth and current field observations.

Figure 1. Methodology



Context

Increasing Commitment to Combatting Neglected Tropical Diseases

Since 2005, leaders in the field have advocated for the need to establish a suitable financing mechanism to combat some of the most common and highest burden NTDs, which were until then overshadowed by those targeted by The Global Fund (HIV/AIDS, tuberculosis and malaria). The

United States Congress recognized the opportunity to make a significant impact on these diseases and created an NTD earmark in 2006;¹ this major step raised the profile of NTD control within the U.S. global

"Today, we have joined together to increase the impact of our investments and build on the tremendous progress made to date," said Bill Gates, co-chair of the Bill & Melinda Gates Foundation. "This innovative approach must serve as a model for solving other global development challenges and will help millions of people build self-sufficiency and overcome the need for aid" (Gates Foundation, 2012).

¹ USAID's Neglected Tropical Disease Control Program (2006-2012), was the first global effort to integrate and scale up delivery of preventive chemotherapy for lymphatic filariasis, onchocerciasis, schistosomiasis, soil-transmitted

health agenda and stimulated other high-level global commitments to NTDs, including from the UK Department for International Development in 2008 (Molyneux, 2014).

In January 2012, officials from the World Health Organization (WHO), the World Bank, the Bill & Melinda Gates Foundation, the world's 13 leading pharmaceutical companies, and government representatives from the United States, United Kingdom, United Arab Emirates, Bangladesh, Brazil, Mozambique and Tanzania participated in a meeting at the Royal College of Physicians. The meeting launched the London Declaration on Neglected Tropical Diseases (London Declaration), which commits these key players to providing more than US\$785 million to eliminate or control 10 NTDs by 2020. Included in the London Declaration are donations of key health products to prevent and treat these diseases as well as investments in research and development to design new technologies and strategies to control, eliminate and eradicate these NTDs altogether. London Declaration partners recognized that focused investment to increase NTD coverage and product availability could represent a cost-effective intervention and directly contribute to reducing poverty and dramatically improving health among some of the poorest populations in the world.

Integrated Neglected Tropical Disease Control Programs

Historically, NTD control programs have experienced significant fragmentation in funding, delivery, and prevention and treatment schemes, despite similarities in treatment guidelines among the diseases. Many believe that this lack of coordination has created significant performance and efficiency challenges. For example, many countries receive vertical support (from donations to staffing to technical assistance) for separate mass drug administration (MDA) campaigns for each disease. In recent years, WHO guidelines, key documents, and multiple assessments have recommended merging management and service delivery for NTDs, primarily by planning joint MDAs for five core diseases.

The integration of NTD vertical control programs aims to contain operational costs, increase cost-efficiencies, simplify the application of control measures, improve the potential for sustainable programs and further extend the coverage of interventions. Combining separate drug campaigns into a single effort would also be more convenient and time efficient for community members, and would therefore hopefully reach a greater proportion of the population.

Preventive chemotherapy (PCT) is the public health strategy recommended by WHO to address a set of core NTDs that

“Efficiencies generated through integrated delivery of SCH and STH treatments and LF and STH treatments (current estimates only assume integration of LF and onchocerciasis treatments) could reduce resource needs by \$549 million over the seven year period” (Abt Associates, 2014).

helminthes and trachoma, which are considered the five core NTDs. USAID supported national NTDCPs in 13 countries and provided short-term technical assistance in six additional countries. Over 100 million people were treated throughout the six years of project implementation, and over 500 million treatments for NTDs were distributed. USAID’s support for these programs is ongoing.

includes lymphatic filariasis, onchocerciasis, schistosomiasis, soil-transmitted helminthes and trachoma. The WHO has developed a conceptual framework for control that moves from a purely disease-centered approach to an integrated approach, with NTDs grouped together based on similar intervention strategies, extensive geographic overlap and co-endemicity.

The integration of MDAs is multidimensional and involves training, funding, planning and management of NTD drug supply chains. Challenges associated with the implementation of the integrated MDAs are outlined in Annex 1, and only limited integration has been achieved in most countries.

Findings

This analysis first reports on the current status of first mile NTD supply chains—the management, storage, and distribution of NTDD from the point of manufacture to receipt by the MOH in-country—to provide context. Then, the report identifies challenges, lessons and opportunities for in-country (last mile) NTD supply chains—management, storage and distribution of NTDD from the point of receipt by MOH in-country to the final distribution to target populations in the community— drawing from a literature review, key informant interviews, and NTD supply chain assessments conducted in three countries. Linking the first mile to the last mile and creating a reliable supply chain is essential to ensuring there are no disruptions in availability of drugs so that the more than one billion people affected by these diseases will be served with the essential health products they need to prevent, treat and, ultimately eradicate NTDs.

First Mile Neglected Tropical Disease Supply Chains

A positive result of the global attention to NTDs is that first mile supply chain concerns are being effectively addressed. A wide range of global partners – including WHO, USAID, World Bank, numerous foundations, and multiple pharmaceutical companies – have worked to develop global programs to provide the essential products needed to combat these diseases. For several years, products have been donated and many lessons learned about how to manufacture and deliver large quantities of these products to countries worldwide, particularly to Sub-Saharan African countries where populations are hardest hit by NTDs, financing for procurement is limited, and supply chains face major infrastructure and governance challenges.

The vast majority of drugs for treating NTDs through PCT are being donated by major pharmaceutical companies including GSK, Pfizer, Merck Serono, MSD and Johnson and Johnson. In 2012, the major donors, WHO and the Bill & Melinda Gates Foundation founded the NTD Supply Chain Forum (NTDSCF), a global coordination mechanism to scale up and strengthen first mile delivery strategies through 2020.

Through the NTDSCF, global partners have committed to increasing production and donations to meet the needs of country programs and to optimize production, shipment, and packaging processes and procedures. Earlier surveys of in-country NTD supply chains noted bottlenecks in ordering, coordinating,

and customs clearance that constrained the timeliness and availability of drugs, and work led by WHO and the major pharmaceutical donor members of the NTDSF has improved coordination, timeliness and availability of NTDD, particularly at the national level.

The key first mile innovations positively impacting NTD drug availability to the last mile include the following:

Coordination of NTD reporting, application and shipment scheduling. The introduction and global adoption of the WHO-led Joint Application Process (JAP) has led to standardized processes, tools and timelines for reporting on the use of NTDD in the past year through the Joint Reporting Form, and for requesting NTDD for the coming year through the Joint Request for Selected PC Medicines.

Increased standardization of freight forwarders. Under the leadership of the NTDSF, more pharmaceutical donors are using a single freight forwarder, which is improving timeliness and coordination of shipments.

Increased direct delivery of shipments. The major pharmaceutical donors are increasingly using direct delivery to the MOH-designated central warehouses, alleviating identified choke points at customs clearance and delivery from port to the central warehouse.

Few health programs or disease areas have experienced this level of commitment, coordination, and support at the first mile. In fact, too often, first mile supply chain issues are as difficult to resolve as those at the last mile. These recent commitments and coordination efforts do not mean that first mile issues will not arise in the future, but having clear and committed partnerships among donors, pharmaceutical companies, as well as commercial sector logistics companies will be critical to quickly mobilizing necessary resources to resolve upstream supply chain challenges and provide sufficient product to cover needs.

Last Mile Neglected Tropical Disease Supply Chains

While there is variability among national supply chains, there are also common characteristics described below in the snapshot of NTD drug last mile supply chains.

Snapshot of Last Mile Neglected Tropical Disease Supply Chains

Commodities: Albendazole, mebendazole, Ivermectin, Zithromax, Zithromax POS, praziquantil, DEC and a limited number of service delivery and reporting tools.

Periodicity of delivery: Drug shipments to the country level, as well as distribution of drugs and supplies within a country, are typically completed once annually. Some products (i.e. albendazole) are distributed twice or more per year.

Timing of distribution: NTDD and supplies are delivered to the country and distributed within

the country according to the timing of each PCT MDA campaign. The timing of campaigns drives the level of integration of last mile supply chains.

Levels in the supply chain: The central level, districts, health centers, and communities are key levels in all NTD supply chains. Some national programs also utilize zonal, provincial, state or regional levels. It is important to note that districts are the key level in charge of MDA implementation and distribution of drugs.

Storage and transport: The majority of NTDCPs rely on MOH storage and transport capacities at all levels. However, a significant minority of country programs utilize NGO or commercial alternatives when they are not able to rely on MOH storage facilities. It should be noted that the last transport and storage links in NTD supply chains are the responsibility of community volunteers and school health teachers.

Staffing and management: Responsibility for managing and reporting on NTDD throughout the last mile supply chain is typically split between NTD coordinators and MOH pharmacists and store keepers. The degree of coordination between program and supply chain personnel is an important determinant of supply management quality and efficiency. Coordination is further complicated in countries where commercial or NGO capacities are used for one or more links in the pipeline. It should be noted that there are often parallel, vertical lines of staffing and management for different campaigns.

LMIS: Most NTDCPs rely on relatively basic systems that record and report quantities of drugs received, used, lost, and in balance. LMIS data are recorded together with the client (service) data on primary tools (i.e. registers, tallies) at the campaign level, and reported together with client data on integrated summary reports following campaigns. There are separate records and reports for each campaign, resulting in multiple LMISs.

Inventory management: NTDD distribution is based on drug quantifications derived from population estimates for each level (i.e. community, district) in the system and knowledge of the quantities used and in balance. In turn, supply information is based on use of inventory records at each storage level in the system. It should be noted that the use of inventory records below the central level is irregular and inaccurate in most programs.

Comparative Advantages of Last Mile Neglected Tropical Disease Supply Chains

Relative to supply chains for routine delivery of commodities for primary health care programs, ensuring availability of NTD MDA drugs at the time and point of service delivery presents fewer challenges. Key strengths of NTD supply chains include:

Less complex distribution. NTDCPs rely on annual, not monthly, commodity distribution. Furthermore, NTDCPs distribute only a handful of drugs.

Limited LMIS data requirements. Unlike routine delivery health programs that issue drugs to lower levels based on monthly consumption patterns reported from health centers, NTDCPs minimally rely on logistics data. The key decision regarding what quantity of each drug to issue to lower levels is driven by more readily available population data.

Cost efficient. Most NTD programs “piggyback” on MOH supply chain capacities for their annual campaign distribution to districts and health centers, and then rely on volunteers for distribution to the communities. They pay few staffing or handling costs at any level in the system.

Challenges Facing Last Mile NTD Supply Chains

In-country last mile supply chains have not received as much attention, nor benefitted from the same level of focused and coordinated investment, as first mile supply chains have. Available documentation regarding last mile supply chains for the five core PCT NTDs highlights two schools of thought. The first is that in-country supply chains for NTDD are constrained by fragmentation, which results in multiple “vertical” supply chains operating without full implementation of standard operating procedures (SOPs). These limitations in turn lead to increased costs and decreased efficiency in ensuring full supply. Further,

“As NTD medicine donations expand, there should be a concomitant expansion of capacity in supply chain management in country to ensure that health workers on-the-ground can manage medicines, maintain their quality throughout the supply chain down to the end-users, and reach the ambitious 2015 and 2020 goals laid out in the Roadmap” (JSI, 2012).

this perspective holds that NTDD will be best managed by fully integrating them into the capacities of Central Medical Stores (CMS) and the standard drug handling procedures of the MOH supply system. A second school of thought holds that last mile supply chains for the NTDD are solely the responsibility of the MOH in each country, are largely adequate for ensuring full supply, and that external initiatives in last mile supply chains risk undermining local ownership and the success of current arrangements.

However, most stakeholders are in agreement that the costs of supply chain failure are inordinately high for PCT campaign programs. Control and elimination of the diseases depend on achieving annual or twice annual coverage targets throughout the life cycle of the parasite.

Missing a year allows for new transmission and requires “resetting the treatment clock.” Missing campaigns, even only in certain districts, can cost the program years of additional effort and drugs. Specific challenges are discussed in greater detail below.

Staffing and Organizational Capacity

All public health programs struggle with human resource capacity constraints, including supply chain management (SCM) competencies, and some more than others (Kruk 2010). Within the spectrum of human resource capacities related to supply chains, NTDCPs are known for being one of the most under-resourced programs, and many struggle to carry out even the most basic management and service-related responsibilities, let alone oversee and execute specialized SCM tasks (WHO 2012).

Typically, relatively small central level teams are tasked with managing all aspects of the program, including MDA roll-out, information management, advocacy, and social mobilization. Country level coordinators usually hold medical or public health degrees, but generally do not have training or strong skills in SCM. Nevertheless, most country coordinators are responsible for organizing and managing in-country supply chain arrangements. For supply chain support, NTDCP staff often rely on non-NTD MOH supply chain managers who themselves are often scarce and/or overcommitted to other priority health programs. Furthermore, these supply chain staff generally have little or no training or guidance on how to manage campaign drugs and tend not to apply best practices to these products.

Researchers noted that in a few countries, including Tanzania, dedicated supply chain expertise has been seconded to the program by an implementing partner, but in most cases, because NTDCPs manage only four-six drugs that are distributed at most two-three times per year, attaching a supply chain professional to NTDCPs has not been considered a priority. Researchers also observed that standard procedures used for routine public health products are often not applied to NTDD; in some countries, NTDD are not stored on pallets at the CMS and stock cards are not used to track the inventory. Standard Operating Procedures for the management of the routine delivery health commodities are generally available to MOH pharmacists, however these SOPs do not include specific procedures to manage campaign drugs and staff do not receive orientation or training on SCM for NTDD.

Campaign drug distribution is not always well coordinated at the lowest levels, leaving staff and community members strained to absorb the quick ramp-up in responsibility required by MDAs. These strains include inadequate staffing to deliver services as well as inadequate infrastructure and resources to store, distribute, and deliver health products from the health facilities to the community level. With less than a day of annual training in all aspects of MDA campaign implementation, lower level staff and volunteers have minimal training in managing the receipt, distribution, recording and reporting of NTDD. The lack of training is made more acute by the lack of SOPs and guidelines with specific procedures for drug management and reporting. Staff and volunteers interviewed were unclear about how to accurately record LMIS data, what to do with remaining drugs in containers that had been opened, how to dispose of drugs no longer viable, and what to do with viable drugs remaining in balance.

Ultimately, the people most affected by MDAs are those operating at the community level. Community Drug Distributors (CDDs), usually volunteers, receive brief MDA training with insufficient emphasis on SCM competencies, and often have relatively limited literacy skills, which poses yet an additional challenge for effectively managing NTD supplies. Furthermore, CDDs receive only small stipends, which are typically not adjusted annually to keep pace with inflation. During field assessments, CDDs as well as national, district and health facility managers noted that small volunteer stipends impact motivation and

are a key constraint to performance. In Ghana, researchers found that coverage in districts visited had been below 70% in the most recent MDA. Sub-district records highlighted some communities with no distribution at all, as community leaders were not able to identify individuals willing to serve as CDDs.

A recent WHO survey found that when NTDCP staff can leverage support from colleagues who work in MOH logistics departments or who have been trained in SCM for other health areas, their distribution strategies are more effective (WHO 2012). Survey respondents also reported that they had better access to resources and systems, such as LMIS, when accessing support from other health programs and supply chain managers within the MOH.

However, even when support can be obtained, NTDCP staff must be careful to preserve the objectives and particularities of each disease program. All staff need to be trained in the specific requirements and SOPs for managing NTD campaign commodities. Furthermore, there are limits to the extent to which various disease-specific programs and supply chains can be merged that must be addressed on a country-by-country basis. Local NTDCP staff are most familiar with specific characteristics of NTD-related interventions and products in their own countries and can contribute to supply chain system design for NTD products and processes.

Challenges

- NTDCPs have very few staff to manage MDA campaigns and most have limited supply chain expertise.
- Management of NTD products is not included in MOH supply chain SOPs and supply chain staff within MOH and CMS have not been trained or oriented to manage MDA-related health products.
- CDDs have limited SCM capacity and literacy skills, and small stipends impact their motivation.

Lessons

- Countries that leverage support from supply chain departments and staff within the MOH have reported more effective distribution and information management strategies.
- Even when support can be obtained, NTDCP staff should be careful to preserve the objectives and particularities of each disease program, all staff need to be trained in the specific requirements of an NTD program, and SOPs must be developed for managing NTD products.
- There are limits to the extent to which various disease specific programs and supply chains can be merged that should be addressed on a country-by-country basis.

Opportunities

- NTDCP staff are most familiar with NTD-related interventions and products in their own countries and can contribute to supply chain system design for NTD products and processes.
- With minimal training and relevant SOPs, supply chain staff at MOH and CMS should be able to adapt to manage campaign drugs.
- Efforts such as the Bill & Melinda Gates Foundation- funded SC4CCM project have identified simple solutions and tools to strengthen the use of community health workers to manage health products and improve access to health care. These experiences should be leveraged to find better supply chain tools and procedures for CDDs.

Quantification: Forecasting and Supply Planning

Multiple assessments suggest that the more codified and collaborative the quantification process, the better the results, particularly when it comes to planning and coordinating subsequent manufacturing processes and shipments (WHO 2012). The advent, adoption and use of the WHO JAP is anticipated to greatly strengthen collaboration between specific campaign and disease managers in the reporting and ordering of NTDD.

National level quantifications form the basis of supply plans that request shipments from the WHO JAP as well as the basis for national distribution plans that detail the quantity and timing of the “push” from the central level to districts and communities. During the country assessments, researchers found that NTDCP staff often forecast their demand for the coming year using largely inaccurate LMIS data –

particularly data regarding the balance of drugs in-country. As such, countries often overestimate their needs, and drug wastage is an ongoing challenge noted in the existing literature.

Researchers also found varying degrees of use and utility of quantifications prepared at lower levels. In Malawi, for example, CDDs collect and report population data to the districts every year. While districts use these data to determine district drug needs, these quantifications are typically superseded by quantifications prepared by higher levels of the program for the district and based on the previous year's population data "aged" forward by the natural growth rate. In sum, even though higher levels often duplicate quantifications prepared at lower levels, overall drug quantification based on easily obtainable population data is a strength of NTDCP SCM.

WHO manages the JAP and convenes a panel to verify annual requests from country programs. Due to the fact that quantifications are driven by coverage and population data, few solid LMIS data (e.g., drugs issued, drugs dispensed to patients, beginning and ending balances) exist. Because of the largely "open-ended" commitments of drug donors to fully supply NTDD globally, and because of the limited accuracy and availability of LMIS data, there is currently a diminished reliance on in-country supply data.

Supply planning is completed after forecasting and quantification, and reconciles available funding, donor ability to fulfill requests, storage and transportation capacity to manage the forecasted amount, and shipment delivery timing (Pou 2012). Many countries face challenges with supply planning since several of the elements listed above are not within their control, including time constraints imposed by donors. When shipment schedules do not match desired MDA dates, campaigns have to be rescheduled, and when a shipment arrives during the rainy season, campaigns have to be delayed due to accessibility constraints.

Global coordination mechanisms, such as the NTDSF and the JAP seek greater visibility into in-country supply chains to prepare more accurate manufacturing and supply plans. This interest could be further leveraged to secure technical support for countries to improve their data collection and analysis and therefore the quality of their forecasts. Technical support to improve the timing of NTDD shipment delivery would also be useful. Logistics coordinating committees may exist in countries with relatively strong forecasting and quantification capacity for other health products. These technical abilities and coordinating bodies could be leveraged to provide technical support to the NTD community to improve forecasts and supply planning.

Challenges

- Population data used for quantification are often inaccurate and/or out-of-date. Logistics data, such as stock-on-hand data, are often inaccurate and incomplete and typically underreport the actual usable stocks remaining in-country, which can lead to high levels of wastage. NTD staff below the central level interviewed were challenged to identify and use the correct calculations for NTD drug quantification.

Lessons

- Concise, user friendly guidance on NTD drug quantification can greatly improve identification of local needs.
- A collaborative forecasting process, which engages all disease and campaign-specific staff can lead to more accurate estimates of need and better coordination.
- Multiple sources of data from multiple levels (central, district, health facility) should be used to prepare forecasts when accurate logistics data are not available.

Opportunities

- Improvements in the accuracy, completeness and timeliness of drug balance data will greatly improve the accuracy for quantifications and reduce drug wastage going forward.
- The NTDSF and the WHO JAP seek greater visibility into in-country supply chains. This interest could be leveraged to secure additional technical support for countries to improve data collection and analysis and therefore the quality of forecasts, and to improve the timing of NTD drug shipments.

Logistics Management Information System

Poorly functioning LMISs impact NTD supply chains at every level. Tools and procedures for recording and reporting distribution and consumption of key NTDD are not a high priority for NTDCPs and often suffer, as reporting of client data required to determine program coverage is emphasized. In addition, the LMIS is a component of the integrated post-campaign Summary Report, and efforts to modify and improve LMIS reporting have to consider the implications of reporting client data in the same reports. Finally, unless annual cascade trainings are lengthened, an expanded emphasis on LMIS will decrease time spent training on other aspects of MDA implementation.

Drug balances, unlike service data, cannot be aggregated from tally sheets and registers. Volunteers, many of whom are minimally trained, overworked and lacking sufficient motivation, must conduct physical inventories to establish remaining balances, which requires counting each pill left in their open bottles. Staff charged with storing drugs at higher levels have to add physical balances from their own facilities to the reported balances from the level below to accurately report balances. These two steps are rarely completed and balance data are routinely underreported, leading to lack of drug collection and reprogramming for future campaigns.

In Ghana, poor reporting of LMIS data, particularly drug balances, as well as poor quantification skills at the lower levels cause uneven distribution, leading to stock-outs and lower coverage in some areas and over-stocks and drug wastage in others. Researchers observed that when drug balance data are reported, they are often underreported, as CDDs do not always count tablets in open bottles, even when only a few tablets out of 500 in the bottle have been used. Furthermore, physical inventories are often not conducted, nor are drugs systematically returned to health facilities when MDAs end. In Malawi, NTDCP summary forms include quantity received, quantity distributed (proxy consumption), losses and balance received or in balance. The tally sheets used by the CDDs do not, however, allow for easy calculation of number of products dispensed, while losses are not recorded anywhere, making it difficult to report accurately.

Some assessments identify concerns with maintaining supply chain integrity, including leakage issues when product is moved from the central level through the supply chain, because mechanisms for accountability such as record keeping are not in place. The extent to which leakage is an issue is unknown as there are little to no data for NTD supply chains. Finally, where accurate information on balances is not a problem, the capacity for returning or retrieving the drugs usually is. Districts do not receive operating funds from the NTDCPs to collect drugs from each health facility following the campaigns, and lower level staff are not compensated for travel costs to return unused drugs to the level above them. These limitations are discussed in further detail below.

Community level

Service and LMIS data are recorded for each person seen, by the volunteers and school health teachers in campaign-specific registers. In the three study countries, volunteers and teachers record data for (on average) 300 persons requiring approximately 25 pages of the register book. Register pages are to be summarized with a page total and all page totals are to be aggregated for a campaign summary report that is submitted to health facilities following MDAs, but for the most part, volunteers do not complete page totals or summary reports. Moreover, they do not conduct physical inventories of drugs remaining in balance, nor systematically return the drugs to the health facilities.

Health facility level

Health center staff who supply CDDs are hard pressed to submit timely, complete and accurate summary reports following campaigns. The frontline health workers (FLHWs) in a health facility responsible for NTD campaigns in 50 villages often receive registers lacking page totals and register totals. To complete their summary reports correctly, they would have to add, by hand, values for twenty indicators across more than 1,200 register pages. As a result, health facility staff tend to prepare their reports without including data from volunteers, contributing to the challenges of lower level data visibility.

Furthermore, LMIS data are not used for decision making and program managers and staff place greater emphasis on the collection of service data for coverage statistics required by other important stakeholders. As a result, LMIS reporting suffers and was observed to be incomplete and inaccurate in all three countries. Other principal causes of data inaccuracy include a lack of inventory records and

physical inventories for NTDD at the health facility store; and a failure to include drug balances in their own stores with the balances reported from the CDDs.

District level

It is most often at the district level that summary reports are computerized. District-level coordinators are tasked with transferring data from, for example, twenty paper reports, each with data for the performance in 50 villages, to an Excel spreadsheet. This requires coordinators to accurately transfer over 10,000 data cells from paper reports to Excel.

Cross-checks of reported balances against physical counts of NTDD demonstrated that LMIS data is inaccurate even when it is timely and complete. The district reports are the cornerstone of the program monitoring and evaluation systems and are used by NTDCPs to complete the national level (WHO) reporting and drug application requirements. Reasons for the inaccuracy of LMIS data include the following:

- Inaccurate CDD data summarized in health facility reports, but not checked for accuracy;
- Lack of inventory records and physical inventories for NTDD at the district store;
- Failure to include drug balances in district stores with the balances reported from the health facilities;
- The burden of reporting coupled with the primacy of coverage data and the lack of decision making based on LMIS data.

Drug supply data recorded and reported should be incorporated into standard data collection and reporting tools to optimize the NTD drug supply chain. Simple LMIS tools and procedures that enable CDDs to effectively report to the next level need to be designed to collect the data needed by the supply chain and NTDCP. Useful tools or LMIS forms, including mobile technology solutions, may already exist in countries for other health product supply chains and should be considered for use by NTD supply chains.

Challenges

- Data are often not up to date, accurate, or complete.
- Countries employ varying degrees of technological solutions to manage logistics information.
- Physical inventories are generally not conducted or, if they are, results are not systematically recorded.
- A variety of methods and forms are used to record transactions.
- Limited procedures manuals or job aids (posters, manuals) are available.
- There are often inadequate or no SOPs for logistics information management processes, and customized processes have rarely been developed for NTD supply chains.
- The lack of information makes understock, overstock and leakage problems hard to identify.

Lessons

- CDDs have limited capacity to track and aggregate logistics information. Only data that will be used by higher levels should be collected. Supply chain tools should be customized to be appropriate for CDDs managing NTD products.

Opportunities

- Logistics management information systems, including software and mobile technology solutions, exist in some countries and should be considered for use by NTD supply chains.

Inventory Management: Storage and Distribution

NTDCPs receive large international shipments once a year that can overwhelm in-country storage and distribution capacity. Funding and support for in-country storage and distribution is limited and NTD Program Coordinators, who are typically not supply chain experts, are forced to develop temporary or ad hoc solutions to store and deliver NTDD to the community level in time for MDA campaigns. These temporary solutions are subject to change and disruption, and pose risks to control and elimination goals. In addition, there are often different supply chains for different NTDD within countries, which increases costs and complicates management. Sometimes vertical NTDCP distribution procedures bypass levels (e.g., zones or regions) while others do not, causing inconsistency in practices for different NTDs in a country.

Many assessments reviewed in the literature discuss storage and distribution challenges at the central level but do not provide details about challenges at lower levels. The three assessments conducted for this research offer insight into challenges faced at higher as well as lower levels of the system, and are discussed below.

Central Level

Although NTDD are meant to be distributed quickly and directly to the community level through MDA campaigns once received in-country, shipments are not necessarily coordinated to arrive at a precise

time to facilitate moving the product immediately to lower levels. This results in having to hold large quantities of products at various levels, including the central level, and finding low-cost strategies to move the products through many intermediary levels.

During all three country assessments, researchers found that the CMS charges a storage and handling fee for all products it manages and this fee is a percentage (sometimes between 6% and 17%) of the declared value of the product. Neglected Tropical Disease Drugs are generally worth tens of millions of dollars and NTDCPs are not able to afford these storage and handling fees charged by CMS. In Ghana and Tanzania, the programs have been issued a waiver for these costs and as such the CMS stores and distributes the products to the next intermediary level using the same mechanism used for other public health products. In Malawi, the CMS provides free central level storage for some NTDD on the condition that they are not responsible for either distribution or intermediary level storage. Other NTDD used for school-based campaigns targeting schistosomiasis and STHs are held for free by the privately owned customs clearing agents. Distribution of both these groups of NTDD requires national level managers to borrow MOH trucks and pay for fuel and driver per diems to move the drugs to districts, which is the least costly option possible.

The literature review and field research highlighted various strategies for distribution of NTDD, such as implementing partners and other donors loaning their vehicles during campaigns to help distribute products, as well as public- private partnerships in which implementing partners fund and work with NTDCPs to set up and manage private transport contracts to deliver products to the community level.

Although these methods ultimately get products to lower levels, there is a certain degree of risk associated with these arrangements. Ministry of Health systems, personnel, and schedules are all oriented toward routine delivery of health products to the entire country. Standard operating procedures do not include procedures for how to store and distribute NTDD, staff are not oriented to manage an annual delivery to select districts, and the MOH supply chain is not flexible enough to easily accommodate campaign drugs with large scale resource needs during peak periods. Furthermore, NTDDs tend to be endemic in districts that are hardest-to-reach, resource poor, and lacking infrastructure; these intrinsic challenges further complicate the ability to quickly store and transport large quantities of products at one time.

Commercial contracting for logistics of NTDD is not always possible, as local firms are not as interested in contracts for only once or twice a year and to remote districts. In addition, managing privately contracted logistics is a challenge for any public health supply chain. This is certainly the case for NTDCPs that face significant human resource constraints.

Intermediary and Community Level

Distribution and storage challenges extend through the supply chain to lower levels, particularly to communities where these products are dispensed during MDA campaigns. Previous assessments do not discuss lower level challenges in detail because they were often carried out at times when these campaigns were not taking place. However, these three country assessments revealed strain on lower

level capacity to manage the influx of products two or three times a year, often without additional resources to support their role.

In Ghana, the district must use district funds to collect products from the regional stores and distribute them to sub-districts, which are then responsible for distributing them to health facilities. This protocol exists despite the fact that the regional stores deliver other health products directly to sub-districts. In Malawi, the NTDCP relies on district pharmacies to store NTDD and district vehicles to distribute NTDD, despite the fact neither is designed to carry out this function, and that other health products are directly distributed to health facilities by the regional stores. District pharmacy stores are generally at capacity without the annual “flood” of NTD campaign drugs, so when NTDD arrive, they are often stored in hallways, offices or training rooms. District vehicles used for distribution are generally highly sought-after vehicles (such as ambulances) and districts are not provided with funding for fuel and per diems. As Malawi has three NTD MDA campaigns that take place in different months, the burden on the district is multiplied. In Tanzania, districts report having sufficient vehicles, fuel and driver per diem to support delivery of NTDD to health facilities. This procedure is in line with the distribution procedures for other health products in the MOH public health supply chain.

Once products reach health facilities, distributing products to CDDs and retrieving unused products are also challenging. Community Drug Distributors are generally expected to collect their products at the beginning of the campaign and then return unused products at the end of the campaign. While the distribution at the beginning of the campaign is usually timed to occur during training (for which CDDs are paid), the procedure for returning unused products, referred to as reverse logistics, is not well implemented, as there is often no incentive or travel reimbursement provided to CDDs or health facilities or districts to carry out this function.

“As in central and regional locations, a lack of storage facilities was reported at MDA sites. Often district health centres reported having limited or no space to stock NTD medicines” (WHO, 2012).

Nearly all reports to date on last mile NTD supply chains identify the lack of reverse logistics for unused drugs as a critical problem (JSI 2012). Many NTDCPs have policies for reverse logistics, but implementation of these policies is rare, as they do not have the resources to pay for the costs associated with it. Furthermore, the lack of clear and operational “open container” policies increases wastage and compromises disposal, which can be dangerous at the community level.

The lack of LMIS data confound efforts to quantify wastage, but discrepancies between sub-district receipts and coverage data in

Malawi, Tanzania and Ghana indicate minimal return of unused drugs from the community level.

Researchers also found that volunteers and FLHWs either did not know the open container policy for NTDD, or did not know how to operationalize the policy. As such, once a bottle of NTDD was opened, few tablets were ever returned or re-programmed. Empty bottles were found being used as pest- and water- proof storage containers; unused drugs were unaccounted for.

Because of the nature of MDA campaigns, NTDD require simple inventory management procedures. NTDD do not require that adequate stock levels be maintained throughout the entire MOH supply chain, while distribution is only required two or three times a year (less if campaigns are well coordinated). If NTD-specific procedures are put in place and timing for MDAs is well planned, NTDD could be moved quickly and/or directly from the central to the community level with minimal stress on infrastructure. Developing and implementing these procedures, however, requires strong commitment and coordination among all partners, and funding to support these functions.

Challenges

- Intermittent influx of large NTD product shipments saturates storage and distribution capacity at all levels.
- Ad hoc supply chain solutions for NTDD storage and distribution that are subject to change or disruption pose risks to control and elimination goals.
- Lack of specific funding for storage and distribution prevent NTDCPs from paying CMS or private contractors to manage logistics.
- Lack of clear procedures for reverse logistics wastes drug and monetary resources and compromises appropriate disposal, which could pose a health risk to communities.

Lessons

- In most countries, health product storage capacity is already often strained. Intermittent and large influxes of health products can cause a significant strain on existing storage space and staff time, and results in products being stored in suboptimal conditions and/or with high costs.
- More effective communication with and among local partners is critical to coordinating the delivery of health products.

Opportunities

- Integrating MDA campaigns could simplify supply chains by moving more NTDD through the same supply chain. If MDA campaigns are well-planned and appropriate procedures are in place, NTD products could be moved quickly and/or directly from the central to the community level.

Benchmarking Analysis

This section summarizes the benchmarking analysis conducted as part of this research. The complete analysis can be found in Annex 2.

Performance benchmarking is a commercial sector supply chain-strengthening technique that has recently started to be applied to public health efforts in developing countries. Organizations and programs use performance benchmarking to evaluate financial and/or functional performance levels

against well-performing peer groups, identify areas of underperformance, define aspirational performance goals, and identify specific strategies for improvement.

The purpose of this analysis is to investigate whether performance benchmarking is an effective strategy for understanding and strengthening Neglected Tropical Disease (NTD) supply chains.

Methodology

Few public health supply chain performance datasets from Africa are available for benchmarking, and even fewer performance data exist for NTD-specific supply chains. The World Health Organization's Expanded Programme on Immunization (EPI) Effective Vaccine Management (EVM) database is the most comprehensive public health supply chain database available for African countries, and EPI programs have a large campaign distribution component.² Based on these criteria, the EVM was deemed more appropriate than others for NTD supply chain benchmarking. While an ideal benchmark includes a representative sample of data points, this research found a lack of relevant supply chain performance data in Africa. The peer group used for benchmarking consists of 20 supply chains.

Planning, distribution, and managing and monitoring inventory indicators were chosen for this analysis. Planning indicators include the existence of SOPs, training materials, and use of evidence-based forecasting methods. Distribution indicators include delivery planning and execution, storage capacity, and transport capacity. Managing and monitoring inventory indicators include stock sufficiency, records maintenance and inventory accuracy.

Fieldwork to compare NTD supply chains to the benchmark was conducted in Malawi, Tanzania and Ghana in mid-2014. Data were collected at central, intermediate and health facility levels using the NTD Supply Chain Assessment Tool developed by JSI for this project.

Initial Analysis

The first part of the analysis focuses on the benchmark itself. Researchers found that just over half of benchmark supply chains have SOPs in place, while fewer than 50% of the supply chains reported that training materials are completely clear and correct. The use of forecast methods was strongest at the central level, with over 50% using multiple evidence-based forecast methods. Distribution indicators were more varied; delivery planning is carried out by approximately half of the central level supply chains, and only slightly more than a quarter deliver according to the plan. Warehouse capacity for benchmarked supply chains is adequate for 65% of central level supply chains and fewer intermediate and health facility-level supply chains, while transport capacity is weaker, with fewer than half of central level supply chains reporting adequate capacity. Indicators for managing and monitoring

² Results from the USAID | DELIVER PROJECT's Logistics Indicators Assessment Tool (LIAT) in various countries in Africa were also considered (USAID | DELIVER PROJECT 2008). While the LIAT reports on indicators similar to those in the EVM, differences in survey design limit the ability to align data sets and results from the two assessments, hence data from the LIAT were not included in this study.

inventory and data also varied. Stock level sufficiency and keeping stock records current are strongest at the central and intermediate levels of the supply chain, while inventory accuracy shows the poorest results of all indicators.

The second part of the analysis compares NTD supply chain performance from field assessments in Malawi, Tanzania and Ghana to the benchmark. While all three countries have SOPs in place, training materials are of fair quality. All countries' use of evidence-based forecast methods aligns with bottom quartile supply chains in the benchmark. Distribution indicators are strong at the central level, with somewhat reduced performance at the lower levels. Warehouse and transport capacity appear strong in all countries when compared with the benchmark, while indicators for managing and monitoring inventory and data vary. Sufficient stock quantities are reported the majority of the time, while record-keeping is often nonexistent, especially at the intermediate and health facility levels. (For summary table of indicators and data, please refer to Annex 2.)

Additional Analysis

Preliminary analyses produced confounding results, whereby known weaknesses looked like strengths. For example, while it appears that warehouse capacity is sufficient for all NTD supply chains assessed, we know from observations during field work that NTD programs rarely have dedicated warehouses and instead typically share space with other programs. As such, the issue isn't whether a warehouse is big enough to store NTDD, but whether there is space available in warehouses when NTDD need to be stored or whether NTDD will overwhelm a storage facility already filled with other health commodities. Because of known confounding issues, researchers conducted additional analysis to highlight methodological and programmatic constraints inherent in benchmarking NTD supply chains against existing data sets. These constraints are described indicator-by-indicator below.

- *Standard Operating Procedures for logistics exist* While NTD supply chains make use of existing supply chain capacities, there were no Neglected Tropical Disease Drug (NTDD) or campaign product-specific SOPs in use. Hence, while the benchmark analysis of NTD supply chains indicates that SOPs are in place, these SOPs are written for non-NTD, non-campaign commodities, and NTDD are managed without relevant SOPs.
- *Warehouse is adequate to receive goods* While adequate warehouse space is a revealing indicator for EPI programs with dedicated storage facilities, it is of limited usefulness for NTD programs, which rarely have dedicated warehouses and typically share Ministry of Health (MOH) warehouse space with other programs. Spatial capacities of MOH warehouses will always exceed the requirements for Neglected Tropical Disease Control Program (NTDCP) drugs. However, MOH warehouses are required to house hundreds of commodities not related to NTD programs, so while the overall storage capacity exceeds NTD needs, the issue is whether there is space available when NTDD arrive, or whether NTDD will overwhelm a storage facility already filled with other health commodities. Many MOH facilities, particularly at the district level, experience acute shortages of space when they receive the annual shipment of NTDD.

- *Transport is adequate to deliver goods* Similar to the adequacy of storage space, the transport capacity indicator is of limited usefulness in understanding the adequacy of transport for distributing NTDD. While EPI programs have dedicated transport with defined capacities, NTD programs rarely do. This indicator measures the capacity of whichever vehicle is borrowed, hired or “piggybacked-on”, but it does not measure the availability of those vehicles when required by the NTDCP nor does it measure whether the vehicles are required to transport other, non-NTD commodities during the same trip.
- *Quantity of goods is sufficient* Inventory records are rare at the lower levels of NTDCPs. Without inventory records for NTDD at the community, health facility and even district levels, answers to whether stock levels are sufficient were based on verbal responses in the field assessments. This may have led to response bias, as those tasked with ensuring full supply for MDAs may be reluctant to report stock outs. Conversely, higher-level facilities that do keep stock records for the NTDD demonstrated a zero balance, but this is the norm for most of the year in an annual campaign program rather than an indication of under-supply.
- *Records are kept up to date and inventory is accurate* Because of the comparative lack of inventory records being used for NTDD at a majority of facilities below central level, the ability to assess whether inventory records are kept up to date and are accurate is compromised.

Conclusion

Many NTD supply chain challenges are similar to those facing other public health supply chains, including poor infrastructure, limited financial, human and material resources, and limited availability of logistics and consumption data. However, NTD supply chains have additional challenges that other health commodity supply chains do not have, including a lack of vertical financial and human resources, a lack of dedicated warehouse and transportation assets and a lack of dedicated cold chain distribution capacities. As such, NTD supply chains are often forced to rely on the resources of other supply chains, which makes performance dependent on the primary program’s supply chain performance. In addition, while most supply chains have well-defined processes in place, and are managed and distributed as routine-delivery drugs in addition to mass-distribution campaign activities, NTD drug management and distribution are typically completed on a yearly basis and only in campaign style. All of these issues confound analysis of the performance of NTD supply chains when compared to benchmark EPI supply chains.

Despite using the EPI EVM, deemed most appropriate to benchmark against because of its large number of country-specific data and its partial use of campaign delivery, there were relatively few supply chain performance measurement data sets and indicators identified as appropriate to use for NTD. These data and indicator limitations, as well as the specific methodological and programmatic constraints associated with using non-NTD data for NTD benchmark purposes, described in depth above, are significant constraints to effective benchmarking. As such, we do not recommend investing additional resources in NTD benchmarking until more appropriate benchmark data sets for NTD supply chains can be developed and are available.

Segmentation Analysis

This section summarizes the segmentation analysis conducted as part of this research. The complete analysis can be found in Annex 3.

Segmentation is a commercial sector approach for determining the right mix of supply chain policies for delivery of a diverse set of products. The underlying idea is that supply chain strategies and procedures should be tailored to the commodities and health services they support. When applied to Neglected Tropical Disease (NTD) last mile supply chains, segmentation can help determine whether it is feasible or appropriate to integrate all or part of the NTD supply chain into existing public health supply systems.

In support of global efforts to strengthen last mile NTD supply chains and meet the London Declaration on Neglected Tropical Diseases goals to control and eliminate NTDs, this report presents a segmentation framework that is applicable to NTD supply chains, and applies the framework in Malawi and Tanzania. Report authors then discuss extending this analysis to other country NTD supply chains, based on global guidance.

The greatest opportunities for NTD supply chains to integrate are with bednet campaigns, nutrition campaigns, and immunization campaigns, as opposed to supply chains that require routine re-supply of commodities (such as anti-retroviral therapy or essential medicine supply chains). This is because the processes and infrastructure required for periodic campaigns differ significantly from those required for routine re-supply operations.

In considering “piggybacking” on these supply chains, it need not be an all-or-nothing decision.

Opportunities for NTD programs to leverage existing capacity can occur at specific tiers and/or geographies and could theoretically include full managerial integration or simply sharing of infrastructure. Specifically, findings from Malawi and Tanzania demonstrate that while NTD and non-NTD campaign programs may include the community level, they are not always held at the same service delivery locations or conducted at the same time.

In considering “piggybacking”, local considerations must be taken into account. Due to differences in timing (i.e. during the school year for school-based programs, before the rainy season, after the harvest), geographic endemicity, and concerns regarding treatment efficacy and adverse drug reactions, it may not be possible to merge all NTD campaigns, much less integrate them completely with another campaign program.

One key area for potential integration is distribution. Other campaign supply chains may have distribution assets that are underutilized during certain times of the year. If the timing of other campaigns complements those of the NTD program, the NTD program may be able to access these assets and simply fund their operating costs, thereby avoiding the need to purchase and maintain dedicated assets. For example, in Malawi, one of the NTD control program managers has an agreement with the Director of the Expanded Programme on Immunization (EPI) program to borrow EPI vehicles

when they are not otherwise being used. Under this arrangement, the NTD control program funds the operating costs of the vehicles.

Many NTD programs are already “piggybacking” on elements of other public and private sector supply chains. In addition to utilizing EPI transport resources in Malawi, the NTD program also relies on the Central Medical Stores Trust and private sector warehouses to store NTDD.

While ad hoc, many of these solutions help to fill critical supply chain gaps. **Using segmentation analysis, countries can identify opportunities for integration or resource sharing, and weigh the costs and benefits of each to find the most appropriate solution.**

Segmentation is not a “one-and-done” proposition. Within a specific country context, it is important to carefully investigate programs to better understand their potential and capacity to support current gaps in the NTD supply chain, while considering the likely challenges and risks to co-implementation. In particular, many of these systems and processes date back several decades, and thus will require significant advocacy and policy work, guided by evidence presented in the segmentation analysis, in order to be successful.

Conclusion

First mile efforts to secure donations of NTD drugs and improve coordination of drug delivery have contributed to significant expansion of integrated NTD control programs worldwide. While last mile NTD supply chains have several strengths, these supply chains suffer constraints in design, capacity, and sustainability, including limited staffing and organizational capacity, compromised storage, transport and distribution systems, poorly functioning logistics management information systems, poor quality data, a lack of effective reverse logistics, and the use of multiple supply chains for a limited number of disease campaigns. As such, achieving the WHO Roadmap goals for control and elimination of NTDs will require significant additional effort and creative strategies to improve all facets last mile NTD supply chains. While several limitations impact the ability to use benchmarking to improve supply chains, segmentation analysis is a useful strategy and there appear to be viable opportunities for NTD supply chains to integrate with other campaigns.

References

Abt Associates. 2014. *Analysis of Funding Gap to Support London Declaration on Neglected Tropical Diseases and WHO 2020 Goals*. Bethesda, MD.

Centers for Disease Control and Prevention. "The Principles of Disease Elimination and Eradication" cdc.gov. <http://www.cdc.gov/mmwr/preview/mmwrhtml/su48a7.htm> (accessed December 17, 2014).

JSI END in Africa. 2012. *Neglected Tropical Diseases Supply Chain Assessments and Capacity Building Plans*.

Kruk, Margaret et al. 2010. Availability of essential health services in post-conflict Liberia. *Bulletin of the World Health Organization*, 88:527-534.

Molyneux, David H. 2014. "Neglected tropical diseases: now more than just 'other diseases'—the post-2015 agenda" *International Health*. 6 (3)

Pou, Bolivar. September 19, 2012. "Building Program Capacity in the Prevention of Neglected Tropical Diseases". *Degrees Blog FHI 360*. <http://degrees.fhi360.org/2012/09/building-program-capacity-in-the-prevention-of-neglected-tropical-diseases/> (accessed June 2, 2014).

Sabin Vaccine Institute. "Integrated neglected tropical disease control and elimination programs: A global health 'best buy'." ScienceDaily. www.sciencedaily.com/releases/2013/01/130117084930.htm (accessed December 17, 2014).

The Bill & Melinda Gates Foundation. "Private and Public Partners Unite to Combat 10 Neglected Tropical Diseases by 2020" [gatesfoundation.org. http://www.gatesfoundation.org/media-center/press-releases/2012/01/private-and-public-partners-unite-to-combat-10-neglected-tropical-diseases-by-2020](http://www.gatesfoundation.org/media-center/press-releases/2012/01/private-and-public-partners-unite-to-combat-10-neglected-tropical-diseases-by-2020) (accessed December 17, 2014).

Uniting to Combat Neglected Tropical Diseases. "Endorsers" [unitingtocombatntds.org](http://www.unitingtocombatntds.org). <http://www.unitingtocombatntds.org/endorsements> (accessed December 17, 2014).

Uniting to Combat Neglected Tropical Diseases. "The London Declaration" [unitingtocombatntds.org](http://www.unitingtocombatntds.org). http://www.unitingtocombatntds.org/downloads/press/london_declaration_on_ntds.pdf (accessed December 17, 2014).

World Health Organization. 2012 (unpublished). *Survey on the supply chain of selected NTD medicines*. Geneva, Switzerland: World Health Organization.

Annex 1 – Neglected Tropical Disease Preventive Chemotherapy MDA Integration

Partners Recognize Integration Goals

Global and implementing partners believe that integration of vertical NTDCPs will help contain operational costs, increase cost-efficiencies, simplify the application of control measures, improve the potential for sustainable programs and further extend the coverage of interventions.

Further, merged MDA campaigns are expected to be more convenient for community members, since multiple, uncoordinated campaigns create an undue burden on their time. Finally, by leveraging and coordinating human, financial and technological resources across programs, it is expected that a higher proportion of the community will be treated in a single campaign.

The State of Integration Today

Although integration was identified as a major objective of many NTD strategies, the integration of MDAs is multidimensional and has been achieved with varying degrees of success to date. Integration involves human resources, funding, and planning. In some cases, countries have taken major strides toward aligning management of these various elements and eliminating some of the fragmentation of the past. In other countries, MDAs are still carried out in an ad hoc fashion and fragmentation still exists across the five disease control programs.

Countries also face other specific obstacles to integration including identifying and coordinating:

- **treatment frequency:** Integrated delivery of medications every 6 to 12 months could efficiently provide treatment for several diseases at once. Delivery coordination across five disease programs is complex both on the service delivery and supply chain management side.
- **treatment coverage:** The optimal level of drug coverage during MDAs is unclear. Although universal coverage would be ideal, attaining high coverage levels requires more resources. The WHO recommends mass antihelminthic coverage levels of $\geq 75\%$ and mass azithromycin coverage levels exceeding $\geq 80\%$ of the total population.
- **targeted treatments:** Targeting MDAs to smaller subsets of the population (e.g., children) might provide further efficiencies. Unfortunately, there has been no consensus across the five NTDs for any such subpopulation; trachoma researchers tend to believe that targeting pre-school children will be most effective, whereas schistosomiasis experts generally believe school-aged children would be the optimal group to target.
- **baseline endemicity.** Integration must include mapping of the five targeted diseases.
- **integrated monitoring and evaluation.** Monitoring and evaluation should be compatible with both the capacity of the health system and scientific need.

- **evidence on cost-effectiveness and cost-benefit studies.** This evidence and the effect of integrated control on health programs and health outcomes is critical.

Beyond the five core diseases discussed above, large-scale preventive chemotherapy strategy is also recommended by WHO for the following diseases: cysticercosis, dracunculiasis (guinea-worm disease), and foodborne trematode infections.³ It is not clear, to date, whether any country is primed to integrate additional diseases into existing MDAs and whether there is a saturation point at which the benefits of more efficient delivery outweigh performance goals for each disease.

The State of NTDCPs Today

Since 2012, there has been much progress made to meet the London Declaration goals:

- Pharmaceutical partners supplied 1.12 billion treatments, meeting increased requests from endemic countries;
- Donors committed funds to support integrated NTDCPs, scale up and expand existing programs, increase resources available for mapping, improve program strategies through research, and develop new tools;
- More than 40 endemic countries developed multi-year integrated NTD plans, and Nigeria, Brazil, Cameroon, Honduras and Burundi launched their plans;
- Oman became the first previously endemic country to verify the elimination of trachoma;
- Partners developed a comprehensive London Declaration Scorecard to promote accountability, transparency and evidence-based prioritization. This scorecard, which is available online, tracks the delivery of commitments, highlights key milestones and targets, and helps identify priority action areas to ensure that 2020 goals are met.

With these product donations and integrated NTD plans, programs are ready to scale up. However, additional resources are urgently needed to achieve WHO goals, as current service and product delivery is only a small part of what it will take to reach targets.

³ Dracunculiasis is a crippling parasitic disease on verge of eradication, with only 542 cases reported in 2012. Cysticercosis/Taeniasis is theoretically amenable to control and declared eradicable by the International Task Force for Disease Eradication in 1993. Nevertheless, solium cysticercosis remains a neglected disease. Foodborne trematode infections, or foodborne trematodiasis, are a group of parasitic infections caused by trematodes (flatworms or “flukes”) that are acquired through ingestion of food contaminated with the larval stages of the parasite. Transmission is linked to human behavior patterns related to methods of producing, processing and preparing foods. Foodborne trematode infections are particularly prevalent in East and Southeast Asia, and in central and South America. The number of individuals affected is difficult to calculate; WHO estimates that at least 40 million people are infected.

Annex 2 – Benchmarking Analysis

Benchmarking Study for Supply Chains for Neglected Tropical Diseases

December, 2014

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List of Acronyms

| | |
|-------|---|
| CMS | Central Medical Store |
| CMS/T | Central Medical Stores Trust |
| EPI | Expanded Programme on Immunization |
| EVM | Effective Vaccine Management |
| JSI | John Snow, Inc. |
| MDAs | Mass Drug Administrations |
| MOH | Ministry of Health |
| NEPI | National Expanded Programme on Immunization |
| NTD | Neglected Tropical Disease |
| NTDCP | Neglected Tropical Disease Control Program |
| NTDD | Neglected Tropical Disease Drug |
| SC | Supply Chain |
| SOP | Standard Operating Procedures |
| STH | Soil-Transmitted Helminth |
| WHO | World Health Organization |

Executive Summary

Purpose

Performance benchmarking is a commercial sector supply chain-strengthening technique that has recently started to be applied to public health efforts in developing countries. Organizations and programs use performance benchmarking to evaluate financial and/or functional performance levels against well-performing peer groups, identify areas of underperformance, define aspirational performance goals, and identify specific strategies for improvement.

The purpose of this analysis is to investigate whether performance benchmarking is an effective strategy for understanding and strengthening Neglected Tropical Disease (NTD) supply chains.

Methodology

Few public health supply chain performance datasets from Africa are available for benchmarking, and even fewer performance data exist for NTD-specific supply chains. The World Health Organization's Expanded Programme on Immunization (EPI) Effective Vaccine Management (EVM) database is the most comprehensive public health supply chain database available for African countries, and EPI programs have a large campaign distribution component.⁴ Based on these criteria, the EVM was deemed more appropriate than others for NTD supply chain benchmarking. While an ideal benchmark includes a representative sample of data points, this research found a lack of relevant supply chain performance data in Africa. The peer group used for benchmarking consists of 20 supply chains.

Planning, distribution, and managing and monitoring inventory indicators were chosen for this analysis. Planning indicators include the existence of standard operating procedures (SOPs), training materials, and use of evidence-based forecasting methods. Distribution indicators include delivery planning and execution, storage capacity, and transport capacity. Managing and monitoring inventory indicators include stock sufficiency, records maintenance and inventory accuracy.

Fieldwork to compare NTD supply chains to the benchmark was conducted in Malawi, Tanzania and Ghana in mid-2014. Data were collected at central, intermediate and health facility levels using the NTD Supply Chain Assessment Tool developed by JSI for this project.

Initial Analysis

The first part of the analysis focuses on the benchmark itself. Researchers found that just over half of benchmark supply chains have SOPs in place, while fewer than 50% of the supply chains reported that training materials are completely clear and correct. The use of forecast methods was strongest at the

⁴ Results from the USAID | DELIVER PROJECT's Logistics Indicators Assessment Tool (LIAT) in various countries in Africa were also considered (USAID | DELIVER PROJECT 2008). While the LIAT reports on indicators similar to those in the EVM, differences in survey design limit the ability to align data sets and results from the two assessments, hence data from the LIAT were not included in this study.

central level, with over 50% using multiple evidence-based forecast methods. Distribution indicators were more varied; delivery planning is carried out by approximately half of the central level supply chains, and only slightly more than a quarter deliver according to the plan. Warehouse capacity for benchmarked supply chains is adequate for 65% of central level supply chains and fewer intermediate and health facility-level supply chains, while transport capacity is weaker, with fewer than half of central level supply chains reporting adequate capacity. Indicators for managing and monitoring inventory and data also varied. Stock level sufficiency and keeping stock records current are strongest at the central and intermediate levels of the supply chain, while inventory accuracy shows the poorest results of all indicators.

The second part of the analysis compares NTD supply chain performance from field assessments in Malawi, Tanzania and Ghana to the benchmark. While all three countries have SOPs in place, training materials are of fair quality. All countries' use of evidence-based forecast methods aligns with bottom quartile supply chains in the benchmark. Distribution indicators are strong at the central level, with somewhat reduced performance at the lower levels. Warehouse and transport capacity appear strong in all countries when compared with the benchmark, while indicators for managing and monitoring inventory and data vary. Sufficient stock quantities are reported the majority of the time, while record-keeping is often nonexistent, especially at the intermediate and health facility levels. (For summary table of indicators and data, please refer to Appendix 1.)

Additional Analysis

Preliminary analyses produced confounding results, whereby known weaknesses looked like strengths. For example, while it appears that warehouse capacity is sufficient for all NTD supply chains assessed, we know from observations during field work that NTD programs rarely have dedicated warehouses and instead typically share space with other programs. As such, the issue isn't whether a warehouse is big enough to store NTD drugs, but whether there is space available in warehouses when NTD drugs need to be stored or whether NTD drugs will overwhelm a storage facility already filled with other health commodities. Because of known confounding issues, researchers conducted additional analysis to highlight methodological and programmatic constraints inherent in benchmarking NTD supply chains against existing data sets. These constraints are described indicator-by-indicator below.

- *Standard Operating Procedures for logistics exist* While NTD supply chains make use of existing supply chain capacities, there were no Neglected Tropical Disease Drug (NTDD) or campaign product-specific SOPs in use. Hence, while the benchmark analysis of NTD supply chains indicates that SOPs are in place, these SOPs are written for non-NTD, non-campaign commodities, and NTDDs are managed without relevant SOPs.
- *Warehouse is adequate to receive goods* While adequate warehouse space is a revealing indicator for EPI programs with dedicated storage facilities, it is of limited usefulness for NTD programs, which rarely have dedicated warehouses and typically share Ministry of Health (MOH) warehouse space with other programs. Spatial capacities of MOH warehouses will always exceed the requirements for Neglected Tropical Disease Control Program (NTDCP) drugs. However, MOH warehouses are

required to house hundreds of commodities not related to NTD programs, so while the overall storage capacity exceeds NTD needs, the issue is whether there is space available when NTD drugs arrive, or whether NTDDs will overwhelm a storage facility already filled with other health commodities. Many MOH facilities, particularly at the district level, experience acute shortages of space when they receive the annual shipment of NTD drugs.

- *Transport is adequate to deliver goods* Similar to the adequacy of storage space, the transport capacity indicator is of limited usefulness in understanding the adequacy of transport for distributing NTDDs. While EPI programs have dedicated transport with defined capacities, NTD programs rarely do. This indicator measures the capacity of whichever vehicle is borrowed, hired or “piggybacked-on”, but it does not measure the availability of those vehicles when required by the NTDCP nor does it measure whether the vehicles are required to transport other, non-NTD commodities during the same trip.
- *Quantity of goods is sufficient* Inventory records are rare at the lower levels of NTDCPs. Without inventory records for NTDDs at the community, health facility and even district levels, answers to whether stock levels are sufficient were based on verbal responses in the field assessments. This may have led to response bias, as those tasked with ensuring full supply for MDAs may be reluctant to report stock outs. Conversely, higher-level facilities that do keep stock records for the NTDDs demonstrated a zero balance, but this is the norm for most of the year in an annual campaign program rather than an indication of under-supply.
- *Records are kept up to date and inventory is accurate* Because of the comparative lack of inventory records being used for NTDDs at a majority of facilities below central level, the ability to assess whether inventory records are kept up to date and are accurate is compromised.

Conclusion

Many NTD supply chain challenges are similar to those facing other public health supply chains, including poor infrastructure, limited financial, human and material resources, and limited availability of logistics and consumption data. However, NTD supply chains have additional challenges that other health commodity supply chains do not have, including a lack of vertical financial and human resources, a lack of dedicated warehouse and transportation assets and a lack of dedicated cold chain distribution capacities. As such, NTD supply chains are often forced to rely on the resources of other supply chains, which makes performance dependent on the primary program’s supply chain performance. In addition, while most supply chains have well-defined processes in place, and are managed and distributed as routine-delivery drugs in addition to mass-distribution campaign activities, NTD drug management and distribution are typically completed on a yearly basis and only in campaign style. All of these issues confound analysis of the performance of NTD supply chains when compared to benchmark EPI supply chains.

Despite using the EPI EVM, deemed most appropriate to benchmark against because of its large number of country-specific data and its partial use of campaign delivery, there were relatively few supply chain performance measurement data sets and indicators identified as appropriate to use for NTD. These data and indicator limitations, as well as the specific methodological and programmatic constraints associated with using non-NTD data for NTD benchmark purposes, described in depth above, are significant constraints to effective benchmarking. As such, we do not recommend investing additional resources in NTD benchmarking until more appropriate benchmark data sets for NTD supply chains can be developed and are available.

Introduction

Performance benchmarking is a commercial sector supply chain-strengthening technique that has recently started to be applied to public health efforts in developing countries. Organizations and programs use performance benchmarking to evaluate financial and/or functional performance levels against well-performing peer groups, identify areas of underperformance, define aspirational performance goals, and identify specific strategies for improvement.

The purpose of this analysis is to investigate whether performance benchmarking is an effective strategy for understanding and strengthening Neglected Tropical Disease (NTD) supply chains.

The specific objectives of this report are to:

- discuss the state of NTD-specific supply chain performance benchmarking;
- identify a selected set of supply chain performance indicators from the most comprehensive supply chain performance data set available to serve as the benchmark;
- analyze the performance of the benchmark;
- compare NTD supply chain performance data from field assessments to the benchmark developed; and
- consider the utility and limitations of this approach.

Methodology

To create the benchmark against which field assessments of NTD supply chains would be compared, researchers conducted a desk review of performance assessments for NTD and relevant non-NTD supply chains in Africa. Among non-NTD supply chains, those of particular interest were supply chains with campaign-style distribution efforts such as vaccines, and those with strong seasonal demand such as malaria, which can drive large seasonal commodity shipment volumes and impact the supply chain in ways similar to mass distribution efforts.

Few public health supply chain performance datasets from Africa are available for benchmarking, and even fewer performance data exist for NTD-specific supply chains. The World Health Organization's Expanded Programme on Immunization (EPI) Effective Vaccine Management (EVM) database is the most comprehensive public health supply chain database available for African countries, and EPI programs have a large campaign distribution component. Based on these criteria, the EVM was deemed more appropriate than others⁵ for NTD supply chain benchmarking. While an ideal benchmark includes a representative sample of data points, this research found a lack of relevant supply chain performance data in Africa. The peer group used for benchmarking consists of 20 supply chains.

⁵ Results from the USAID | DELIVER PROJECT's Logistics Indicators Assessment Tool (LIAT) in various countries in Africa were also considered (USAID | DELIVER PROJECT 2008). While the LIAT reports on indicators similar to those in the EVM, differences in survey design limit the ability to align data sets and results from the two assessments, hence data from the LIAT were not included in this study.

Planning indicators chosen include the existence of standard operating procedures (SOP), training materials, and use of evidence-based forecasting methods. Distribution indicators include delivery planning and execution, storage capacity, and transport capacity. Managing and monitoring inventory indicators include stock sufficiency, records maintenance and inventory accuracy. Some of these indicators were only analyzed at the central level due to absence of data at other levels, while others were analyzed at central, district and health facility levels. Several additional indicators were considered for inclusion but in the end were omitted from analysis. These included on-time delivery,⁶ condition of shipments upon arrival,⁷ product loss rate,⁸ product expiry rate⁹, and reporting rate.¹⁰

Fieldwork to compare NTD supply chains to the benchmark was conducted in Malawi, Tanzania and Ghana in mid-2014. Data were collected at central, intermediate and health facility levels using the NTD Supply Chain Assessment Tool which was developed for this project. Quartile analysis for Malawi and Tanzania, discussed in detail in Appendix 1, was completed before fieldwork was conducted in Ghana. As such, the formal quartile analysis was not conducted for Ghana although the data were collected, reviewed, are consistent with findings from other countries and have been included in the report.

Data Limitations

- **Few sources to draw comparable data.** Few data sources are available that report on performance of public health supply chains in Africa, and even fewer that report on this particular set of indicators. No data were found that directly report on performance of NTD supply chains. Malaria supply chains in Africa were reviewed, given their strong seasonal demand, but no relevant and comparable data found. Hence, to create this benchmark, data were drawn primarily from performance reports on supply chains in Africa that carry out vaccine distribution, which often incorporates annual mass distribution or campaign-style distribution activities.
- **Small sample size of benchmarked supply chains.** A small number of comparable supply chains comprise the sample evaluated and are neither statistically significant nor geographically

⁶ On-time delivery rates from suppliers may be available through the USAID | DELIVER Project, but they are not indicative of in-country distribution performance. International performance benchmarks for on-time delivery from suppliers are also available. Delivery according to schedule is available in the EVM data and is included in this study.

⁷ EVM data do not measure the condition of shipments on arrival as a separate indicator; rather, they are combined with the measure of shipments arriving with complete documentation. A measure of the condition of shipments upon arrival from suppliers may be available through the USAID | DELIVER Project, but this is not indicative of in-country distribution performance.

⁸ EVM data do not provide data on loss due to theft or leakage. LIAT and other data sources reviewed also did not provide loss rate due to theft or leakage.

⁹ EVM data measure whether or not a facility has expired product on hand and if product is “expired” due to temperature exposure. They do not measure expiry value or rate due to other causes such as exceeding the shelf life of the product. LIAT and other data sources reviewed did not provide expiry value or rate.

¹⁰ EVM data do not include reporting rates. LIAT reporting rates are based on number of facilities surveyed, but this may or may not be statistically significant or representative of the nationwide rate for the country surveyed.

representative. Results describe the relative performance of the limited number of comparable supply chains where data were available.

- **No performance data for individual facilities below the central level.** Data available for this set of indicators were only available as aggregated results for each country at each level of the supply chain rather than at the individual facility level. The benchmark was created based on aggregated scores or average results.
- **Less consistent performance data for lower levels of the supply chain.** Central level data were available for all benchmark indicators, but data became less consistent for facilities below the central level. Intermediate level data were available for most benchmark indicators, while health facility level data were available for only two indicators.

Benchmark Performance Findings

This first part of the analysis focuses on the benchmark itself. It provides an overview of the indicators used to assess performance by benchmark supply chains and discusses performance across all measured indicators.

Planning Indicators

Standard Operating Procedures for logistics exist

This indicator measures whether supply chain policies and guidelines that support standardized processes are in place and are used as reference material for workers who are responsible for supply chain activities. Three aspects of this indicator were measured: a Standard Operating Procedures (SOP) manual exists, the facility surveyed has a copy of the manual, and clear and correct logistics training materials exist. Data for this indicator were available only for the central level of supply chains. Fifty-three percent of supply chains comprising the benchmark have SOP manuals in place and had a copy available at the facility, while fewer than 50% of the supply chains report that training materials are completely clear and correct. It should be noted that this indicator did not assess whether or not the SOPs for logistics are actually followed.

Data-based forecast method is used

This indicator measures how many supply chains are using evidence-based methods to develop forecasts, including whether a standard method is used; whether a target population is used; whether coverage data is used; and whether drug wastage rate data is used. At the central level, over 50% of supply chains report using all four methods while at the intermediate level this figure was somewhat lower. Data for the health facility level were not available for this indicator.

Distribution Indicators

Deliveries are scheduled in advance and done according to plan

This indicator measures how many facilities send a distribution plan or notification to the receiving party, as well as how many deliveries are made according to that plan. At the central level, 53 percent of facilities send a distribution plan or notification to the recipient; however, only 29 percent of deliveries are made according to schedule. At intermediate levels, performance varies widely, with between 0 and

100 percent of supply chains sending distribution plans prior to delivery and delivering according to the schedule. Even among the highest performing quartile of intermediate level supply chains, performance ranges from 45-100 percent for sending distribution plan notification and from 41-100 percent for delivering according to schedule at the intermediate level. Data for the health facility level were not available for this indicator.

Warehouse is adequate to receive goods

This indicator measures whether or not the capacity of the warehouse is adequate to store the maximum volume of commodities to be stored. At the central level, 65 percent of facilities report adequate storage capacity, while at the intermediate level, the top two quartiles of supply chains report between 71 and 100 percent of adequate storage capacity, indicating relatively good storage capacity for these supply chains. The top two quartiles of health facility level supply chains report between 90 and 100 percent of adequate storage capacity.

Transport is adequate to deliver goods

This indicator measures whether or not transport capacity is adequate for the maximum volume of commodities to be transported between levels. Only 43 percent of central level facilities report that transport capacity is adequate for the maximum volume of commodities. Data for this indicator were only available for the central level.

Managing and Monitoring Indicators

Quantity of goods is sufficient

This indicator measures two aspects of stock sufficiency—whether stock was available on hand during the review period and whether or not the facility is able to service or fill orders for lower level facilities. Over half of central and intermediate level supply chains report necessary stock levels at greater than 50 percent, while at the health facility level, the corresponding figure is 45 percent. Note that results for the health facility level reflect stock availability only, i.e., no stock outs, as health facilities do not serve lower level facilities.

Records are kept up to date

This indicator measures whether or not stock transactions are recorded and stock balances updated within one working day of the transaction. At the central level, 76 percent of facilities report that records are kept up to date.

Inventory is accurate

This indicator measures whether or not results of a physical inventory count are within 1 percent of inventory recorded on stock records, based on counting a sample commodity. Data for this indicator were only available at the central level, and only 11% of central level facilities report accurate inventory when compared with records.¹¹

¹¹ It should be noted that the sample size for measuring inventory accuracy for the supply chains in the benchmark is thought to be one commodity per facility; however, the sample size cannot be verified. It is also important to

Summary of Benchmark Performance Findings

For the supply chains that comprise the benchmark, 53% have SOPs in place, while fewer than 50% of the supply chains report that training materials were completely clear and correct. The use of forecast methods is strongest at the central level, with over 50% using four evidence-based forecast methods. Distribution indicators are more varied, with delivery planning carried out by approximately half of the central level supply chains, and only slightly more than a quarter delivering according to the plan. Warehouse capacity for benchmarked supply chains is adequate for 65% of central level supply chains and fewer intermediate and health facility-level supply chains, while transport capacity is weaker, with fewer than half of central level supply chains reporting adequate capacity. Indicators for managing and monitoring inventory and data also vary. Stock level sufficiency and keeping stock records current are strongest at the central and intermediate levels of the supply chain, while inventory accuracy shows the poorest results of all indicators. A summary table of indicators and data are found in Appendix 1.

NTD Supply Chain Performance Findings from the Field Assessments

This second part of the analysis compares NTD supply chain performance from field assessments to the benchmark and discusses performance across all measured indicators. A more detailed quartile analysis of field assessments in Malawi and Tanzania are found in Appendices 2 and 3.

Planning Indicators

Standard Operating Procedures for logistics exist

All three countries have SOPs in place, but the quality of all training materials is fair.

Data-based forecast method is used

In all three countries, use of evidence-based forecast methods aligns with the lowest performing group of benchmarked supply chains at central and intermediate levels.

Distribution Indicators

Deliveries are scheduled in advance and done according to plan

In Malawi, all levels of the NTD supply chain report that a majority of facilities sent distribution plans and delivered against them, making Malawi a top performer when compared to the benchmark. Tanzania's central level of the NTD supply chain also reports scheduling deliveries in advance and delivering against the schedule; however, lower levels report less frequent use of scheduling and mixed results regarding adherence to the schedule. In Ghana, the central level performs well; no data were collected at the intermediate and health facility levels.

Warehouse is adequate to receive goods

In all three countries, warehouse capacity is at least 110% of the maximum volume to be stored.

note that this indicator only measures whether the inventory was accurate on the day of the assessment, not over a longer period of time.

Transport is adequate to deliver goods

In all three countries, transport capacity is at least 110% of the maximum volume to be transported.

Managing and Monitoring Indicators*Quantity of goods is sufficient (no stock outs)*

In all three countries, NTD drug stock levels at the central level are reported as sufficient to service all orders. Stock sufficiency levels are lower at the intermediate and health facility levels in Malawi and Tanzania; no data were collected at the intermediate and health facility levels in Ghana.

Records are kept up to date

In Malawi and Ghana, record keeping is conducted at the central level, but lower levels do not use stock records.

In Tanzania, no record keeping results were reported at the central level while at the intermediate level, record keeping is fair. Surprisingly, the health facility level reports the best relative performance of all three levels in Tanzania, aligning with the 2nd highest performing group of the benchmark.

Inventory is accurate

Malawi's inventory accuracy at the central level ranks with a small percentage of benchmark supply chains reporting good results, while Tanzania and Ghana report poor results for inventory accuracy at the central level. No other inventory accuracy data were collected.

Summary of Findings from the Field

Supply chain performance findings from the field assessments vary widely. While all countries have SOPs in place, training materials are of fair quality. All countries' use of evidence-based forecast methods align with bottom quartile supply chains in the benchmark. Distribution indicators in all countries are strong at the central level, with reduced performance at the lower levels. Warehouse and transport capacity are strong in all countries, while indicators for managing and monitoring inventory and data vary. In all three countries, NTD drug stock levels at the central level are reported as sufficient, while stock sufficiency levels are lower at the intermediate and health facility levels in Malawi and Tanzania. Record-keeping is often nonexistent, especially at the intermediate and health facility levels. More information about the field assessments can be found in Appendices 2 and 3.

Analysis of Confounding Methodological and Programmatic Issues

While some of the findings reported above appear promising, the reader should review these results with caution, as these analyses produced confounding results, whereby known weaknesses looked like strengths. Because of this, researchers conducted additional analysis to highlight methodological and programmatic constraints inherent in benchmarking NTD supply chains against existing data sets. These methodological and programming issues are discussed below.

NTD supply chains are most often integrated into the greater MOH commodity distribution system. While SOPs for logistics may exist in some facilities that manage Neglected Tropical Disease Drugs

(NTDDs), the SOPs are often for routine-delivery drugs rather than for mass distributed or campaign drugs such as NTDs, which may not be handled in the same way and likely require a different set of SOPs. In countries where fieldwork was conducted, NTDDs are handled at the central level by MOH pharmacists trained in, and using, SOPs for handling drugs, but there are no NTDD, or even campaign product-specific SOPs in use, and the MOH pharmacists do not use many of the standard procedures (e.g. pallets and stock cards) for the NTD drugs that they use for routine distribution commodities. Hence, while NTDCPs and National Expanded Programmes on Immunization (NEPIs) may both score “yes” on this indicator, only NEPI programs have and use SOPs that are appropriate for their commodities.

Similarly, training materials are available at MOH facilities for routine distribution health commodities, but these training materials are not generally relevant for campaign commodities, and the NTD logistics training materials found during field assessments are of fair quality at best.

In terms of data-based forecast methods, routine distribution supply chains including those used in the benchmark typically use several forecasting methods, comparing usage data-based forecasts to those based on population size and/or service statistics. Generally speaking NTD supply chain decision makers do not use multiple forecast methods and in all countries visited, forecasts rely first and foremost on population data.

Comparing the storage and transport capacity of NTD supply chains to the warehousing and transportation benchmark is also problematic. While the measurement of warehouse and transport capacity appear very strong in all three field assessment countries, conclusions drawn are misleading. Typically, NTDD supply chains share storage and transport with other health commodities rather than having their own dedicated storage and transport assets, due to the yearly or twice-yearly arrival and distribution of NTD drugs. As such, assessment of NTDD capacity requires estimating the storage or transport space needed for NTD drugs *as well as all other commodities* that use that resource; simply comparing the maximum volume of NTD drugs shipped to a given district against the total capacity of a district hospital store does not provide insight into whether there is space for the drugs when they arrive. In reality, NTD drugs often overwhelm storage and transport capacity, resulting in NTD drugs being stored in offices, corridors, and sunlit areas. In a similar way, while the benchmark transport indicator can measure the capacity of vehicles borrowed, hired or “piggybacked-on”, it cannot measure whether those vehicles are actually available when required or whether NTDDs are given lower priority than other health commodities in terms of transport.

There are also confounding factors with regard to managing and monitoring inventory indicators. Field assessment data indicate that inventory records are often missing. Without such records for NTDDs, establishing whether or not there were adequate stock levels was based on verbal responses, which may lead to response bias, as those tasked with ensuring full supply for MDAs may have been reluctant to report stock outs. Malawi, which reported keeping stock records at the central level, demonstrated a zero balance, but this is the norm for most of the year in an annual campaign program, and is not indicative of stock-out or under-supply. (Adequacy of stock availability for campaign programs has a temporal factor which routine supply distribution programs do not have.) In terms of inventory record-keeping and accuracy, interpretation of performance is compromised by the comparative lack of inventory records being used for NTDDs at a majority of facilities below central level.

Recommendations for NTD Supply Chains

- Develop and implement SOPs and keep copies on hand at facilities as reference for logistics staff. While procedures for NTDDs could be included in SOPs for other health products, they should contain specific instructions for handling and distributing NTDDs and other products destined for campaigns.
- Use three or more evidence-based methods when developing forecasts.
- Develop and share distribution plans with all partners in advance for all campaigns or MDA activities
- Strive to deliver goods according to the plan at a greater rate of execution than supply chains in the benchmark.
- Fill all orders at all levels of the supply chain. This is particularly critical given that distribution campaigns take place infrequently, requiring timely arrival of requested quantities.
- Improve record-keeping of NTDDs (receipt issuance, inventory levels) despite the

Conclusions

Many NTD supply chain challenges are similar to those facing other public health supply chains, including poor infrastructure, limited financial, human and material resources, and limited availability of logistics and consumption data. However, NTD supply chains have additional challenges that other health commodity supply chains do not have, including a lack of dedicated (vertical) financial and human resources, a lack of dedicated warehouse and transportation assets and a lack of dedicated cold chain distribution capacities. As such, NTD supply chains are often forced to rely on the resources of other supply chains, which makes performance dependent on the primary program's supply chain performance. In addition, while most supply chains have well-defined processes in place, and are managed and distributed as routine-delivery drugs in addition to mass-distribution campaign activities, NTD drug management and distribution are typically completed on a yearly basis and only in campaign style. All of these issues confound analysis of the performance of NTD supply chains when compared to benchmark EPI supply chains.

Despite using the EPI EVM, deemed most appropriate to benchmark against because of its large number of country-specific data and its partial use of campaign delivery, there were relatively few supply chain performance measurement data sets and indicators identified as appropriate to use for NTD. These data and indicator limitations, as well as the specific methodological and programmatic constraints associated with using non-NTD data for NTD benchmark purposes, described in depth above, are significant barriers to effective benchmarking. As such, we do not recommend investing additional resources in NTD benchmarking until more appropriate benchmark data sets for NTD supply chains can be developed and are available.

Appendix 1: NTD Supply Chain Benchmark Indicators – Results by Quartile

Defining “top” performance among supply chains is a subjective activity; therefore, the performance data for supply chains comprising the benchmark is organized and analyzed into quartiles. For each level, facilities are aggregated¹², sorted by rank (best to worst) within each indicator, and grouped into quartiles—four groups of data containing an equal number of data points for each supply chain level. Examining each indicator individually, the first quartile contains the top 25 percent of data points by rank, representing the top performing supply chains for that indicator; the fourth quartile contains the bottom 25 percent of data points, representing supply chains with the poorest performance for that indicator. The data point noted in each quartile is the highest performance result for the supply chains captured in each quartile. Because performance for each indicator is assessed individually, the top quartile will not necessarily contain the same supply chains across all indicators.

In the data set selected for this study, each data point represents performance for one entire supply chain level in one country. At the central level, one data point reflects performance of each central facility where data were collected. At lower supply chain levels, one data point reflects the aggregated performance of all facilities in the named level for one country’s supply chain. Disaggregated data that reflects the performance of individual facilities below the central level were not available.

Some indicator results are reported as Yes/No results, and hence results were categorized into top and bottom performers only. At the central level, four indicators are measured in quartiles and seven as binary responses (Yes/No); all data from lower levels of the supply chain are measured in quartiles.

| Indicator | SC Level | Benchmark Results | | | | Malawi Results | Tanzania Results | Ghana Results |
|---|-----------------|----------------------|-----------------|-----------------|-----------------------|----------------|------------------|---------------|
| | | 4 th / No | 3 rd | 2 nd | 1 st / Yes | | | |
| 1. SOPs for logistics exist | | | | | | | | |
| 1.1 Is there a Standard Operating Procedures (SOP) manual? [Y/N] | Central | 47% | -- | -- | 53% | Y | Y | Y |
| 1.2 If there is an SOP manual, does the facility have a copy of it? [Y/N] | Central | 47% | -- | -- | 53% | Y | Y | Y |
| 1.3 Are logistics training materials clear and correct? [Scale 0-100] | Central | 0-50% | 75% | 100% | 100% | 63% | 50% | 50% |
| 2. Data-based forecast method is used | | | | | | | | |
| 2.1 Is a data-based forecast method used? (<i>Measures the percentage of four evidence-based forecasting methods in use at each facility surveyed.</i>) [Scale 0-100] | Central | 0-75% | 100% | 100% | 100% | 50% | 50% | 25% |
| | Inter-mediate | 0-50% | 65% | 93% | 100% | 50% | 50% | 25% |
| | Health Facility | -- | -- | -- | -- | -- | -- | 25% |
| 3. Delivery is according to plan | | | | | | | | |
| 3.1 During the period under review, did the issuing store send a distribution plan or notification to each receiving store identifying dates for the delivery? [Y/N] | Central | 47% | -- | -- | 53% | Y | Y | Y |
| | Inter-mediate | 0-10% | 29% | 44% | 100% | 100% | 38% | -- |
| | Health Facility | -- | -- | -- | -- | 75% | 58% | -- |

¹² Note that the central level typically represents *one facility*, therefore no facilities are aggregated at the central level.

| | | | | | | | | |
|---|-----------------|-------|-----|-----|------|------|------|------|
| 3.2 If a distribution plan was in place, were the actual number of deliveries within +/-20% of plan? | Central | 71% | -- | -- | 29% | Y | Y | Y |
| | Inter-mediate | 0-2% | 20% | 40% | 100% | 63% | 67% | -- |
| | Health Facility | -- | -- | -- | -- | 89% | 100% | -- |
| 4. Warehouse capacity is adequate | | | | | | | | |
| 4.1 Is warehouse capacity at least 110% of the maximum volume to be stored? | Central | 35% | -- | -- | 65% | Y | Y | Y |
| | Inter-mediate | 0-24% | 70% | 87% | 100% | 100% | 100% | 100% |
| | Health Facility | 0-57% | 89% | 98% | 100% | 100% | 100% | 100% |
| 5. Transport capacity is adequate | | | | | | | | |
| 5.1 Is transport storage capacity at least 110% of the maximum volume to be transported? | Central | 57% | -- | -- | 43% | Y | Y | Y |
| 6. Stock levels are sufficient (no stock outs) | | | | | | | | |
| 6.1 During the review period, were stock levels sufficient to supply all lower levels? | Central | 0% | 50% | 50% | 100% | 100% | 100% | 100% |
| | Inter-mediate | 0-28% | 52% | 69% | 100% | 88% | 75% | -- |
| | Health Facility | 0-29% | 44% | 56% | 76% | 92% | 75% | -- |
| 7. Stock records are kept current | | | | | | | | |
| 7.1 Are all stock transactions (arrivals and issues) recorded and stock balances updated within one working day of the transaction? | Central | 24% | -- | -- | 76% | Y | -- | Y |
| | Inter-mediate | 0-59% | 78% | 90% | 100% | NA | 50% | NA |
| | Health Facility | 8-43% | 65% | 87% | 100% | NA | 67% | NA |
| 8. Inventory is accurate | | | | | | | | |
| 8.1 Was physical inventory count found to be +/- 1% of inventory on stock records? [Y/N] | Central | 0-89% | -- | -- | 11% | Y | N | N |
| | Inter-mediate | -- | -- | -- | -- | -- | -- | -- |
| | Health Facility | -- | -- | -- | -- | -- | -- | -- |

Appendix 2: Field Results—Malawi

To compare Malawi's supply chain for NTD drugs to the benchmark, data from three different MDA campaigns were collected in April 2014 using the NTD Supply Chain Assessment Tool developed by JSI. Data were collected at two central level facilities: the Central Medical Stores Trust (CMS/T) and Allied Freight. The first was the MOH facility and used for one community-based distribution and trachoma drugs. The second was private and belonged to the company paid for by project donors to complete customs clearance. Data were also collected at eight intermediate level facilities and 13 health facilities.

The first MDA campaign is a community-based campaign that targets onchocerciasis, lymphatic filariasis and soli transmitted helminthes (STHs) by distributing ivermectin and albendazole to eligible populations. The second targets schistosomiasis and STH by distributing praziquantel and albendazole to all eligible school-aged children. The third program targets trachoma, distributes Zithromax in endemic districts and is executed vertically by trachoma program.

Planning Indicators

Standard Operating Procedures for logistics exist

Both central level facilities report having SOPs in place, and having a copy of it. The MOH CMS/T facility reports moderately clear and correct training materials, placing the supply chain in the 3rd quartile relative to the benchmark.

| Indicator 1: SOPs for logistics exist | SC Level | Benchmark Results | | | | Malawi Results |
|---|----------|----------------------|-----------------|-----------------|-----------------------|----------------|
| | | 4 th / No | 3 rd | 2 nd | 1 st / Yes | |
| 1.1 Is there a Standard Operating Procedures (SOP) manual? [Y/N] | Central | 47% | -- | -- | 53% | Y |
| 1.2 If there is an SOP manual, does the facility have a copy of it? [Y/N] | Central | 47% | -- | -- | 53% | Y |
| 1.3 Are logistics training materials clear and correct? [Scale 0-100] | Central | 0-50% | 75% | 100% | 100% | 63% |

Data-based forecast method is used

The second indicator measures the use of four evidence-based methods in developing forecasts—whether a standard method is used; whether a target population is used; whether coverage data is used; and whether drug wastage rate data is used.

Malawi's central and intermediate levels report using two of the four types of data, placing it in the lowest quartile of benchmarked supply chains.

| Indicator 2: Data-based forecast method is used | SC Level | Benchmark Results | | | | Malawi Results |
|--|-----------------|----------------------|-----------------|-----------------|-----------------------|----------------|
| | | 4 th / No | 3 rd | 2 nd | 1 st / Yes | |
| 2.1 Is a data-based forecast method used? (Measures the percentage of four evidence-based forecasting methods in use at each facility surveyed.) [Scale 0-100] | Central | 0-75% | 100% | 100% | 100% | 50% |
| | Intermediate | 0-50% | 65% | 93% | 100% | 50% |
| | Health Facility | -- | -- | -- | -- | -- |

Distribution

Deliveries are scheduled in advance and done according to plan

Malawi reports relatively strong performance for planning and executing deliveries. The central level reports sending a distribution plan in advance, while all facilities at the intermediate level and 75% of facilities at the health facility level report sending a distribution plan in advance. The central level

reports completing deliveries according to the plan, while 63 percent of intermediate facilities and 89 percent of health facilities deliver according to the plan.

| Indicator 3: Delivery is according to plan | SC Level | Benchmark Results | | | | Malawi Results |
|--|-----------------|---------------------|-----------------|-----------------|----------------------|----------------|
| | | 4 th /No | 3 rd | 2 nd | 1 st /Yes | |
| 3.1 During the period under review, did the issuing store send a distribution plan or notification to each receiving store identifying dates for the delivery? [Y/N] | Central | 47% | -- | -- | 53% | Y |
| | Intermediate | 0-10% | 29% | 44% | 100% | 100% |
| | Health Facility | -- | -- | -- | -- | 75% |
| 3.2 If a distribution plan was in place, were the actual number of deliveries within +/-20% of plan? | Central | 71% | -- | -- | 29% | Y |
| | Intermediate | 0-2% | 20% | 40% | 100% | 63% |
| | Health Facility | -- | -- | -- | -- | 89% |

Warehouse is adequate to receive goods

This indicator measures whether or not the capacity of the warehouse is adequate to store the maximum volume of commodities to be stored. At all levels, warehouse capacity was adequate.

| Indicator 4: Warehouse capacity is adequate | SC Level | Benchmark Results | | | | Malawi Results |
|---|-----------------|---------------------|-----------------|-----------------|----------------------|----------------|
| | | 4 th /No | 3 rd | 2 nd | 1 st /Yes | |
| 4.1 Is warehouse capacity at least 110% of the maximum volume to be stored? | Central | 35% | -- | -- | 65% | Y |
| | Intermediate | 0-24% | 70% | 87% | 100% | 100% |
| | Health Facility | 0-57% | 89% | 98% | 100% | 100% |

Transport is adequate to deliver goods

This indicator measures whether or not transport capacity is adequate for the maximum volume of commodities to be transported between levels. At the central level, transport was adequate.

| Indicator 5: Transport capacity is adequate | SC Level | Benchmark Results | | | | Malawi Results |
|--|----------|----------------------|-----------------|-----------------|----------------------|----------------|
| | | 4 th / No | 3 rd | 2 nd | 1 st /Yes | |
| 5.1 Is transport storage capacity at least 110% of the maximum volume to be transported? | Central | 57% | -- | -- | 43% | Y |

Managing and Monitoring

Quantity of goods is sufficient (no stock outs)

This indicator measures two aspects of stock sufficiency combined—whether stock was available on hand during the review period and whether or not the facility was able to fill all orders for lower level facilities. As the health facility does not serve any lower levels, it is measured on stock availability only. An item is considered as stocked out if an order is not able to be filled when placed. All NTD drugs supplied by the facility are considered in this measure.

In Malawi, stocks of four drugs were assessed. The central level supply chain reports sufficient stocks and the ability to fill all orders. The intermediate and health facility level performance is also strong. The intermediate level reports stock sufficiency at 88 percent, placing it in the 1st quartile with top performing supply chains, as do health facilities, reporting 92 percent stock sufficiency.

| Indicator 6: Stock levels are sufficient (no stock outs) | SC Level | Benchmark Results | | | | Malawi Results |
|--|----------|---------------------|-----------------|-----------------|----------------------|----------------|
| | | 4 th /No | 3 rd | 2 nd | 1 st /Yes | |
| 6.1 During the review period, were stock levels sufficient to supply | Central | 0% | 50% | 50% | 100% | 100% |

| | | | | | | |
|-------------------|-----------------|-------|-----|-----|------|-----|
| all lower levels? | Intermediate | 0-28% | 52% | 69% | 100% | 88% |
| | Health Facility | 0-29% | 44% | 56% | 76% | 92% |

Records are kept up to date

This indicator measures whether stock transactions are recorded and stock balances are updated within one working day of the transaction. At the Malawi central level, stock transactions were recorded and balances were updated in a time manner. This indicator was not measured below the central level because of minimal use of stock cards.

| Indicator 7: Stock records are kept current | SC Level | Benchmark Results | | | | Malawi Results |
|---|-----------------|---------------------|-----------------|-----------------|----------------------|----------------|
| | | 4 th /No | 3 rd | 2 nd | 1 st /Yes | |
| 7.1 Are all stock transactions (arrivals and issues) recorded and stock balances updated within one working day of the transaction? | Central | 24% | -- | -- | 76% | Y |
| | Intermediate | 0-59% | 78% | 90% | 100% | NA |
| | Health Facility | 8-43% | 65% | 87% | 100% | NA |

Inventory is accurate

This indicator measures whether results of a physical inventory count are within one percent of inventory recorded on stock records, based on counting a sample commodity. The sample size for the benchmark supply chains is thought to be one commodity per facility; however, the sample size cannot be verified. Data for the NTD supply chains include all NTD drugs managed by the program. Benchmark data were only available for the central level.

Few benchmark supply chains were found to have inventory accurate within one percent and Malawi's central level ranks among those few strong-performing supply chains, reporting inventory accuracy for the four drugs assessed. No intermediate and health facilities reported accurate inventory for the four drugs.

| Indicator 8: Inventory is accurate | SC Level | Benchmark Results | | | | Malawi Results |
|--|-----------------|---------------------|-----------------|-----------------|----------------------|----------------|
| | | 4 th /No | 3 rd | 2 nd | 1 st /Yes | |
| 8.1 Was physical inventory count found to be +/- 1% of inventory on stock records? [Y/N] | Central | 0-89% | -- | -- | 11% | Y |
| | Intermediate | -- | -- | -- | -- | -- |
| | Health Facility | -- | -- | -- | -- | -- |

Appendix 3: Field Results—Tanzania

To compare Tanzania's supply chain for NTD drugs to the benchmark, data from three different MDA campaigns were collected in May 2014 using the Supply Chain Assessment Tool.¹³ Data were collected at the central level Medical Stores Department, three zonal facilities (grouped below with intermediate facilities), eight intermediate level facilities and 15 health facilities.

The first MDA campaign is a community-based campaign that targets onchocerciasis, lymphatic filariasis and soli transmitted helminthes (STHs) by distributing ivermectin and albendazole to eligible populations. The second targets schistosomiasis and STH by distributing praziquantel and albendazole to all eligible school-aged children. The third program targets trachoma, distributes Zithromax in endemic districts and is executed vertically by trachoma program.

Planning Indicators

Standard Operating Procedures for logistics exist

The central level facilities report having SOPs in place and having copies of it at the facility. The only training materials are powerpoint presentations used during the annual cascade training.

| Indicator 1: SOPs for logistics exist | SC Level | Benchmark Results | | | | Tanzania Results |
|---|----------|---------------------|-----------------|-----------------|----------------------|------------------|
| | | 4 th /No | 3 rd | 2 nd | 1 st /Yes | |
| SOPs for logistics exist | | | | | | |
| 1.1 Is there a Standard Operating Procedures (SOP) manual? [Y/N] | Central | 47% | -- | -- | 53% | Y |
| 1.2 If there is an SOP manual, does the facility have a copy of it? [Y/N] | Central | 47% | -- | -- | 53% | Y |
| 1.3 Are logistics training materials clear and correct? [Scale 0-100] | Central | 0-50% | 75% | 100% | 100% | 50% |

Data-based forecast method is used

The second indicator measures the use of four evidence-based methods in developing forecasts—whether a standard method is used, if a target population is used, if coverage data is used, if drug balance data is used and if drug wastage data is used.

Tanzania's central and intermediate level supply chains report use of two of four evidence-based methods, placing them in the bottom quartile of performance.

| Indicator 2: Data-based forecast method is used | SC Level | Benchmark Results | | | | Tanzania Results |
|--|-----------------|---------------------|-----------------|-----------------|----------------------|------------------|
| | | 4 th /No | 3 rd | 2 nd | 1 st /Yes | |
| 2.1 Is a data-based forecast method used? (Measures the percentage of four evidence-based forecasting methods in use at each facility surveyed.) [Scale 0-100] | Central | 0-75% | 100% | 100% | 100% | 50% |
| | Intermediate | 0-50% | 65% | 93% | 100% | 50% |
| | Health Facility | -- | -- | -- | -- | -- |

Distribution

Deliveries are scheduled in advance and done according to plan

Tanzania's central level supply chain reports sending a distribution plan in advance and completing shipments according to the plan. At the intermediate level, 38 percent of facilities report sending distribution plans while 67 percent report completing shipments as planned. Health facility level supply chains report better performance than the intermediate level, with 58 percent sending distribution plans and 100 percent of those facilities delivering as planned.

| Indicator 3: Delivery is according to plan | SC Level | Benchmark Results | | | | Tanzania Results |
|--|-----------------|---------------------|-----------------|-----------------|----------------------|------------------|
| | | 4 th /No | 3 rd | 2 nd | 1 st /Yes | |
| 3.1 During the period under review, did the issuing store send a distribution plan or notification to each receiving store identifying dates for the delivery? [Y/N] | Central | 47% | -- | -- | 53% | Y |
| | Intermediate | 0-10% | 29% | 44% | 100% | 38% |
| | Health Facility | -- | -- | -- | -- | 58% |
| 3.2 If a distribution plan was in place, were the actual number of deliveries within +/-20% of plan? | Central | 71% | -- | -- | 29% | Y |
| | Intermediate | 0-2% | 20% | 40% | 100% | 67% |
| | Health Facility | -- | -- | -- | -- | 100% |

Warehouse is adequate to receive goods

This indicator measures whether or not the capacity of the warehouse is adequate to store the maximum volume of commodities to be stored. At all levels, warehouse capacity was adequate.

| Indicator 4: Warehouse capacity is adequate | SC Level | Benchmark Results | | | | Tanzania Results |
|---|-----------------|---------------------|-----------------|-----------------|----------------------|------------------|
| | | 4 th /No | 3 rd | 2 nd | 1 st /Yes | |
| 4.1 Is warehouse capacity at least 110% of the maximum volume to be stored? | Central | 35% | -- | -- | 65% | Y |
| | Intermediate | 0-24% | 70% | 87% | 100% | 100% |
| | Health Facility | 0-57% | 89% | 98% | 100% | 100% |

Transport is adequate to deliver goods

This indicator measures whether or not transport capacity is adequate for the maximum volume of commodities to be transported between levels. At the central level, transport was adequate.

| Indicator 5: Transport capacity is adequate | SC Level | Benchmark Results | | | | Tanzania Results |
|--|----------|---------------------|-----------------|-----------------|----------------------|------------------|
| | | 4 th /No | 3 rd | 2 nd | 1 st /Yes | |
| 5.1 Is transport storage capacity at least 110% of the maximum volume to be transported? | Central | 57% | -- | -- | 43% | Y |

Managing and Monitoring

Quantity of goods is sufficient (no stock outs)

This indicator measures two aspects of stock sufficiency combined—whether stock was available on hand during the review period and whether or not the facility was able to fill all orders for lower level facilities. As the health facility does not serve any lower levels, it is measured on stock availability only. An item is considered as stocked out if an order is not able to be filled when placed. All NTD drugs supplied by the facility are considered in this measure.

At all levels, Tanzania places in the top quartile when compared to benchmark supply chains.

| Indicator 6: Stock levels are sufficient (no stock outs) | SC Level | Benchmark Results | | | | Tanzania Results |
|--|-----------------|---------------------|-----------------|-----------------|----------------------|------------------|
| | | 4 th /No | 3 rd | 2 nd | 1 st /Yes | |
| 6.1 During the review period, were stock levels sufficient to supply all lower levels? | Central | 0% | 50% | 50% | 100% | 100% |
| | Intermediate | 0-28% | 52% | 69% | 100% | 75% |
| | Health Facility | 0-29% | 44% | 56% | 76% | 75% |

Records are kept up to date

This indicator measures whether stock transactions are recorded and stock balances are updated within one working day of the transaction. Results for this indicator were not available for the central level in Tanzania. At the intermediate level, half of facilities reported keeping records current by updating them within one working day of a transaction, while at the health facility level, 67 percent of facilities at this level reporting keeping records current.

| Indicator 7: Stock records are kept current | SC Level | Benchmark Results | | | | Tanzania Results |
|---|-----------------|---------------------|-----------------|-----------------|----------------------|------------------|
| | | 4 th /No | 3 rd | 2 nd | 1 st /Yes | |
| 7.1 Are all stock transactions (arrivals and issues) recorded and stock balances updated within one working day of the transaction? | Central | 24% | -- | -- | 76% | -- |
| | Intermediate | 0-59% | 78% | 90% | 100% | 50% |
| | Health Facility | 8-43% | 65% | 87% | 100% | 67% |

Inventory is accurate

This indicator measures whether results of a physical inventory count are within one percent of inventory recorded on stock records, based on counting a sample commodity. The sample size for the benchmark supply chains is thought to be one commodity per facility; however, the sample size cannot be verified. Data for the NTD supply chains include all NTD drugs managed by the program. Benchmark data were only available for the central level.

Tanzania's central level supply chain performance aligns with the vast majority of the benchmark supply chains in that physical inventory is *not* accurate when compared to records for the commodities assessed.

| Indicator 8: Inventory is accurate | SC Level | Benchmark Results | | | | Tanzania Results |
|--|-----------------|---------------------|-----------------|-----------------|----------------------|------------------|
| | | 4 th /No | 3 rd | 2 nd | 1 st /Yes | |
| 8.1 Was physical inventory count found to be +/- 1% of inventory on stock records? [Y/N] | Central | 0-89% | -- | -- | 11% | N |
| | Intermediate | -- | -- | -- | -- | -- |
| | Health Facility | -- | -- | -- | -- | -- |

References

Eghan, K., and D. G. Daniel. 2012. *Assessment of the Neglected Tropical Diseases Pharmaceutical Management System in Uganda*. Submitted to the United States Agency for International Development by the Strengthening Pharmaceutical Systems (SPS) Program. Arlington, VA: Management Sciences for Health.

Eghan, K., and D. G. Daniel. 2011. *Rapid Assessment of the NTD Pharmaceutical Management System in Cameroon*. Submitted to the United States Agency for International Development by the Strengthening Pharmaceutical Systems (SPS) Program. Arlington, VA: Management Sciences for Health.

END in Africa. 2012. *Supply Chain Management Capacity Building Plan: Neglected Tropical Diseases Supply Chain Assessments and Capacity Building Plans*. Arlington, VA: END in Africa.

END in Africa. 2012. *Ghana: Neglected Tropical Diseases Supply Chain Assessment*. Arlington, VA: END in Africa.

Nersesian, Paula, P.B.L. Ndao. 2012. *Sierra Leone: Neglected Tropical Diseases Supply Chain Assessment*. Arlington, VA: END in Africa.

Oyediran, Kola' A., L. Rosenblum, K. Falayajo, V. Ajulo, and D. Michael. 2014. *Cross River State, Nigeria: Essential Drugs Program Logistics System Assessment - Quantitative and Qualitative Results from the LIAT and the LSAT*. Arlington, Va.: USAID | DELIVER PROJECT, Task Order 4.

The Fritz Institute. 2008. *Assuring Effective Supply Chain Management to support UNHCR's Beneficiaries. Policy Development and Evaluation Service*. Geneva, Switzerland: United Nations High Commissioner for Refugees.

USAID | DELIVER PROJECT. 2008. *Logistics Indicators Assessment Tool (LIAT)*. Arlington, Va.: USAID | DELIVER PROJECT, Task Order 1.

World Health Organization. 2010. *Effective Vaccine Management Assessment Tool (EVM)*. Geneva, Switzerland: World Health Organization.

World Health Organization. 2012 (unpublished). *Survey on the supply chain of selected NTD medicines*. Geneva, Switzerland: World Health Organization.

World Health Organization. 2013. *Sustaining the drive to overcome the global impact of neglected tropical diseases: second WHO report on neglected diseases*. Geneva, Switzerland: World Health Organization.

Annex 3 – Segmentation Analysis

Segmentation Analysis for Supply Chains for Neglected Tropical Diseases

December, 2014

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List of Acronyms

| | |
|------|---|
| CDD | Community Drug Distributors |
| EPI | Expanded Programme on Immunization |
| FLHW | Frontline Health Workers |
| HAS | Health Surveillance Assistants |
| HC | Health Center |
| HF | Health Facility |
| ILS | Integrated Logistics System |
| ITN | Insecticide-Treated Nets |
| MDA | Mass Drug Administration |
| MEDA | Mennonite Economic Development Associates |
| MSD | Medical Stores Department |
| NTD | Neglected Tropical Disease |
| PSI | Population Services International |
| SDP | Service Delivery Point |
| SIA | Supplemental Immunization Activities |
| WHO | World Health Organization |

Executive Summary

Segmentation is a commercial sector approach for determining the right mix of supply chain policies for delivery of a diverse set of products. The underlying idea is that supply chain strategies and procedures should be tailored to the commodities and health services they support. When applied to Neglected Tropical Disease (NTD) last mile supply chains, segmentation can help determine whether it is feasible or appropriate to integrate all or part of the NTD supply chain into existing public health supply systems.

In support of global efforts to strengthen last mile NTD supply chains and meet the London Declaration on Neglected Tropical Diseases goals to control and eliminate NTDs, this report presents a segmentation framework that is applicable to NTD supply chains, and applies the framework in Malawi and Tanzania. Report authors then discuss extending this analysis to other country NTD supply chains, based on global guidance. A summary of findings is below.

The greatest opportunities for NTD supply chains to integrate are with bednet campaigns, nutrition campaigns, and immunization campaigns, as opposed to supply chains that require routine re-supply of commodities (such as anti-retroviral therapy or essential medicine supply chains). This is because the processes and infrastructure required for periodic campaigns differ significantly from those required for routine re-supply operations.

In considering “piggybacking” on these supply chains, it need not be an all-or-nothing decision.

Opportunities for NTD programs to leverage existing capacity can occur at specific tiers and/or geographies and could theoretically include full managerial integration or simply sharing of infrastructure. Specifically, findings from Malawi and Tanzania demonstrate that while NTD and non-NTD campaign programs may include the community level, they are not always held at the same service delivery locations or conducted at the same time.

In considering “piggybacking”, local considerations must be taken into account. Due to differences in timing (i.e. during the school year for school-based programs, before the rainy season, after the harvest), geographic endemicity, and concerns regarding treatment efficacy and adverse drug reactions, it may not be possible to merge all NTD campaigns, much less integrate them completely with another campaign program.

One key area for potential integration is distribution. Other campaign supply chains may have distribution assets that are underutilized during certain times of the year. If the timing of other campaigns complements those of the NTD program, the NTD program may be able to access these assets and simply fund their operating costs, thereby avoiding the need to purchase and maintain dedicated assets. For example, in Malawi, one of the NTD control program managers has an agreement with the Director of the Expanded Programme on Immunization (EPI) program to borrow EPI vehicles when they are not otherwise being used. Under this arrangement, the NTD control program funds the operating costs of the vehicles.

Many NTD programs are already “piggybacking” on elements of other public and private sector supply chains. In addition to utilizing EPI transport resources in Malawi, the NTD program also relies on the Central Medical Stores Trust and private sector warehouses to store NTD drugs.

While ad hoc, many of these solutions help to fill critical supply chain gaps. **Using segmentation analysis, countries can identify opportunities for integration or resource sharing, and weigh the costs and benefits of each to find the most appropriate solution.**

Segmentation is not a “one-and-done” proposition. Within a specific country context, it is important to carefully investigate programs to better understand their potential and capacity to support current gaps in the NTD supply chain, while considering the likely challenges and risks to co-implementation. In particular, many of these systems and processes date back several decades, and thus will require significant advocacy and policy work, guided by evidence presented in the segmentation analysis, in order to be successful.

Introduction

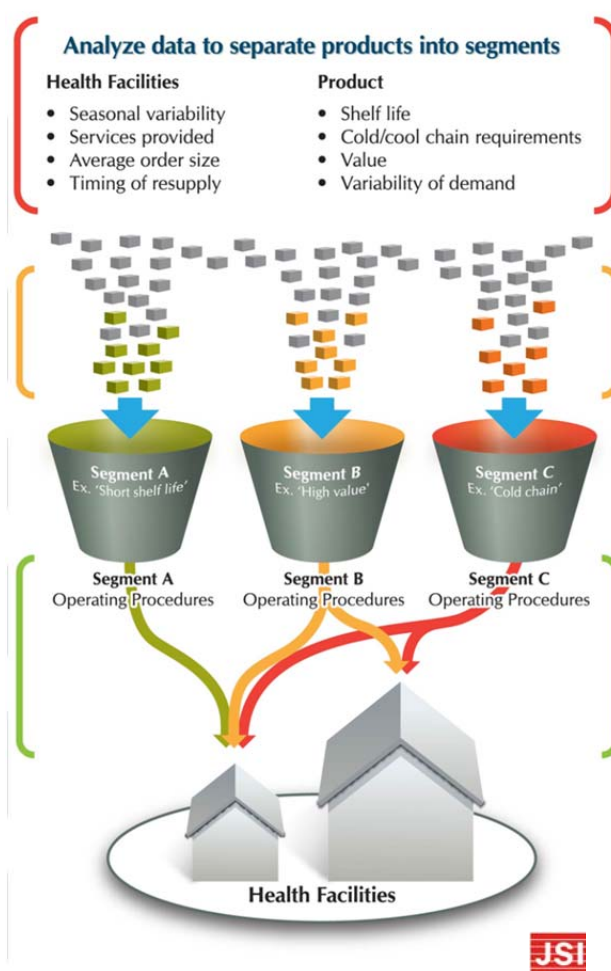
Strengthening supply chain performance by adding an under-performing program to the operations of a better-performing system should be considered carefully when pursuing rapid performance improvements. Country contexts may impact the feasibility and potential benefits of this approach, but it is worthwhile to analyze the potential for integrating product streams either by consolidating assets and management or having one set of commodities “piggyback” on the supply chain for another. This analysis must be conducted carefully to ensure that the system to be used to deliver an expanded set of commodities is well suited to an expanded scope of work and to meeting any unique requirements of the additional program.

Segmentation is a commercial sector approach for determining the right mix of supply chain policies for delivery of a diverse set of products. Segmentation arose from the understanding that a single set of supply chain operating policies cannot efficiently and effectively manage a group of products that have inherently different requirements. For example, a grocery chain in a developed economy may be responsible for ensuring the in-store availability of both fresh produce and bulk cereals. In order to cost-effectively manage both, the company may elect to implement separate procedures to handle these two product groups. The company may have frequent small shipments of the short shelf-life produce and large, less frequent shipments of the bulk cereals. These distinct procedures would have been chosen to directly support the logistics characteristics of these two product groups as well as the buying patterns of customers (Fisher 1997). Fundamentally, segmentation helps to manage the inherent tradeoff between *responsive* and *efficient* strategies, aligning supply chain policies with the requirements of customers and commodities.

In terms of health commodities, segmentation analysis is the process of analyzing data on customers' needs and products' characteristics to determine which segments – or groupings of products – make most sense to procure, store or deliver together (JSI 2013). This process is shown in Figure 1 above.

Given the breadth of commodities and customers handled, developing country healthcare supply chains are good candidates for segmentation. For example, in 2006 Zambia designed and implemented a

Figure 1. Segmentation Analysis



segmented approach to resupplying laboratory commodities. Using this approach, separate ordering and delivery procedures for fast and slow-moving products helped to achieve both rapid delivery of reagents (which have a short shelf life) and more efficient management of slower-moving products (JSI 2013).

Last-mile supply chains for Neglected Tropical Disease (NTD) programs present another distinct perspective on segmentation. Currently NTD supply chains display the following characteristics:

- NTD supply chains are predominantly operated as periodic mass drug administrations (MDAs) to endemic populations and geographies rather than as routine health commodities. As such, they do not need to maintain constant levels of inventory across the system but instead require periodic peaks of warehousing, transportation, and management capacity.
- MDAs usually involve community-level volunteers to support dispensing of drugs to recipients, as well as other tasks.
- MDAs support delivery of at most six relatively stable drugs that do not have special handling requirements such as active cooling. In addition, these drugs have long shelf lives, which means that specialized warehousing or distribution capacity is not required.
- NTD programs typically rely on the district level of the health system to implement MDAs, meaning that the NTD supply chain must deliver commodities to this level. Other commodity programs often bypass the district level in order to reduce in-country inventory pipelines and reduce decentralized order fulfillment capacity requirements.
- NTD supply chains require distribution capacity serving the community level of the health system.
- NTD supply chains are based on top-down estimates of commodity requirements rather than bottom-up requisitions. As such, they do not have a critical need for detailed data on quantities dispensed, quantities on hand, and losses and adjustments.
- Drugs delivered through MDAs are provided at a global level by major pharmaceutical corporations with World Health Organization (WHO) coordination for quantification, order verification, and placement.
- There is variability in the timing and degree of integration between MDAs for different NTDs. In addition, in many countries the various NTD control programs continue to act without managerial or operational integration.
- Resources and infrastructure for NTD programs in general, and NTD supply chains in particular, are limited compared with many other public health programs.
- The number of distinct MDAs and the number of diseases treated during MDAs varies depending on the national burden of disease as well as the level of effective integration between respective NTD programs.

This report first presents a segmentation framework that is applicable to NTD supply chains. It then applies the framework in Malawi and Tanzania, using data collected through in-person surveys that followed the structure of the segmentation framework. In each country, survey teams visited central

level partners responsible for management of national bednet and immunization programs. These two programs were targeted because of their campaign focus and national coverage. Additional public health supply chain systems were not included due to resource and time constraints and the conclusion that routine systems would not offer viable integration opportunities with NTDs. Report authors then discuss extending this analysis to other country NTD supply chains, based on global guidance.

Segmentation Framework for Last Mile Supply Chains: Identifying Systems that Could Support NTDs

Following the basic premise that a supply chain's design should purposefully accommodate the commodities and customers it serves, conducting a segmentation analysis requires an understanding of the commodities themselves as well as the service delivery characteristics that impact demand. These parameters comprise a basic framework to help decision-makers understand the true supply chain requirements of NTD programs as well as identify the other last mile supply chains that are most appropriate for potential NTD integration.

The framework includes qualitative and quantitative indicators and is summarized in Table 1 below. Significant knowledge of the local NTD system and a general understanding of supply chain management are required to answer framework questions and analyze results. Stakeholders should then answer the framework prompts for those supply chains to better understand the possible benefits or challenges of integration.

Table 1. Segmentation Analysis Framework

| Qualitative Indicators | Quantitative Indicators |
|---|--|
| Commodities: <ul style="list-style-type: none"> • Shelf life • Special handling | <ul style="list-style-type: none"> • Total cubic volume of annual demand • Variance of annual demand • Frequency of in-country delivery |
| Customer/Demand at Service Delivery Point: <ul style="list-style-type: none"> • Predictability of demand • Seasonality of demand • Where products dispensed to users • Capacities of service providers | |

Qualitative Indicators

Qualitative indicators include those related to commodities (each commodity handled within the systems of interest), customers (service delivery points), and demand, all of which affect capacity requirements of a supply chain.

Commodities

- **What is the shelf life once received in-country?** Commodities must be delivered and consumed by health system users within their viable life. This requires that in-country pipelines be shorter than the shelf life at central level receipt. Most essential medicines and public health commodities have shelf lives of between two and five years, but commodities with particularly

short lives (such as laboratory reagents) may need shorter pipelines. Product manufacturers, suppliers, and procurement specialists can provide this information for specific commodities.

- **Are there special handling considerations?** Many commodities in tablet or suspension form require storage at temperatures above freezing but below 25 degrees Celsius, which in tropical climates requires some form of active temperature management. Others may require dedicated assets and policies for cold chain management. Product manufacturers, suppliers, and procurement specialists can provide this information for specific commodities.

Customer/Demand at Service Delivery Level

- **Is demand predictable or unpredictable?** Achieving product availability targets for commodities with unpredictable demand requires higher levels of safety stock with routine monitoring of demand and responsive resupply. Campaign-based programs have highly predictable demand, and can be accommodated with pre-planned quantities, (or “pushed”), distribution. Program planners and system staff can render qualitative judgments about demand predictability.
- **Is demand seasonal or constant?** Periodicity of demand influences the level of effort and capacity requirements throughout the supply chain. Campaign-based programs only require distribution capacity for specific periods during the year, while routine health services require continuous cycles of order fulfilment and delivery.
- **At what service delivery levels and at which geographic locations are the products dispensed to users?** Adding new delivery locations or levels to an existing system may require additional effort beyond that of delivering higher volumes, as delivery modes, transport contracts, and delivery procedures should reflect the commodity destinations.
- **What capacities do service providers have to record and submit consumption or stock status information?** The educational levels, specialization, and access to resources of staff involved in stock management at the service delivery level may guide the approach to logistics data collection. Program planners, augmented by information collected through direct interactions with service delivery level staff can provide needed information.

Quantitative Indicators

Quantitative indicators include those related to demand which affect supply chain capacity requirements. Ideally these should also be incorporated into the segmentation process, but stakeholders may not have enough data to include these indicators, in which case they should be approximated qualitatively.

- **What is the total cubic volume of annual demand?** If this can be determined by product, it can provide an estimate of the total annual storage and distribution requirements of the program, and can demonstrate whether total volume is largely driven by a subset of products. When comparing different programs, total cubic volume can illustrate whether inclusion of one program’s commodities in the other represents a drastic increase in capacity requirements. Cubic volume can be estimated by multiplying known quantities for distribution (from historical records) with per unit or per carton cubic volumes (typically obtainable from the supplier or also

from the USAID | DELIVER PROJECT at deliver.jsi.com). Knowing the cubic volume per individual period is also helpful.

- **What is the variance of annual demand?** Demand variance can be estimated quantitatively with access to sufficient historical records. For routine resupply systems, calculating the standard deviation of demand per period can provide the likelihood that demand will fall within a certain range, and inform comparison between multiple programs. Adding a set of commodities with highly variable demand to a system with low variability, especially if that demand is considered unpredictable, could cause challenges.
- **How frequently are products delivered through the in-country pipeline?** Historical records and knowledge of current system designs can show the level of effort required in terms of order fulfilment and delivery frequency.

Results Interpretation – How Do Responses Inform Decision-Making?

These indicators, as they relate to current NTD distribution systems and target systems for potential inclusion of NTD commodities, provide a sense of the strategic and operational compatibility between the two. Key questions to ask before considering a complete integration include:

- Would the overall strategies and approaches of the target systems support the supply chain goals of NTD programs?
- Would inclusion of NTD commodities in another system fill currently underutilized assets or require new investments?
- Are there specific elements of the target system that could be leveraged to support NTD commodity management?

Integration can also potentially occur for specific functions in isolation, as integration of certain functions may be easier and more beneficial than others (Yadav 2013). For example, stakeholders could decide to preserve an independent information system for NTD commodities while integrating last mile storage and delivery with another system, given the relative ease of integrating those functions. These questions can be considered once potential candidate systems have been identified, and should be answered for all NTD and candidate systems to the degree possible.

- What is the current distribution structure between the central level and last mile?
- Do distribution timings coincide with or complement one another?
- How would distribution timings affect storage and distribution capacities if commodities were integrated?
- Is there available capacity that could be utilized or contracted, or would new assets have to be purchased?
- If central level storage is to be integrated, how do national receipt timings coincide with or complement one another?

Field Results: Malawi

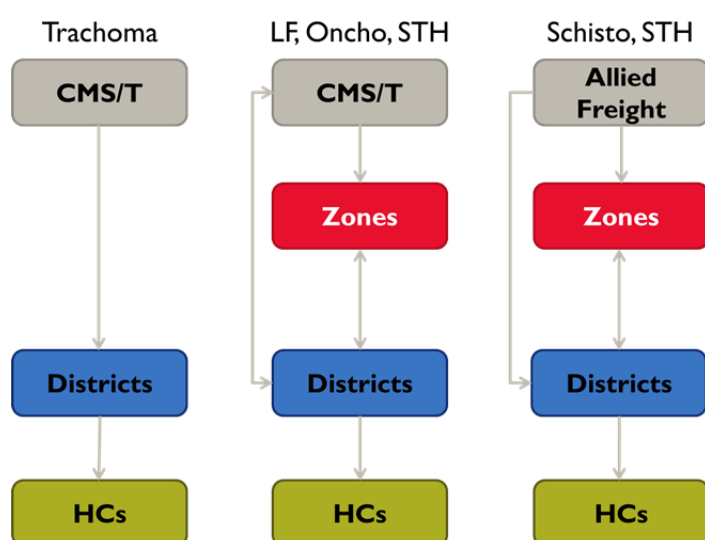
NTD Programs

Malawi's health system operates three separate MDA-driven supply chains for NTDs (see Figure 2).

These include MDAs for:

- trachoma, delivering Zithromax capsules
- lymphatic filariasis, onchocerciasis, and soil transmitted helminthes, delivering albendazole and ivermectin
- schistosomiasis, delivering praziquantel and albendazole

Figure 2. Distribution Channels for NTD drugs in Malawi



Commodities

- Shelf life: Most of the relevant products have between two and five years of shelf life when properly stored (WHO 2014).
- Special handling considerations: None besides typical temperature requirements for tablets and capsules.

Customer/Demand at Service Delivery Level

- Predictability of demand: Commodity distribution through annual MDAs with variation only occurring at the lowest levels of the system during implementation.
- Seasonality of demand: 'Demand' timings driven by campaign cycles, which only occur once over several weeks each year.
- Geography and service delivery level of product dispensing: All districts included, with products being delivered to the health center level before distribution to Health Surveillance Assistants (HSAs) who dispense commodities in the community.

- Service provider capacity for logistics reporting: HSAs have limited capacity in this area, currently only coverage and population data are recorded.

Interpretation

Malawi's NTD supply chains are driven by short-term annual MDAs, meaning that capacity requirements are generally predictable but present a seasonal spike. A highly responsive, requisition-based delivery approach is not required, but finding storage and distribution capacity on a short term basis is a challenge. Based on this, only last mile supply chains with campaign-based delivery were surveyed for potential integration with NTD supply chains. Opportunities for integrating with established supply chains could include systems that have excess capacity at health system tiers on the way to the health center level, or systems that have a seasonal dip in capacity requirements that could be complemented by MDA timings. Alternatively, a system that has well-established contracts for storage and distribution could potentially increase its requirements rapidly and efficiently.

Bednet Distribution Campaigns

Population Services International (PSI) is a private health organization which implements health projects in developing countries. In Malawi, PSI has responsibility for last mile distribution of insecticide-treated nets (ITNs) as part of its antimalarial programs. In total this might include approximately 3.4 million ITNs per year, donated by the Global Fund for AIDS, TB, and Malaria and the United States President's Malaria Initiative, and distributed both routinely and as part of an annual campaign.

Commodities

- Shelf life: Up to five years depending on the manufacturer.
- Special handling considerations: Although relatively bulky, ITNs do not require additional temperature control. It should be determined whether local policies require that storage spaces or vehicle beds can handle drugs for oral consumption without previous cleaning.

Customer/Demand at Service Delivery Level

- Predictability of demand: Quantities for delivery are predetermined based on HSA estimates of pregnant women and women with children under five, which should be relatively stable year to year.
- Seasonality of demand: Campaigns occur once per year and are deliberately timed to precede the influx of mosquitoes during the rainy season.
- Geography and service delivery level of product dispensing: Bednets are delivered to schools, community events, and health centers, particularly antenatal care clinics. Geographically, bednets are distributed across the country, as every household in Malawi is technically eligible for the program.
- Service provider capacity for logistics reporting: HSAs ensure final delivery to the community with Ministry of Health supervision.

Interpretation

Although the last mile bednet supply chain for PSI does not include the district level in the distribution chain, it does cover much of the country down to the health center level. According to PSI staff, renting storage space is relatively easy in Malawi, as there is periodically underutilized capacity in the local tobacco industry. It would be important to ensure, however, that pharmaceutical-grade warehousing standards can be established to ensure that the basic storage requirements of these commodities are met. Currently, PSI operations also support storage of commodities used by other health projects. Private sector distribution capacity is also reported to be available, although careful contract management would be required to ensure performance. In summary, it may be possible to leverage potential storage lessons and resources from these bednet campaigns, if not the physical structures themselves.

Nutrition and Vaccination Campaign

Malawi's health system delivers supplemental immunization activities (SIAs) to increase coverage beyond the coverage achieved by routine immunization. Specifically, this includes measles and polio vaccines, injection materials, vitamin A tablets and de-worming tablets. Vaccines are handled by the vertical Expanded Programme on Immunization (EPI) distribution system, going from the national EPI store to regional and then district EPI stores (or sometimes EPI refrigerators at the District Medical Store). Along the way they are transported on EPI trucks until delivery to health centers on district vehicles. Nutrition commodities effectively "piggyback" on these campaigns by using EPI storage and distribution assets and paying for required fuel.

Commodities

- Shelf life: Both the measles and oral polio vaccine have a shelf life of 24 months when properly stored (WHO 2014).
- Special handling considerations: The measles vaccine requires sustained storage temperatures of between two and eight degrees Celsius. This requires dedicated cold chain storage capacity and coolers for transport or refrigerated trucks. The oral polio vaccine only requires storage at 20 degrees Celsius.

Customer/Demand at Service Delivery Level

- Predictability of demand: Campaign vaccine quantities are ordered separately from vaccines for routine immunization, and target children under five who were not reached by routine immunization, making the quantities relatively predictable.
- Seasonality of demand: SIA campaigns only occur once every two to three years because routine immunization coverage is relatively high in Malawi. The campaigns occur during the dry season.
- Geography and service delivery level of product dispensing: Commodities are delivered to health centers throughout the country as well as to outreach clinics and temporary sites.
- Service provider capacity for logistics reporting: HSAs dispense commodities, while EPI staff track and manage inventory at the EPI storage locations.

Interpretation

Vaccine campaigns already share some capacity with NTDs, namely the use of EPI trucks at the national level by the schistosomiasis program. Additionally, in some cases the district NTD focal person is also the district EPI coordinator, providing shared visibility across the two programs at that level. While the EPI cold chain capacity is not required for NTDs, the campaign approach and shared destinations does facilitate straightforward sharing of transport capacity as long as the NTD program provides operating costs and NTD volumes do not exceed EPI capacities.

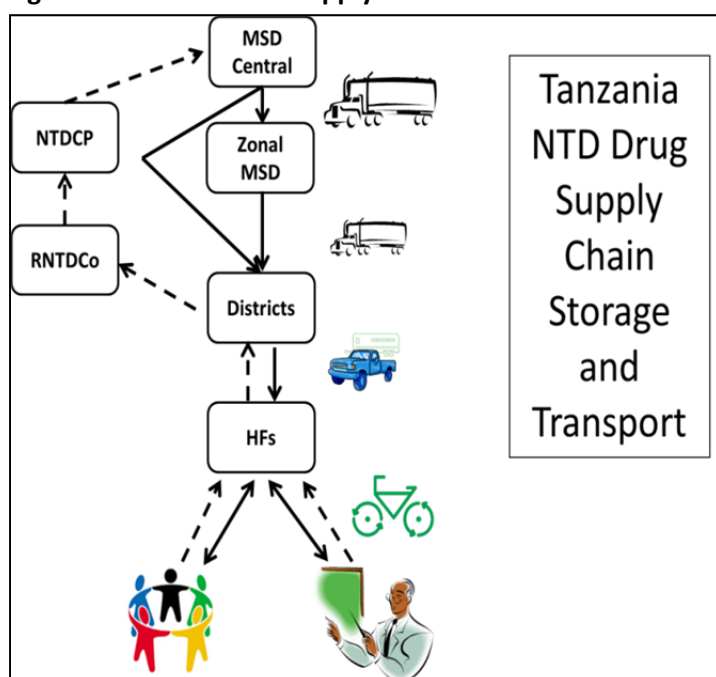
Field Results: Tanzania**NTD Programs**

Tanzania's NTD control programs deliver five drugs through annual MDAs. The NTD program is already "piggybacking" on the existing public health supply chain, as the delivery of NTD drugs occurs partly through Tanzania's integrated national supply chain. First, NTD drugs go through the Medical Stores Department (MSD) central and zonal stores (which handle other commodity programs), and are then delivered to districts and then health facilities, where they are picked up by community-level health workers for ad-hoc transport to schools and communities (see Figure 3). The central level delivers to zones, zones deliver to districts and so on based on distribution lists provided by the national NTD office. The timing is set in advance and drugs are distributed within weeks of the start of the campaign. From the district level the NTD drugs are delivered to health facilities using District Medical Office vehicles and resources. The delivered drugs are Zithromax (tablets and powder for oral suspension), mectizan, praziquantel, and albendazole.

The cycle of deliveries from MSD through the national supply chain occurs in line with MDA timings rather than through the predominant requisition calendar for commodities routinely supplied through the Integrated Logistics System (ILS). NTD distribution plans are based on centrally-determined, population-based algorithms and are designed to meet timings of the MDAs, unlike the ILS, which is a consumption-based system whereby facilities order supplies based on the total product consumed during the reporting period.

Commodities

- Shelf life: Most of the relevant products have between two and five years of shelf life when properly stored (WHO 2014).
- Special handling considerations: None besides typical temperature requirements for tablets and capsules.

Figure 3. Tanzania NTD Supply Chain Product Flow**Customer/Demand at Service Delivery Level**

- Predictability of demand: Forecasts are dependent on population data (i.e. number of school-aged children in a given district) and although several challenges regarding estimating annual populations for each catchment area have been noted, population-based demand is relatively predictable and accurate.
- Seasonality of demand: Distribution capacity requirements are driven by the annual MDA campaigns, so are relatively predictable.
- Geography and service delivery level of product dispensing: Nation-wide but depending upon endemicity in each district and community, not throughout the entire country (i.e., not all districts are included depending on epidemiology) therefore less predictable
- Service provider capacity for logistics reporting: MDAs rely on volunteer Community Drug Distributors (CDDs) and Frontline Health Workers (FLHWs). CDDs in particular are not fully trained and are responsible for completing several complex reports, leading to limited data quality.

Interpretation

Tanzania's NTD MDAs present predictable, annual distribution capacity requirements for the public health system. These MDAs require that commodities reach health facilities (and subsequently villages) across the country. Although Tanzania's NTD drugs are already integrated into the broader public health supply chain at the central and zonal levels of the supply chain, distribution capacity at lower levels could be strengthened through additional coordination with other systems when capacity exists and NTD performance is below expectations. Partners should consider other similarly timed, campaign-

driven systems with excess (or easily expanded) capacity that support the lowest levels in a way that is compatible with NTD MDAs, or systems with under-utilized capacity during MDAs.

National Malaria Control Program Bednet Distributions

Mennonite Economic Development Associates (MEDA) manages country-wide distribution of ITNs intended for all Tanzanians. The nets are produced locally in Arusha and delivered directly from the factory to communities across the country, using third-party distributors to manage transportation.

Commodities

- Shelf life: Up to five years depending on the manufacturer
- Special handling considerations: No temperature restrictions, but local policies may require that storage and transport equipment be cleaned before handling drugs for oral consumption.

Customer/Demand at Service Delivery Level

- Predictability of demand: High, as quantities are based on household enumerations, although coverage can be constrained by funding.
- Seasonality of demand: Low, as distributions are not campaign-driven. Instead, distributions occur gradually throughout the year, covering each community once.
- Geography and service delivery level of product dispensing: Per the availability of funds for commodity purchase, bednets are delivered to all communities in the country.
- Service provider capacity for logistics reporting: Village and Ward Executive officers are responsible for receiving and dispensing bednets to the community, and should have basic capacity for reporting quantities dispensed.

Interpretation

The system used by MEDA to deliver bednets in Tanzania does not offer many opportunities for integration with NTD delivery. Although deliveries extend to the community level annually, they roll-out gradually throughout the year, meaning that deliveries would only overlap with MDA timings in a few areas in the country. Additionally, the origin of the bednet deliveries (Arusha) does not match the point of origin for the NTD supply chain.

Immunization and Vaccination Development Program

Tanzania implements several campaigns to support immunization coverage across the country. To reach children not covered by routine immunization services, Tanzania implements a National Immunization Week, a Child Health Day, and a National Immunization Day/Measles campaign. These campaigns deliver six vaccines: the pentavalent vaccine, rotatrim, PCV, BCG/measles, OPV/polio, and tetanus toxoid. Commodities are delivered to districts through a national supply chain for routine immunization (which includes national and subnational order fulfilment and delivery), and then campaign quantities are drawn from remaining stocks already held at health facilities. This means that capacity mobilization for the immunization campaigns predominantly occurs at the lowest levels of the system.

Commodities

- Shelf life: Most of the relevant products have between two and five years of shelf life when properly stored (WHO 2014).
- Special handling considerations: The pentavalent vaccine, rotatrim, PCV, and BCG vaccines should be kept in cold storage (between 2 and 8 degrees Celsius), while the OPV and tetanus toxoid only need to be kept at 20 degrees Celsius (WHO 2014).

Customer/Demand at Service Delivery Level

- Predictability of demand: Relatively high – the campaigns serve to vaccinate the small percentage of children not covered by routine immunization services.
- Seasonality of demand: High – these campaigns only occur during other pre-scheduled campaigns, and they occur at the same times across the country.
- Geography and service delivery level of product dispensing: The campaign vaccinations occur across the country at health centers and community events.
- Service provider capacity for logistics reporting: High – trained FLHWs administer the vaccinations, though those that occur in the community must take place without electronic resources for recordkeeping.

Interpretation

The supply chain for vaccine campaigns offers some potential overlap of requirements with NTDs, particularly at the health facility and community levels of the supply chain. While one of the periods for immunization campaigns occurs during Child Health Week, this may not be the case for NTD campaigns, meaning that vaccine distribution capacity may be underutilized outside of their campaign timings. While the cold chain capacity that supports vaccines is not needed for NTDs, at the lowest levels of the supply chain vaccines might travel in passive coolers inside of larger vehicles, offering the opportunity to transport other commodities. This idea is supported by recent analyses in Tunisia and Senegal, which focused on identifying opportunities to integrate elements of immunization supply chains with other public health supply chains. The study found that from an immunization perspective, integration of transportation at the last mile was feasible and would lead to more effective route planning and vehicle utilization. However, the study cautioned that such decisions would require extensive changes in deeply entrenched processes and practices, so would likely face resistance by relevant stakeholders. (Yadav P. et al, 2013)

Global Guidance for NTD Programs: Using Segmentation to Identify Integration Opportunities

While the prior examples illustrate segmentation analysis based on specific country examples, the segmentation framework can provide general insight for considerations of NTD supply chain strengthening globally, and for applying this analysis in additional countries.

Table 2 below applies the segmentation framework to NTD programs in general, with the intention of identifying the most appropriate systems for integration at the country level.

Table 2. Qualitative commodity and costumer/demand characteristics for NTD segmentation

| Commodities | |
|---|---|
| Shelf life: | Normally between 3 and 5 years given adequate storage conditions |
| Special handling considerations: | None beyond normal room temperature requirements typical of most essential medicines |
| Customer/Demand at Service Delivery Level | |
| Predictability of demand: | High – once forecasted based on demographic and incidence data, ‘demand’ is predetermined and delivered through a distribution campaign |
| Seasonality of demand: | High – though the number and timings of NTD MDAs varies by country, they typically occur once per year for each NTD program |
| Geography and service delivery level of product dispensing: | The geographies that require annual MDAs vary by country, and the exact dispense locations may also vary, but they will typically be at the primary health care center or community level |
| Service provider capacity for logistics reporting: | Capacity will vary by country depending on general education levels and staff involved in logistics reporting, but this will generally be fairly low at the community dispensing level |

The overall trend indicates that NTD program partners looking for opportunities to have NTD delivery integrate with other existing delivery systems should consider systems that can cost-effectively incorporate storage or delivery of annual spikes of commodity volumes to the community level. These solutions do not need to comprehensively support NTD management from the port of entry to the end recipient as long as they strengthen performance in key areas. However, this global guidance will focus on potential major opportunities for NTD programs. The following table summarizes, at a high level, the potential opportunities provided by common developing country public health supply chains to NTD MDAs.

Table 3. Potential opportunities for support to NTD MDAs

| Common Programmatic Last Mile Delivery System | Opportunity for NTD MDA Delivery |
|--|---|
| Essential Medicines and Family Planning Programs | Low – these programs support routine resupply to secondary, primary, and sometimes community levels |
| Malaria Control Programs (anti-malarials) | Low – these programs support routine resupply to secondary, primary, and sometimes community levels |
| Malaria Control Programs (ITNs) | High – these programs support seasonal, annual campaigns to hard-to-reach communities. May have to consider temperature |

| | |
|---|--|
| | suitability of storage and transport assets |
| Anti-Retroviral Therapy Programs | Low – in many cases these programs support routine resupply, but testing or male circumcision campaigns may mobilize one-off supply chain capacity |
| Immunization Programs | Medium to high – in many cases these programs occur as periodic campaigns with delivery to the primary or community health levels, although cold storage is not necessary for NTDs |
| Nutrition Programs | High – these programs may already occur in conjunction with NTD MDAs through child health days. |
| Integrated Maternal and Child Health Programs | Low to medium – these programs support routine resupply, though they may support the community health level directly. |

In general, supply chains which manage annual or periodic mass distributions of commodities to peripheral communities – bednet, immunization, and nutrition campaigns – offer potential for shared resources with NTD programs. Of course, these opportunities must be examined at a country level to see how actual geographies and timings overlap or complement each other, and compare cubic volumes for storage and delivery where possible. Additionally, it should be noted that in many countries, individual NTD programs themselves are not integrated with one another, so these may present opportunities given their shared supply chain characteristics.

Finally, even when a delivery system has been identified to have characteristics similar to NTD programs, the challenges of combining or coordinating parallel supply chains can be significant. Barriers can include community acceptance of drug provision, the burdening of limited resources such as community volunteers, and sacrifices in ideal timing for targeting specific population subgroups. However, a well-considered segmentation exercise can ensure that only realistic opportunities are pursued.

Conclusion

Given the urgency of supply chain strengthening efforts to support the goals of NTD control and elimination, stakeholders should consider transitioning under-performing NTD supply chain activities to better functioning supply systems in-country through increased integration, “piggybacking” and resource sharing. This would allow NTD programs to tap into existing commodity distribution systems and infrastructure instead of consuming time and resources to develop internal capacity.

As a tool for identifying supply chain strategies that align with product and delivery considerations, segmentation can serve as a guiding framework to help judge the potential effectiveness of such integration, as seen in the case studies later in this report. Using segmentation logic, stakeholders can better understand the theoretical supply chain requirements for NTD programs, and see how these compare with existing in-country capacities. This exercise must, however, analyze the logical and practical feasibility of transitioning operations responsibility.

References

Fisher, Marshall L. 1997. "What is the Right Supply Chain for Your Product?" *Harvard Business Review*. March-April 1997.

JSI. 2013. *Segmentation: A Commercial Sector Approach to Designing Supply Chains*. Washington, D.C.

Thomas, Kelly. 2012. "Supply chain segmentation: 10 steps to greater profit." *CSCMP's Supply Chain Quarterly*.

World Health Organization "Immunization standards." who.int.
http://www.who.int/immunization_standards/vaccine_quality/pq_142_mmr_1dose_sii/en/ (accessed December 17, 2014).

World Health Organization "Pentavalent and Hexavalent Vaccines" who.int.
http://www.who.int/immunization/policy/pentavalent_hexavalent.pdf (accessed December 17, 2014).

World Health Organization "Specifications for Vaccine Vial Monitors (VVM)" who.int.
http://www.who.int/immunization_standards/vaccine_quality/vvm_specifications_e6in5.pdf (accessed December 17, 2014).

Yadav P., J. Oswald, M. Dicko, P. Lydon and M. Zaffran. 2013. *Integration of Vaccine Supply Chains with Other Health Product Supply Chains: A Framework for Decision Making*. Technical Report. Geneva, Switzerland: WHO and Project Optimize.

Yadav P., P. Lydon, J. Oswald, M. Dicko, M. Zaffran. 2014. "Integration of vaccine supply chains with other health commodity supply chains: A framework for decision making." *ScienceDirect JVAC-15818*