Development Plan for Optimizing NTD Drug Supply Chains 2015–2020

January 2015

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Support for this work was provided by the Bill & Melinda Gates Foundation

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Recommended Citation

Perry, Steven; Laaff, Sarah; Rosenblum, Leona; Bahirai, Ellie; Rosen, James. 2015. Development Plan for Optimizing NTD Drug Supply Chains 2015–2020. Arlington, Va.: John Snow, Inc. for the Bill & Melinda Gates Foundation.

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Table of Contents

Acronyms

BMGF	Bill & Melinda Gates Foundation
CDD	Community Drug Distributor
CMS	Central Medical Store
FEFO	First-Expire-First-Out
FLHW	Frontline Health Worker
GFATM	Global Fund to Fight AIDS, TB and Malaria
HSA	Health Surveillance Assistant
HIV/AIDS	Human Immunodeficiency Virus/Acquired Immunodeficiency Syndrome
JSI	John Snow, Inc.
LMIS	Logistics Management Information System
MDA	Mass Drug Administration
mHealth	Mobile Health
MOH	Ministry of Health
NGO	Non-Governmental Organization
NTD	Neglected Tropical Disease
NTDCP	Neglected Tropical Disease Control Program
OR	Operations Research
PBI	Performance-Based Incentives
PCT	Preventive Chemotherapy
RMS	Regional Medical Stores
RTAC	Regional Technical Assistance Center
SHT	School Health Teachers
SMS	Short Message Service
SOP	Standard Operating Procedure
USAID	United States Agency for International Development
WHO	World Health Organization

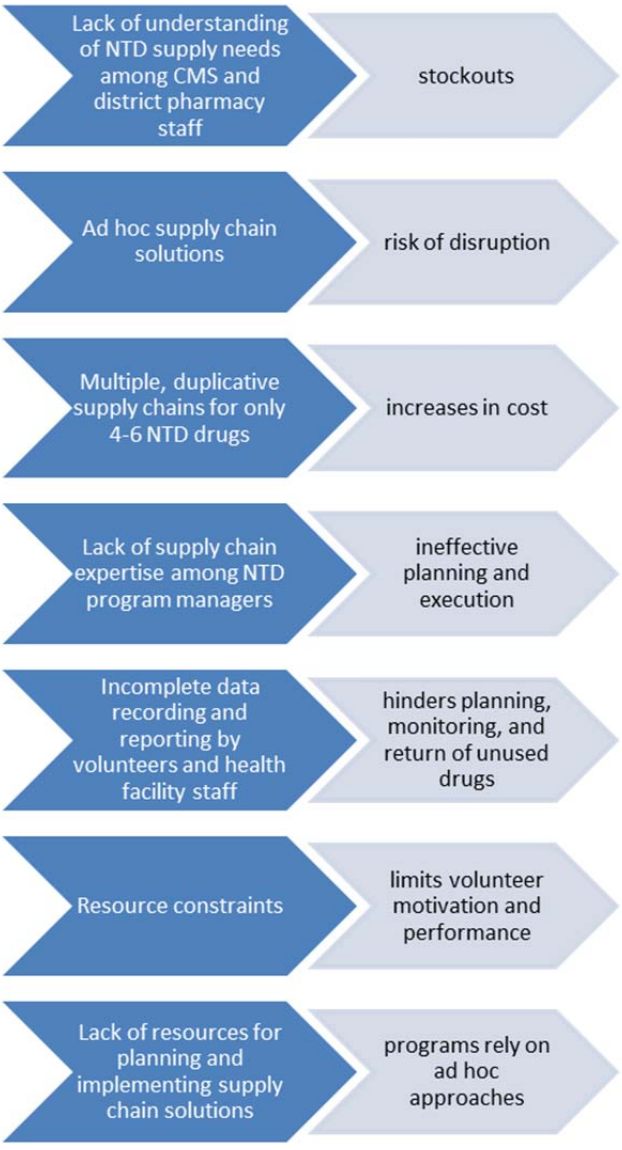
Executive Summary

This document constitutes a development plan for optimizing Neglected Tropical Disease (NTD) supply chains in the five-year period from 2015 to 2020. Based on studies funded by the Bill and Melinda Gates Foundation (BMGF), the development plan aims to identify activities which would strengthen supply chains for NTD drugs to help meet the goals of the World Health Organization (WHO) Roadmap to control and eliminate NTDs.

The development plan is part of a suite of documents that lays the groundwork for interventions designed to transform NTD supply chains. This includes a landscape analysis of public health supply chains to identify potential solutions for NTD supply chain constraints; in-depth NTD supply chain assessments in Ghana, Malawi, and Tanzania; a literature review; and segmentation and benchmarking analyses. The development of these materials included interviews with supply chain experts to better understand strengths and weaknesses to help devise effective strategies to improve NTD supply chains. A Summary Report provides an overview of key findings.

Based on the landscape review and other studies, the development plan lays out the steps for carrying out the proposed interventions. Aligned with first mile partner support, these interventions would ensure a full supply of NTD drugs and the capacity needed to distribute them, as well as optimizing the management of the supply chain for potential cost savings. The development plan includes a global plan with generic actions that can be adjusted to any country context, and country-specific plans for Ghana, Malawi, and Tanzania with actions tailored to address the challenges observed in these countries and as discussed with the respective National Coordinators.

Figure 1. Key Challenges for NTD Supply Chains and Their Impact



Background

Integrated neglected tropical disease control programs (NTDCPs) and the in-country supply chains that serve them are relatively new phenomena. Over the last decade, the global NTD community has focused on securing commitments for and improvements to the coordination and donation of NTD drugs that have provided a basis for the successful expansion of integrated NTD control programs worldwide. This focus on the challenges of assuring first-mile processes for NTD drug supply to country programs has over-shadowed the understanding and improvement of how the drugs are being managed in 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. Further, many of the available studies are from single-disease programs so the body of work on integrated NTDCP supply chains is limited. However, based on the reports, interviews with NTD control and supply chain experts, and field assessments in three countries, central themes regarding the effectiveness of last-mile NTD supply chains can be identified. This research reinforces previously identified challenges in human resources capacity development and motivation, health system strengthening, and health system funding that impact annual NTD campaigns and the supply chains that support them.

Review of available documentation regarding last-mile supply chains for the five “core” preventive chemotherapy (PCT) NTDs highlights two schools of thought. First, that in-country supply chains for NTD drugs 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 NTD drugs into the standard central medical stores (CMS) and district pharmaceutical management processes. The alternative view is that last-mile supply chains for NTD drugs are the responsibility of Ministries of Health (MOH) and are adequate for ensuring full supply, and external initiatives to bolster supply chain effectiveness risk undermining the success of current arrangements and ownership by national programs.

The current 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 support to NTDCP in-country supply chains need not undermine national ownership. 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. However, the ad hoc supply chains in place in some countries suffer constraints in design, capacity, and sustainability—even within the relatively short temporal framework of NTDCPs. Achieving the WHO Roadmap goals for the control and elimination of NTDs as expressed in the London Declaration will require country-appropriate strategies to ensure adequate supply of NTD drugs while minimizing wastage of valuable donated drugs.

The NTD country reports for Ghana, Malawi, and Tanzania, as well as other research, identified a number of challenges to effective last mile supply chain management for NTD programs. The recommendations and conclusions from the body of research led to four key strategies that anchor this development plan and an eight-point call to action to improve last mile supply chains for NTD programs.

The strategies can be operationalized in global and country contexts through specific steps outlined in this plan.

Four key strategies to improve last mile supply chains for NTD programs:

- Providing easy access to supply chain expertise through Regional Technical Assistance Centers.
- Improving processes by developing and implementing standard operating procedures (SOPs), guidelines, and materials.
- Strengthening the logistics management information system with mobile health (mHealth).
- Improving performance by introducing performance-based incentives (PBI).

While some countries experience similar challenges, each strategy should be tailored to a country's particular context to build on existing strengths and leverage local and regional resources to overcome difficulties specific to the environment, culture, and organization.

Global Development Plan

Based on the body of research described above, NTD supply chains face similar challenges in many countries. The primary risks to full supply during mass drug administration and to cost-effective management of the NTD drugs, along with their impacts, are outlined above in figure 1. They include lack of understanding of NTD supply needs, ad hoc supply chain solutions, duplicative supply chains, lack of supply chain expertise, incomplete data reporting, resource constraints, and lack of resources for planning and implementing solutions. These challenges can lead to disruption of the supply chain, increased distribution costs, lack of accurate supply data, supply imbalances with too many drugs in some locations and too few in others, and ultimately to high levels of drug wastage and to unmet coverage targets.

Eight Action Points

Based on these common challenges, the following eight-point call to action highlights general areas of improvement for strengthening last mile NTD supply chains.

Strengthen Capacity

1. **Build human capacity in supply chain management at the community level.** Create concise, community-level training and reference materials for frontline health workers (FLHWs) and community drug distributors (CDDs) that include key supply chain messages, and incorporate them into the national NTD control programs training system.
2. **Strengthen planning and management of NTD drugs for district health management teams.** Develop guidelines and reference materials for district NTD program coordinators, pharmacists, and health management teams on NTD drug management and on planning and budgeting for the delivery of drugs for MDAs and the collection of unused drugs following MDAs.
3. **Strengthen NTD program district-to-central-level accountability.** Develop tools and guidelines to help NTD programs develop plans and budgets for direct post-MDA meetings between central and district NTD coordinators and central to district-level assessment of district performance. Visibility into district level performance is critical for MDA success.
4. **Develop regional providers of supply chain capacity.** Develop regional (e.g., West Africa, East Africa) campaign supply chain expertise resource centers to help national and district NTD coordinators assess needs and develop plans and budgets for better coordinated, more reliable, and more sustainable supply chains. Regional experts should support NTD programs to identify, cost, and plan for private and/or non-governmental organization (NGO) alternatives to MOH supply chains when government systems are not a reliable or cost-effective option for ensuring drug availability.
5. **Strengthen coordination of NTD drug shipments and MDAs.** Develop tools and advocacy materials to help NTD programs better coordinate international shipments of drugs and implementation of mass drug administrations to reduce the number of parallel supply chains.

Identify New Approaches

6. **Improve performance at the community and health facility levels.** Conduct operations research to determine cost-effective strategies for improving reporting and return of unused NTD drugs. Strategies to be tested include: 1) "second-tier stipend" for community drug distributors returning their registers, completed reports, and unused drugs on-time; and 2) performance-based incentives (e.g., cellular air time credits or "mobile banking" transfers) to reward reporting and return of unused drugs.

7. **Improve data visibility and utility.** Conduct operations research on the most robust and cost-effective mobile health (mHealth) solutions to improve reporting on drug distribution. Areas for study include: 1) technology platform (e.g., type of phones and messaging); 2) level in the system to target (e.g., CDD versus health facility); and 3) level of data (e.g., the full report versus LMIS data or drug balances only).

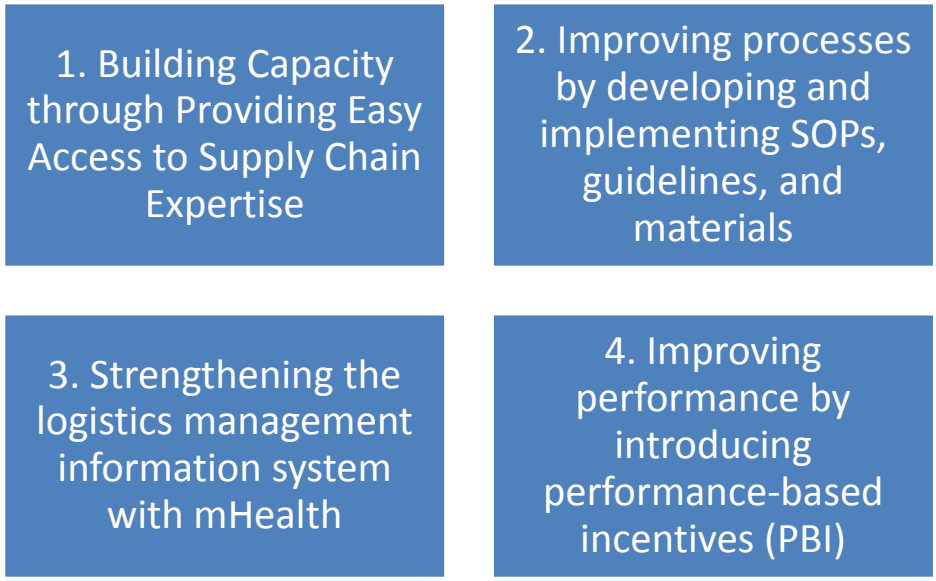
Leveraging New Resources

8. **Develop new public-private partnerships to support last-mile NTD supply chains.** The current partnership with pharmaceutical corporations is one of the largest and most successful partnerships in international public health. A complementary effort and partnership would improve the management of the drugs in the last mile. BMGF could engage the major telecoms companies—which are among the most successful and fastest growing businesses in Africa—to support the last mile of NTD drug supply chains.

Four Strategies

These eight actions can be reduced to four key strategies that anchor this development plan; the strategies (see figure 2) can be operationalized in global and country contexts through specific activities and results outlined in the step-by-step overview for each strategy.

Figure 2. Four Key Strategies for Improving Last Mile Supply Chains for NTD Programs



Strategy 1: Building Capacity through Providing Easy Access to Supply Chain Expertise

Like all public health programs, the success of NTD control programs is largely dependent on their ability to ensure that the right quantities of the right drugs are available in the right places when needed. Ensuring high coverage rates (i.e. 80 percent) is the driving necessity of PCT mass drug administration campaign programs, but it will not be achieved without reliable last mile supply chains. From the in-depth assessments in the three study countries and the broader landscape analysis, it is clear that NTD supply chains suffer design, capacity and implementation challenges that pose risks to full and uninterrupted drug availability. However, unlike most public health programs, NTDCPs do not have easy access to supply chain support required to identify and mitigate challenges to drug availability and to minimize drug wastage following campaigns.

With relatively few drugs to distribute in annual campaigns, hiring dedicated supply chain managers for NTDCPs has not been a priority. National NTDCs, with support from in-country partners, take the lead in identifying and developing supply chain solutions to managing the distribution of the NTD supplies. The coordinators do not generally have the logistics management skills required to assess their needs and challenges and to weigh the benefits and risks of different supply chain options.

Nor is there a designated source or sources of last mile logistics management expertise to support NTDCPs in the way that Expanded Programme on Immunization, malaria, reproductive health, HIV/AIDS and other public health programs benefit from central and regional supply chain support mechanisms funded by WHO, USAID, GFATM and others.

Challenges

While many of the ad hoc solutions being used by country programs have been successful in ensuring full supply of drugs at the time of the campaigns, others have not. Consequences of this approach to supply chain design and management are as follows:

Table 1. Key Challenges to Be Addressed with Better Access to Supply Chain Expertise and Their Impact

Challenge	Impact
Assessment: National NTDCP do not typically have access to the tools or expertise to assess the strengths, weaknesses, opportunities, and in particular, threats to existing in-country drug delivery systems. Assessment capability is important to identify important risks and key bottlenecks and design the most appropriate solutions.	Disrupted (failed) supply chains Inefficient supply chains Inaccurate supply data
Planning: Without capacity to systematically assess their supply chains NTDCP's are constrained from developing "best practice" supply chain strategies and the plans and budgets needed to implement those strategies.	Insufficient coordination Use of multiple supply

This is particularly crucial when NTDCPs do not have access to strong MOH capacities for each link in the supply chain and need to identify alternative providers of supply chain capacity suited to their needs. Resulting supply chain solutions are often ad-hoc and subject to negotiation and disruption each year.	chain solutions for four to six drugs Increased cost and complexity of drug distribution
Advocacy: National Coordinators tasked with coordinating with MOH supply chain assessment and planning do not always have the tools and expertise required to effectively advocate with supporting partners for the resources necessary to establish and sustain effective supply chains.	Lack of visibility and financial and technical resources needed to ensure full supply of NTD drugs
Implementation: Insufficient assessment, planning and advocacy limit the quality of supply chain strategies used in many country programs. As most NTDCPs utilize as much of the existing MOH delivery structure as possible there has been less focus on how the NTD drugs are handled and less ability to coordinate NTD specific (campaign delivery) solutions within the greater MOH supply chain limiting implementation of effective and cost effective strategies.	Multiple supply chains
LMIS and Quantification: NTD drug supply data is often inaccurate and incomplete due to issues in the design and use of data collection and reporting linkages. In many instances, small but necessary modifications of data collection and reporting practices are not identified or implemented limiting the quality of local and national quantifications of NTD drug needs.	Supply imbalances and a tradition of over-ordering Drug wastage
Policy: Three key policy challenges impacting last mile supply chains are: how to handle open containers after campaigns, how to handle drugs remaining in balance after the end of the campaigns, and how to dispose of drugs that have expired, or are damaged. While many MOH programs have policies they are rarely effectively operationalized or used by those implementing the campaigns – particularly at the lowest levels.	Drug wastage Drugs and drug containers remaining in the communities that should be destroyed

Considerations

Different mechanisms have been used over the last several decades to support various public health supply chains along the last mile. More highly resourced programs have been championed by specific donor funded mechanisms with central and regional level support, as well as extensive country-specific bi-lateral projects, to ensure availability of health commodities at the point of delivery. Some mechanisms have emphasized vertical supply chain support solutions while others have an integrated supply chain focus. Some programs have opted for long-term, in-country supply chain strengthening projects while others have relied on more targeted, “as needed” support.

NTDCPs do not typically have access to these mechanisms. The challenge for the global NTD community is to agree how to best support national NTDS control programs in the last mile of the supply chain. The main consideration is how to provide that support in light of the current resource constrained context in which NTD control programs operate.

Proposed Solution

We believe that the most time- and cost-efficient mechanism for supporting NTD last mile supply chains will be the development of regional (e.g., West Africa, East Africa) technical assistance centers (RTACs) to allow NTDCPs easy access to supply chain expertise tailored to the needs of campaign MDA programs. The RTACs should support NTDCP Coordinators to assess risks to NTD drug availability and to develop plans and budgets to strengthen last mile supply chains as needed. The resource centers could be located with NGOs, universities, or other local providers of supply chain expertise.

Implementation Steps for Providing Supply Chain Expertise (RTACs)

Activity	Results
• Develop a consensus within the national NTDCPs and supporting partners regarding the need for and mission of the RTAC model • Develop a framework for the types of support the RTACs will need to provide NTDCPs in supply chain management, and the means to transfer that technology and capacity • Identify sources of funding for developing RTACs	**Consensus developed and funding sources identified for implementing RTACs**
• Develop criteria, and a request for proposal, for selection of organizations to host the RTA • Identify and short-list potential providers of regional supply chain expertise, issue the RFP and evaluate responses • Select and contract the organization based on capacity and cost criteria specified in the RFP	**Location and organization/s to host RTACs identified and contracted**
• Identify and empower an organization/mechanism to provide support to the identified RTAC to develop technical capacities and capacities to manage the interface (financial and reporting requirements) with the funding agency • Develop the specific NTD supply chain support capacities of the selected organization based on the framework (proposed above)	**RTAC empowered to provide NTD campaign supply chain expertise and to manage interface with funding agency**
• Develop priority list of country programs requiring/requesting last mile supply chain support and implement initial assessments to identify risks and to develop plans to mitigate risks and strengthen last mile supply chains. • RTAC to support NTD program Coordinators upon request and within the funding envelope of its mandate on an ongoing basis.	**RTACs providing last mile supply chain support to national control programs**

Strategy 2: Improving Processes by Developing and Implementing Standard Operating Procedures, Guidelines, and Materials

NTD last mile supply chains are less complex and less resource intensive than those for routine service delivery health programs. They distribute five or six drugs, once or twice a year, and rely on population, rather than monthly consumption data, to determine drug requirements at all levels. Where possible, NTD programs rely on the physical and managerial capacities of MOH supply chains at both central and district levels.

However, NTD last mile supply chains need to function at a uniformly high level in every endemic district, and for each year, until disease control or elimination goals are achieved. Moreover, they do so without dedicated program supply chain expertise or vertical supply chain capacities.

Challenges

Staff and volunteers tasked with managing NTD drug supply chains do not have the SOPs, guidelines, or training materials required for the job. The annual cascade training is a day or less in duration at the lower levels and managing drug supply is not the primary subject area. With fewer resources and less complex supply chains, NTDCPs have not targeted investment in developing the logistics SOPs, printed guidelines, job aids, and curricula available to most public health programs.

Table 2. Key Challenges to Be Addressed through Development and Implementation of NTD Campaign Specific SOPs, Guidelines, Training Materials, and Job Aids

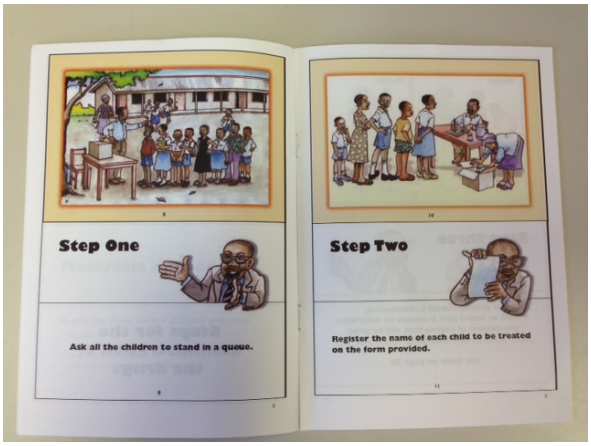
Challenge	Impact
MOH pharmacists and storekeepers are not provided with, SOPs/guidelines and related materials for managing and reporting on NTD drugs.	Poor handling and management of NTD drugs Dearth of accurate drug balance data
Health facility staff and volunteers do not, in many countries, receive training materials, job aids, or guidelines regarding managing and reporting on NTD drugs.	Under-reporting and inaccurate reporting of LMIS data. Poor reverse logistics and drug wastage
NTD managers frequently do not have job aids or procedures clarifying the quantification calculation	Inaccurate quantification Supply imbalances and drug wastage
National NTD coordinators do not have clear supply chain design documents detailing roles and responsibilities for managing and reporting on NTD drugs	Ad-hoc supply chains at risk of disruption Higher costs of multiple supply chains

Proposed Solutions

We recommend the Foundation and partners invest in developing a series of generic SOPs, training materials, and guidelines that can be adapted to specific country contexts. The materials should build on the strengths of existing materials in terms of the number and depth of messages to include and how to present them for audiences such as CDDs. These materials can be adapted for specific programs with support from the regional technical assistance centers recommended above, or from other sources of bilateral or multilateral support. RTACs can also support the NTDCPs to design and implement training programs to build capacity of staff and volunteers to use the materials once developed. Supply chain management materials that should be developed include the following:

Community level: concise, best-practice training and reference materials for the least highly-trained and educated staff and volunteers engaged at the lowest levels in managing NTD drugs. The materials should include the key messages for drug supply chain management such as the following:

- Submitting accurate LMIS data
- Handling of drugs in bottles that have been opened
- Disposal of expired drugs
- The return of unused campaign drugs



These messages should also be incorporated into the cascade training materials and into the reference booklets to be disseminated at the training for FLHWs and CDDs. Supervisory checklists should be developed to reinforce these key procedures.

MOH pharmacists and storekeepers: develop basic guidelines regarding the management of (campaign) NTD drugs for MOH pharmacists in countries where the NTDCP drugs are integrated into the MOH supply chain. The SOPs should clarify use of pallets, FEFO and inventory records, open container and disposal policies, and the procedure for receiving and reprogramming unused drugs.

District NTD management teams: create guidelines, budget template, and checklist for holding post-MDA group meetings between the national leadership and the district NTD teams to review and compile summary reports, validate the data, and identify data needing further analysis and where the coverage is weak and requires “mop-up” support. Develop and disseminate laminated wall charts detailing the calculations and timelines for quantification of drug needs and other key messages such as the policies regarding open containers and the return of unused drugs.

NTDCP coordinators and national level: create best-practice SOPs, guidelines, curricula, and training materials that clarify the supply chain system design and responsibilities within the system. Develop an improved “summary report” design for reporting balances and guidance for developing clear and

operational open container and disposal policies for NTD drugs. Develop guidance for NTDCPs to determine which MDAs can be best co-implemented to reduce cost of distribution of NTD drugs.

Implementation Steps for Developing and Implementing Guidelines and Other Materials for Managing NTD Drugs

Activity	Results
• Develop a consensus within the national NTDCPs and supporting partners regarding the need for best practice guidance and materials to manage NTD drug last mile supply chains • Identify sources of funding for developing and implementing materials	**Consensus developed and funding sources identified for developing and implementing SOPs and other materials**
• Identify an appropriate contracting mechanism and source or sources of expertise to lead the process • Create a broad-based technical advisory group including national coordinators and members of the global NTD community committed to last mile supply chains	**Lead technical development organization and TAG identified and contracted**
• Develop a prioritized list of materials to be developed and the process for drafting and finalizing materials • Develop and produce generic versions of best practice supply chain SOPs and materials specific to the needs of campaign programs • Disseminate the SOPs and materials at major NTD fora	**Prioritized generic NTD supply chain management guidelines developed and disseminated**
• Adapt the guidelines and materials for specific country and language contexts based on demand from the NTDCPs and supporting partners • Work with appropriate regional or local organizations (e.g. the RTACs) to build the capacity of NTD drug last mile supply chains through dissemination and training responsible staff based on the adapted guidelines and curricula.	**Guidelines and materials adapted for country programs disseminated and implemented**

Strategy 3: Strengthening the Logistics Management Information System with mHealth

Mobile health (mHealth) solutions can support health interventions by improving service delivery, providing information to the population or to health workers, managing information, or strengthening monitoring and evaluation systems. Within supply chains, mHealth tools can strengthen the collection, aggregation, utilization, and dissemination of both health services and logistics data. When implemented correctly, mobile reporting tools can benefit NTD supply chains by—

- improving data visibility by providing disaggregated data
- improving data accuracy
- reducing the burden of reporting
- expediting the flow of information through the supply chain
- enabling decision makers to access data in real-time and rapidly respond to problems
- improving the effectiveness of campaigns by sending reminder messages.

Challenges

NTDCP reporting systems, although different in detail, share a common architecture and many of the challenges they face are similar. They include missing or inaccurate drug balance data, inaccurate calculation of drugs needed at each level of the system because of inaccurate data and human error, and a heavy reporting burden for staff at the sub-district and district levels. These challenges lead to potential drug wastage because drugs are unaccounted for and too many drugs may be distributed. The root cause is missing data and poor data quality, which can be addressed by implementing mobile technology. Table 3 outlines the challenges and the impact on the supply chain.

Table 3. Key Challenges in NTD LMIS and Their Impact

Challenge	Impact
Poor visibility of LMIS data due to incomplete and inaccurate reporting of drug supply data from the lowest levels.	NTD managers making decisions without access to accurate picture of drug needs and availability at lower levels.
Drug balances following MDA campaigns are often missing or inaccurate.	Drugs remaining are not accounted for, leading to over-ordering and drug wastage and disposal issues.
Annual drug quantifications made without access to quality supply data are less accurate.	Supply imbalances resulting in over-supply in some locations and shortages in others.
Reporting is a significant burden for staff at all levels.	Decreased data completeness, accuracy, and timeliness of submission.

Key Considerations

Before making the decision to implement a mobile technology solution in any public health context, stakeholders should consider—

- whether their system will run on smartphones or basic phones
- the mobile network operators/connectivity landscape
- the existing mobile health infrastructure in the country, and how this intervention can and should connect to it
- how messages and data transmitted through the system will be paid for
- what training will be required
- what the turnover rates of users will be
- the platform on which the data that is transmitted will be processed, analyzed, reported, and accessed.

A solution should always be developed with an understanding of these factors. In determining the following recommendations for applying mobile technology to NTD supply chains, particular consideration was given to the specific realities of the NTD reporting system and supply chain, which set it apart from other potential mobile health interventions. This includes—

- the infrequency of reporting
- the large number of volunteers who collector data
- the burden of recording and reporting for lightly trained volunteers
- the burden of reporting for sub-district level staff receiving raw (non-aggregated) data from volunteers
- the on-going challenge of reverse logistics
- the reporting of services and logistics data on a single (integrated) form
- the general resource constraints for supply chain solutions in the NTD context.

These features of NTD programs influence the design of the proposed mobile health intervention.

Proposed Solution

mHealth should be utilized to address NTD program reporting challenges in those country contexts where it is most needed and feasible. Based on an analysis of the specific NTD supply chain reporting context, the best approach to supporting NTD reporting with mobile technology is likely an SMS-based system that leverages users' own phones. This implies use of the most basic cell phones which in turn impacts the design strategy. A key design decision that should be based on further study is at which level (volunteer versus health facility) to implement the SMS reporting to achieve the maximum improvements in reporting at the lowest costs.

Since the mHealth solution can be implemented in a variety of ways, options for the level of data and for the level of personnel who will be using mobile reporting should be tested and validated through operations research (OR). Each hypothesis should be tested in our focal country contexts (Ghana, Malawi and Tanzania) by running parallel pilot testing of different solutions to the same challenge.

The OR should be carried out in selected districts or sub-districts of one country, with baseline and end-line evaluation of predetermined indicators, leading to expansion of the solution that proves to be most efficient and cost effective in the country in which the OR is conducted. Lessons learned in the analysis of the OR results will be used in the subsequent expansion of the most effective mHealth strategy.

Each country context should be assessed to understand whether the challenges faced are best addressed with mHealth solutions. Figure 4 below presents a basic framework for the decisionmaking steps in that framework. Key factors that influence decisions for implementing an mHealth solution include mHealth infrastructure, connectivity, and whether users have access to phones. Other countries with the need and capacity to benefit from mHealth solutions can use the same approach to gauge the feasibility of implementing specific solutions.

mHealth Operations Research

Operations research should be carried out before embarking on the development of an mHealth solution. The OR will address two main issues:

Which data points should be captured?
Operations research can address which option provides the optimal balance between data visibility for decision makers and reporting burden for system users. This means identifying which data points to capture with mobile phones. Options to be tested include—

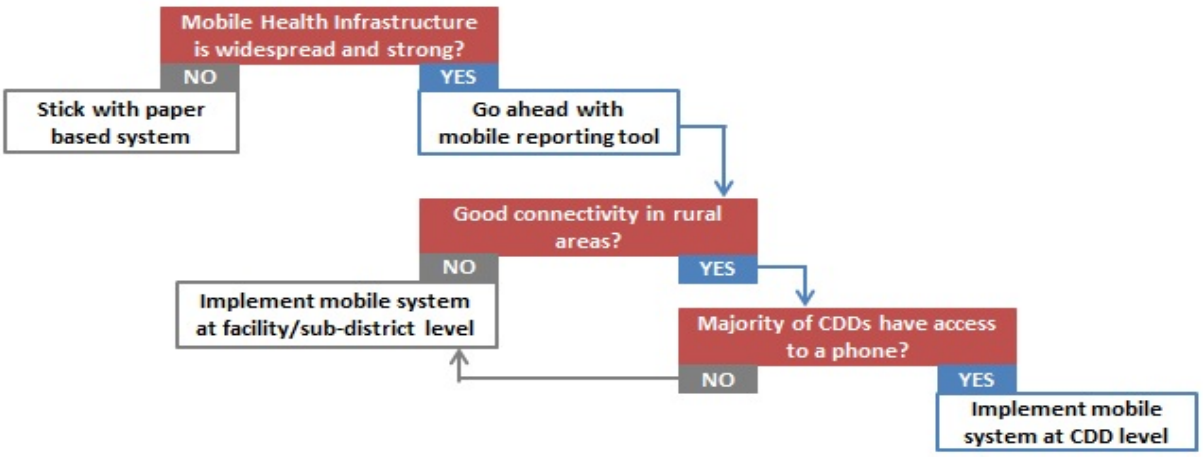
- remaining balance of product available only
- quantity received, quantity used, and balance
- quantity received, quantity used, balance, limited services indicators

Which level of personnel should use mobile phones to report?
Operations research can help determine feasibility of whether mobile reporting can be implemented down to the lowest level of the supply chain, which for NTD programs is the CDD level, to address the reporting burden. Options to be tested include—

- mobile phone reporting at the CDD level
- mobile phone reporting at the sub-district level

Operations research can be conducted to compare the cost effectiveness, reporting rates, timeliness, and data quality for the different approaches.

Figure 4. Decision Tree for Determining to What Extent Mobile Reporting Can Be Implemented



Implementation Steps for mHealth Solutions

Activity	Results
• Identify the best country contexts in which to test each OR hypothesis and facilitate a consensus with the MOH and key stakeholders for conducting an mHealth assessment. • Conduct landscape assessment of the mobile ecosystem and requirements gathering to develop draft system design and workflow for the OR pilot. • Select the districts or sub-districts in which to pilot test the alternative strategies as well as for the control group • Engage a software vendor and finalize system requirements and configuration • Develop job aids SOPs and a training plan for the OR pilot.	**Finalized OR pilot system ready for testing**
• OR pilot field testing with small group of users simulating MDA training and system use. • OR pilot in conjunction with MDA, with trained users who report, as well as trained users who receive data via dashboards.	**Implementation of OR pilot and availability of results**
• Conduct a phased roll-out of the selected reporting system incorporating the results of the OR study in the system design	**Reporting system scaled up countrywide**
• Monitor, evaluate and refine the reporting system as needed.	**Full evaluation report of the mobile system roll-out and resulting data**
• Compile mhealth lessons learned in the pilot countries for use globally, and disseminate them to potential countries considering mHealth solutions.	**mHealth lessons learned report shared**

Strategy 4: Performance Based Incentives for NTDCP Supply Chains

Performance-based Incentives (PBI), also known as performance based financing and pay-for-performance, are cash or non-monetary benefits given for measurable actions or achievement of a clearly specified result or defined performance target. In the context of NTD supply chains, PBI will help improve various aspects of MDAs by linking payment to performance.

NTD campaigns depend on unsalaried volunteers to carry out the distribution of drugs to the end user; record, summarize, and submit service and logistics data; and return any unused commodities. For these tasks, the volunteers typically receive a small stipend, which in many program contexts, has remained fixed over a number of years. During the same period, the cost of living in much of Africa has increased significantly. CDDs volunteer for many reasons, but it was noted in each of the countries visited that it was the decrease in stipend value that was the biggest factor in the high rate of attrition among the volunteers and difficulty in recruitment. This in turn greatly impacted performance in that new volunteers were less effective than those who have been with the program for many years. Evidence from other public health programs highlights that PBI strategies are an effective tool for enhancing volunteer motivation, performance, and retention.

Challenges

It is increasingly difficult to find volunteers, and the attrition rate is high for existing CDDs, which undermines the goal of reaching 80 percent coverage in the population for any given NTD drug. In some cases, the lack of volunteers results in gaps, where entire communities get no coverage, potentially disrupting the overall strategy for NTDs (see the Ghana Assessment report).

During MDAs, volunteers often fail to record and summarize logistics data. This adds to the reporting burden at higher levels in the supply chain and results in poor reporting of logistics data, which affects quantification and creates wastage because remaining drug balances are unknown.

The country assessments revealed a significant problem of drug wastage and disposal because health facility staff have few, if any, incentives to return unused drugs. Table 4 lists key challenges that a PBIapproach can contribute to solving.

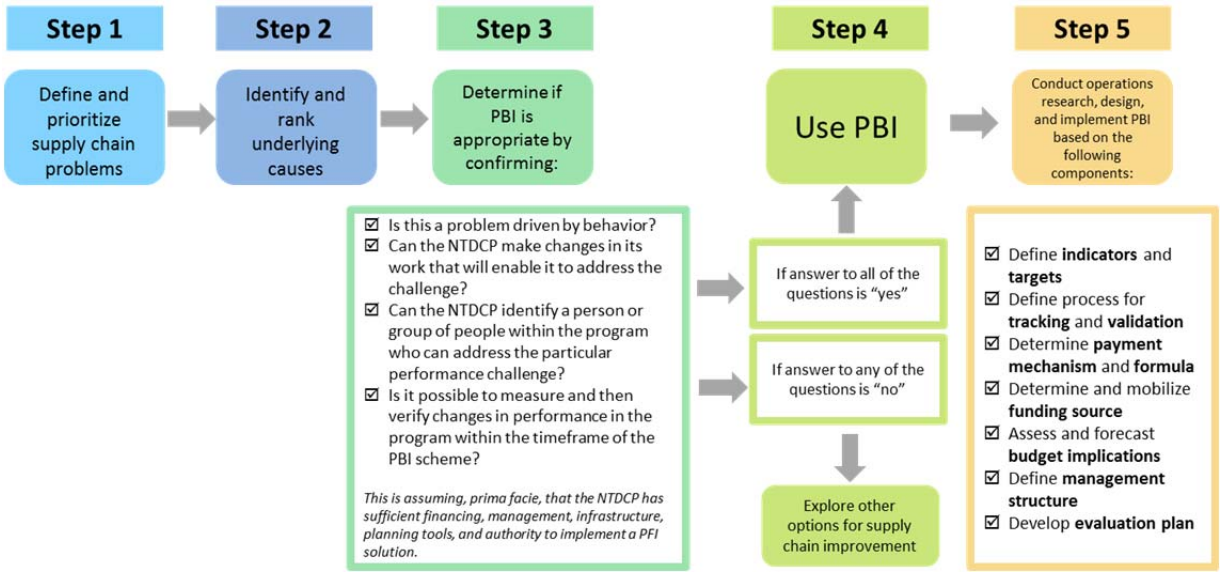
Table 4. Key Challenges That Relate to Motivation, Performance, and Retention and Their Impact

Challenge	Impact
Difficulty attracting and retaining volunteers	Gaps in NTD drug coverage Decreased effectiveness due to higher number of new, less experienced volunteers
Low level of performance among volunteers and health facility staff	Poor reporting of logistics data, impacting quantification and creating potential drug wastage
Unused drugs are rarely returned	Potential drug wastage Improper disposal of drugs in the communities

Key Considerations

Any PBI intervention should be based on a thorough assessment of the specific environment to determine if performance can be improved by offering incentives. Incentives are inherent in any work environment and reflect underlying levels of financial, reputational, and political risk associated with poor performance. Performance-based incentives work by altering this risk calculus. Moreover, performance-based incentives must be designed in a way that does not lower workers' intrinsic motivation, that is, the motivation to do their job well regardless of the reward. Figure 5 shows the steps for deciding whether to use PBI, as well as key considerations for designing and implementing a PBI scheme.

Figure 5. Performance-Based Financing for Supply Chains Expanded Conceptual Framework (adapted from "Overview of the Supply Chain Assessment Process," *Options Guide: Performance-Based Incentives to Strengthen Public Health Supply Chains—Version 1 2012*)



Proposed Solutions

To address the challenges that relate to motivation, performance, and volunteer retention, impacting LMIS reporting and the return of NTD drugs, we propose three PBI strategies and related operations research to achieve the optimal solutions. The combination of which cadre to incentivize, the delivery method of the incentive, and the action being rewarded will be investigated to determine the most cost-effective strategies to achieve the desired performance improvement.

Operations research will precede the implementation of PBI solutions for reporting to gauge technical effectiveness and the most cost-effective solution. A key question is what level of incentivization is substantial enough to trigger behavior change among the recipients but still within an acceptable level of risk for the NTDCP.

We recommend addressing challenges to motivation, performance, and volunteer retention that negatively impact reporting and the return of NTD drugs following campaigns through the following three PBI strategies:

- **PBI via bonus (second-tier) stipend delivered in the same manner as basic stipend**
  Volunteers returning complete reports and unused drugs will receive a bonus (second-tier) stipend over and above the standard stipend. This would be disbursed to the hi-performing volunteers when they present their timely, completed paper summary reports and drugs to health facilities and in the same manner as they currently receive the basic stipend.

- **PBI stipend through mobile money transfer**
  Sub-district staff who return timely, complete summary reports and unused drugs to the districts will receive mobile money transfers by cell phone. The compensation value would need to compensate for transport costs to/from the district, plus an incentive to motivate the staff to take these steps.

- **PBI stipend using cell phone minutes reward**
  Cell phone minutes could be used to reward CDDs in two scenarios: (a) With mHealth reporting, CDDs would receive cell phone minutes for sending in their text message reports. (b) Without mHealth reporting, CDDs would receive cell phone minutes for timely paper reporting and return of drugs.

PBI Operations Research

Before implementing PBI solutions to improve reporting and return of unused drugs, operations research will be conducted to address three main questions:

Which level of personnel should be selected for PBI?
At which level of the supply chain should PBI be applied to achieve the most improvement for the least cost? Options to be tested include—

- Community drug distributors
- Front-line health workers

What type of incentive is most effective?
The delivery method chosen for each incentive can influence the effectiveness and cost effectiveness of the PBI solution. Options to be tested include—

- Cell phone minutes
- Mobile money transfers
- Second tier bonus stipend

How much should be paid?
What level of incentive payment sums will suffice to increase performance regarding reporting and returning unused drugs, as well as retaining volunteers?

- Gauge various payment thresholds, such as $3 vs. $10 and 30 free cell phone minutes vs. 50 free cell phone minutes.

Implementation Steps for PBI Solutions

Activity	Results
• Identify the best country contexts in which to test each OR hypothesis and facilitate a consensus with the MOH and key stakeholders for conducting a PBI assessment • Select the districts or sub-districts in which to pilot test the alternative strategies as well as for the control group • If implementing a mHealth-based PBI strategy, engage a software vendor and finalize system requirements and configuration • Develop job aids, SOPs, and a training plan for the OR pilot	**Finalized OR pilot system ready for testing**
• OR pilot field testing with small group of users during MDA	**Implementation of OR pilot and availability of results**
• Conduct a phased roll-out of the selected PBI solution incorporating the results of the OR study in the system design	**PBI scheme scaled up countrywide**
• Monitor, evaluate and refine the PBI scheme as needed	**Full evaluation report of the PBI scheme roll-out and resulting data**
• Identify PBI feasibility for other country NTDCPs by engaging Regional Technical Assistance Center and by applying assessment model to identify other NTD programs that would benefit from PBI solutions	**Implementation plan for OR pilot in additional country NTDCPs**

Operations Research (OR) Model to Test Strategies 3 and 4

Based on in-depth supply chain assessments conducted in 2014 in our three focal countries, key challenges to NTD drugs were identified that lend themselves to mHealth and PBI solutions. However, key questions remain regarding the most optimal operationalization of these interventions. Conducting operations research (OR) provides the opportunity to test proposed mHealth and PBI solutions for optimization of country NTDCPs.

The eight step schematic in figure 3 reflects a recommended model of OR used in health and development that will guide the implementation of OR for PBI and mHealth. OR for a specific question can be conducted in one or more countries. Based on analysis of country contexts and the outcomes of PBI and mHealth decision frameworks, we propose conducting OR for both PBI and mHealth in the three priority countries, as presented below:

Ghana:

- mHealth
  - Level of the supply chain
- PBI
  - Level of personnel to incentivize
  - Quantity of payment

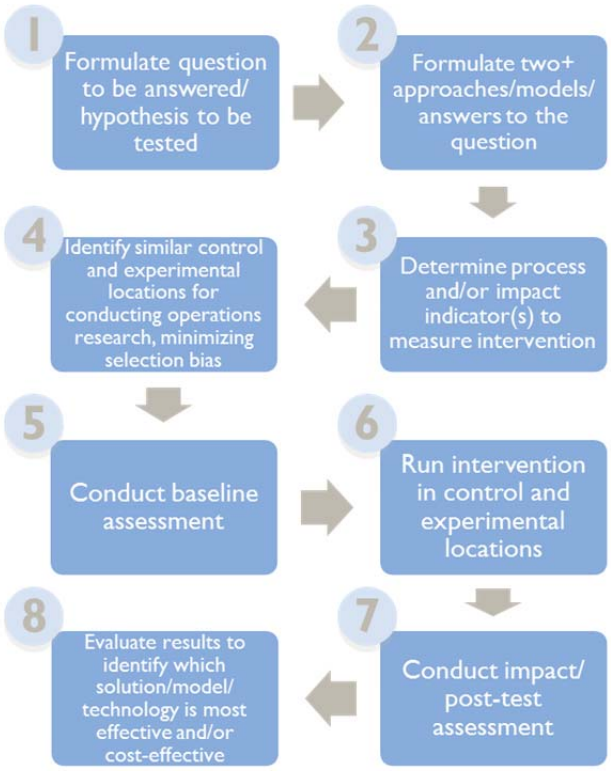
Tanzania:

- mHealth
  - Level of the supply chain
- PBI
  - Level of personnel to incentivize
  - Quantity of payment

Malawi

- mHealth
  - Data points captured

Figure 3. Operations Research Model



Answers to these key questions in the application of mHealth (see page 14) and PBI (see page 18) interventions should guide the implementation of these solutions.

Once the OR pilot district results are available, the optimal solutions should be rolled out nationally in the focal countries in which the OR was conducted. The implementations in the focal countries should be monitored and the lessons learned should be integrated into the assessment and planning for further mHealth and PBI work in other countries with similar challenges lending themselves to these solutions.

Ghana Development Plan

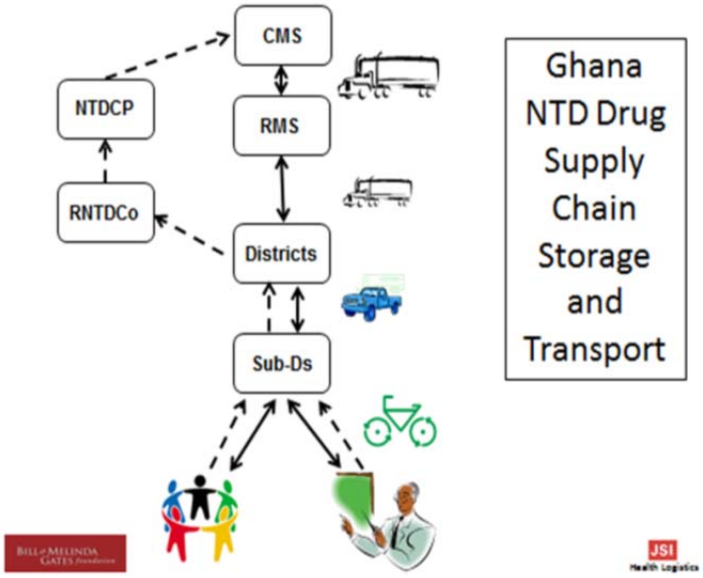
Introduction

Based on recommendations from the country reports and the four key strategies discussed in the Global Chapter of this document, the Ghana Development Plan proposes solutions that will lead to supply chain improvements for NTD MDAs in Ghana, with specific actions and results for the five-year period 2015–2020. The plan includes an overview of the supply chain and outlines key challenges in the country's last mile NTD supply chains. For a fuller understanding of the Ghana context, please review the Ghana Assessment Report, August 2014, available on the JSI website at http://www.jsi.com/JSIInternet/Resources/index.cfm

Supply Chain Overview

The supply chain for Ghana's NTD program is managed through a single supply chain system, which benefits from the services and capabilities of the country's public health supply chain. NTD drugs are distributed from the CMS to the Regional Medical Stores (RMSs), and from there to districts that deliver them to sub-districts. The sub-districts distribute the drugs to health facilities that provide CDDs and school health teachers (SHTs) with supplies for MDAs (see figure 6).

Figure 6. Ghana's NTD Supply Chain



Service and logistics data are collected by CDDs and SHTs, and reported up through sub-districts and districts in summary format. The summaries are then sent to the regional NTD coordinator, the NTDCP, and the CMS.

Key Challenges

Table 5. Key Challenges for NTDCP Last Mile Supply Chains in Ghana

Human Resources
The central level is the only level in the NTD program with dedicated staff. Regions, districts, and sub-districts all rely on district NTD coordinators recruited by the program, who have many duties unrelated to NTDs.
The estimated twenty thousand volunteers who carry out MDAs receive minimal training, supervision, and monetary support (stipends); there is low motivation and high attrition among CDDs, which is a risk to the continued success of the program.
There is a lack of training materials and reference guidelines for health facility staff, CDDs and SHTs.
Training and guideline limitations result in inaccurate quantification at district level and below.

LMIS
At all levels in the system LMIS data were less likely to be accurately recorded and reported than service delivery data.
The LMIS summary report does not facilitate the collection of balance data, and a large proportion of the NTD drug balance is not reported. Accurate data are rarely available at higher levels, which is a prerequisite for reducing the wastage of drugs.
The burden of reporting for under-motivated and lightly trained CDDs and over-worked FLHWs is a leading cause of the general poor quality of the LMIS data. CDDs and SHTs do not summarize data in their registers, significantly increasing the reporting burden for the NTD in-charge at the sub-district.
LMIS data do not drive decision making by the NTDCP regarding how many drugs to issue to which facility; the decision is based on population data and balance remaining data when available.
Many facilities do not maintain inventory control records for NTD drugs.
Storage and Transportation
District-level resources for distribution are limited. The RMSs do not always deliver the NTD drugs and districts must collect them from RMS facilities and distribute them to sub-districts.
There is no funding for returning remaining drugs after the MDAs. Most of these drugs stay at the lowest levels instead of being returned to the RMS level for use in future MDAs. CDDs and SHTs, as well as FLHWs, receive no compensation for transportation to return drugs and are therefore not motivated to do so.
Decisions related to distribution of NTD drugs are made at all levels, but there is minimal coordination between them.
There is a lack of SOPs for the management of NTD drugs.
On January 13th, 2014 the Ghana MOH CMS central warehouse suffered a massive fire and there is no longer a CMS facility to receive and hold NTD drugs.

Proposed Solutions

Ghana's last mile NTD supply chain challenges will be addressed through the four key interventions discussed in the global chapter. Although the challenges listed above are specific to Ghana, they are reflective of issues found in other countries as well. The solutions take into consideration the challenges in this country's particular environment, while applying best practices and lessons learned from across the globe.

1. **Easy access to supply chain expertise**
    a. On January 12, 2015 the Ghana CMS burnt to the ground. As the NTDCP relies on the CMS to receive, store and distribute NTD drugs and supplies, they should have an immediate supply chain assessment to identify an alternative capacity for what is lost from CMS and to plan for both an immediate "stop-gap" and a longer term supply chain solution.

2. **mHealth**
    a. Operations research should be conducted to test the best approach for implementing mHealth reporting, based on Ghana's specific country context. The specific approach should be determined in coordination with OR in other priority countries (see global chapter).

b. mHealth reporting of LMIS data, or at least the drug balance data, should be implemented to ease reporting and improve the use of drug data for purposes such as redistribution during campaigns, return and reuse of drugs remaining after MDA, and for quantifications of requirements at all levels. Based on country-specific information, the preliminary recommendation is that the best approach to supporting NTD reporting with mobile technology is a SMS-based system that leverages users own phones. CDDs or sub-district staff in charge of NTD campaigns, would report drug supply data following each annual campaign. These conclusions will need to be tested and validated through operations research as described above in the OR component of the Global Development Plan.

3. Performance-Based Incentives

a. Operations research should be conducted to test the best approach for implementing PBI, based on Ghana's specific country context. The specific approach should be determined in coordination with OR in other priority countries (see global chapter).
b. CDDs and SHTs should be incentivized to return NTD drugs remaining after campaigns through a "second tier" stipend paid after the submission of records and reports and the return of left over NTD drugs within one month of the end of the MDA.
c. District Health Management Teams should be oriented to the collection of drugs remaining in balance at the sub-districts following campaigns and compensated for fuel and per diems.

4. Guidelines & Materials

a. SOPs should be developed and encased in short, level-appropriate guidelines for MOH Pharmaceutical Management Units. The SOPs should include clear and manageable guidelines for the open vial policy.
b. CMS, RMS, and district PMU staff should be oriented through training to the timing, management, and data (LMIS) requirements of the NTDCP.
c. The post-MDA Summary Reports should be modified as proposed above to improve the reporting of drug balances.
d. The key messages regarding recording and reporting LMIS data should be included in level-appropriate SOP "booklets" that should be developed for FLHWs, CDDs, and SHTs and disseminated during the cascade training.
e. The NTDP and partners should identify adequate resources for implementing the full training schedule rather than splitting the time and costs with other programs.
f. Develop and disseminate clear quantification wall charts for staff at all levels.

Malawi Development Plan

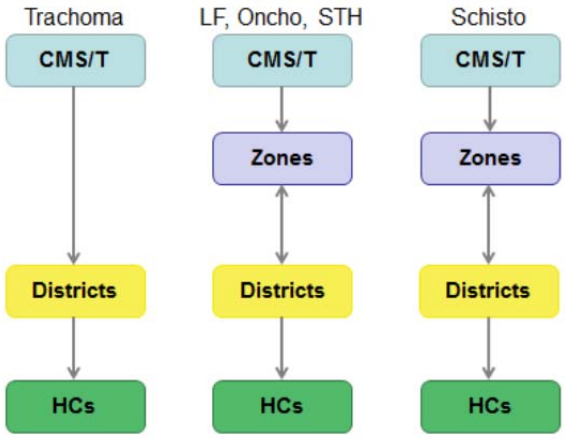
Introduction

Based on recommendations from the country reports and the four key strategies discussed in the Global Chapter of this document, the Malawi Development Plan proposes solutions that will lead to supply chain improvements for NTD MDAs in Malawi, with specific actions and results for the five-year period 2015–2020. The plan includes an overview of the supply chain and outlines key challenges in the country's last mile NTD supply chains. For a fuller understanding of the Malawi context, please review the Malawi Assessment Report, April 2014, available on the JSI website at http://www.jsi.com/JSIInternet/Resources/index.cfm

Supply Chain Overview

In Malawi, five NTD drugs are supplied to MDAs via three distinct supply chains; for all three supply chains, products are delivered from the CMS and distributed to health centers through the districts. In two supply chains, products move through the zonal warehouses before being delivered to the districts (see figure 7).

Figure 7. NTD Supply Chains in Malawi



Annual MDAs are implemented by Health Surveillance Assistants (HSA), CDDs, and teachers, who distribute drugs to the population and collect treatment and logistics information on standardized tally sheets and registers. HSAs summarize the data and send it to the districts, where it is aggregated and passed on to the central level. At annual post-MDA report review meetings, the national NTD Coordinator and the district NTD focal persons review the data for completeness and coverage. If districts are missing significant amount of data or fall short of coverage targets, they are strongly encouraged to take action to close these gaps.

Key Challenges

Table 6. Key Challenges for NTDCP Last Mile Supply Chains in Malawi

Supply Chain Organization
Having three supply chains for just five NTD drugs increases the cost and complexity of drug distribution. Despite a decision by the MOH/NTD Task Force to designate a National NTDCP Coordinator to integrate disease programs, MDA campaigns, to a significant degree, continue to be planned and scheduled independently. This causes MDAs to be implemented in different months, requiring duplication of resources for transport, storage, and management of drugs.
Human Resources
Lack of guidelines, SOPs, and job aids to assist NTD staff at lower levels to better manage quantification,

receipt, storage, distribution, reverse logistics, and reporting of NTD drugs.
Duplication of effort in quantification
Quantifications are taking place at the health facility, the district, and the central levels, resulting in duplication of effort.
LMIS
A critical shortage of stationary for LMIS reporting, including tallies, report forms, and blank paper for hand-drawing forms when supplies run out. Hand-drawn replacements do not always mirror the official forms leading to inaccurate recording of data.
Printed reports do not come in a "multi-copy" format, leaving facilities and districts without a copy of the report, which means they are unable to track progress from year to year.
Minimal use of inventory records for NTD drugs even in places with good management of other drugs; drug supply fields (quantities received, used, in balance) in the health facility annual reports are often not completed, which means that managers do not know where drugs were used or what quantities remain.
A heavy burden of reporting for HSAs and Senior HSAs means that the drug supply data is not always aggregated, or used, at higher levels.
Storage and Transportation
MDAs rely on districts to store NTD drugs, but districts do not have spare capacity. During MDAs districts are inundated, and NTD drugs are not managed as well as routine drugs.
MDA campaigns do not provide funding for use of district vehicles and drivers to support transportation of NTD drugs. Vehicles are often over-subscribed, which is a factor in supply decision-making.
Lack of available transport affects reverse logistics, resulting in higher wastage of the donated drugs. HSAs and senior HSAs are not always compensated for travel to return drugs, which decreases their motivation to do so.
Having three separate MDA campaigns multiplies the burden of storage and transportation for the districts.
Reliance on ad-hoc agreements and under-resourced solutions for storage and transportation increases the vulnerability of the supply chain.

Proposed Solutions

Malawi's last mile NTD supply chain challenges will be addressed through the four key interventions discussed in the global chapter. Although the challenges listed above are specific to Malawi, they are reflective of issues found in other countries as well. The solutions take into consideration the strengths and challenges of this country's particular environment, while applying best practices and lessons learned from across the globe.

1. Easy access to supply chain expertise

a. The NTD Task Force and implementing partners should encourage the integration of the various disease programs now under the integrated NTDCP to facilitate co-implementation of MDAs and reduce the resource burden for supply chain management.

b. The NTDCP should be encouraged and supported to move towards a single supply chain system for the various MDAs. This implies coordination of the timing of international shipments, MDA campaigns and agreements with District Medical Officers, as well as national level coordination under the post of the national NTD Coordinator.

c. Immediate-term: The NTDCP should quantify the costs for fuel and driver per diems to both distribute NTD drugs from the districts, and collect drugs remaining after MDA at the health facilities. The costing should be reviewed with the Task Force and with implementing partners to identify resources for support. Furthermore, the NTDCP should be supported to identify additional (temporary) district storage capacity to be used for the NTD drugs at the time of campaign only. Solutions might include unused but dry and secure space within the district health office compound, within a neighboring school or government facility or even commercial space.
d. Longer-term: The NTDCP should develop a supply chain master plan to move from three ad-hoc supply chain solutions to a single supply chain solution contracted to a third party provider. Two such providers are currently serving the public health sector and are both efficient and cost-effective in ensuring full supply down to the health facility level.

2. mHealth

a. Operations research should be conducted to test the best approach for implementing mHealth reporting, based on Malawi's specific country context. The specific approach should be determined in coordination with OR in other priority countries (see global chapter).
b. The current mHealth (SMS) reporting being used in the health sector for reporting from the CDD and/or health facility levels should be leveraged for NTD drug reporting. Both the quantification and the drug supply reporting could be converted to SMS reporting that would easily generate quantifications by locale, national supply balances and reports of numbers of treatments dispensed. Based on country-specific information, the preliminary recommendation to supporting NTD reporting with mobile technology is a SMS-based system that leverages users' own phones. The system should be implemented from the lowest level, where HSAs would report community level drug supply data following each (annual) campaign. These conclusions will need to be tested and validated through Operations research.

3. Guidelines & Materials

a. The Malawi NTDSCF should quantify needs and costs to ensure full supply of standard records, registers, reports and blank stationery. The quantification should be reviewed with the Task Force and with implementing partners to identify resources to support this relatively small, but important, cornerstone of the NTD program.
b. The annual (post-MDA) Summary Reports should be in multi-copy format to ensure that both the lower and higher level retain a record of performance.
c. The NTDCP should develop brief standard operating procedures for receiving, storing, reporting and returning NTD drugs after MDA. These should be included in the existing NTD booklets used in Malawi as training and reference materials.

Tanzania Development Plan

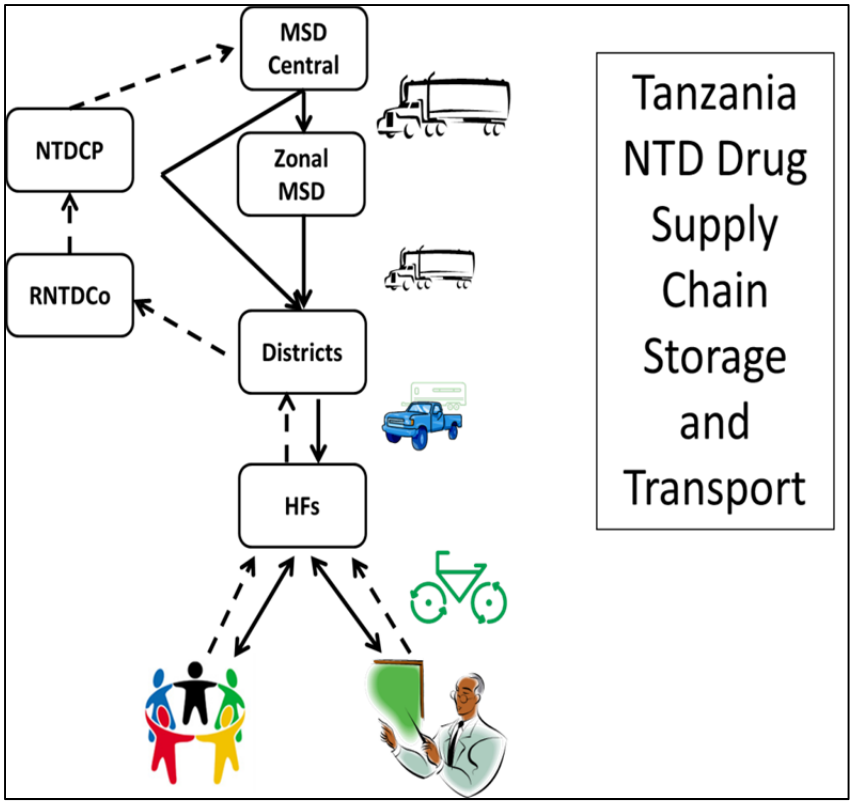
Introduction

Based on recommendations from the country reports and the four key strategies discussed in the Global Chapter of this document, the Tanzania Development Plan proposes solutions that will lead to supply chain improvements for NTD MDAs in Tanzania, with specific actions and results for the five-year period 2015–2020. The plan includes an overview of the supply chain and outlines key challenges in the country's last mile NTD supply chains. For a fuller understanding of the Tanzania context, please review the Tanzania Assessment Report, June 2014, available on the JSI website at http://www.jsi.com/JSIInternet/Resources/index.cfm

Supply Chain Overview

In Tanzania, the MOH has taken steps to integrate vertical NTD programs over the past decade. Currently, MDAs for the five core NTDs are integrated in 17 of 25 mainland regions. The NTD program has an integrated management structure with expertise on the various NTDs, as well as supply chain and monitoring and evaluation capabilities.

Figure 8. Tanzania's NTD Supply Chain



Supplies for NTD MDAs are sent from the country's CMS, the central Medical Stores Department (MSD), through the MSD's Zonal warehouses, and on to the districts. In some cases, products go directly from the central MSD to the districts. Districts transport supplies to health facilities, where CDDs and SHTs collect them. Forms and registers are used to record clinical and logistics data, which is summarized in an integrated NTD summary report. The data is aggregated as it moves up through higher levels of the supply chain to the NTDCP and the central MSD (see figure 8). Any unused drugs should be returned to the health facility after the MDA has ended.

Key Challenges

Table 7. Key Challenges to NTDCP Last Mile Supply Chains in Tanzania

Supply Chain Organization
The integrated NTDCP does not yet cover all of mainland Tanzania.
Human Resources
While training is implemented at the higher levels, many health facility staff, CDDs, and SHTs are not consistently trained and materials are sometimes lacking.
CDDs are increasingly difficult to recruit; the insignificant stipend provided for their efforts often barely covers transport costs to and from the health facility, where they collect and return the MDA materials. As a result, CDDs are not motivated to return unused drugs, leading to wastage.
LMIS
The integrated registers and reports are not always available and not consistently used in all districts. Districts sometimes continue to use old forms, which are less burdensome to fill out; even within districts there can be variations in reporting formats.
The burden of reporting at the lowest levels compromises the completeness, accuracy, timeliness and use of the data. From the lowest level, the data is not summarized, putting a greater burden on the FLHWs.
At the district level, reports are transferred to Excel format and NTD focal persons must key in as many as 40,000 data points to complete a district summary report for a single MDA.
Data collected through registers and summary sheets is often incomplete and incorrect due to the complexity of reporting and the lack of training and motivation at the lower levels. As a result, the balance of drugs held at dispensaries, sub-districts, and districts is frequently under-reported leading to wastage.
LMIS data is often not used for decision-making and many store personnel and NTD focal persons are unable to use the data to quantify drugs.
Storage and Transportation
Zonal level stores appear to be over-burdened with products and have difficulty finding adequate space.
The NTDCP relies on the MSD, a para-statal agency with the MOH as its only client, to distribute NTD supplies. As of 2014, MSD was owed over $60M in back fees and may not be able to keep its operations going more than 12-18 months without an injection of capital.

Proposed Solutions

Tanzania's last mile NTD supply chain challenges will be addressed through the four key interventions discussed in the global chapter. Although the challenges listed above are specific to Tanzania, they are reflective of issues found in other countries as well. The solutions take into consideration the challenges in this country's particular environment, while applying best practices and lessons learned from across the globe.

1. **Provide easy access to supply chain expertise**
    a. The NTDCP should be assisted to more closely define the risk to its program as posed by the situation at the MSD, and to identify an alternative supply chain solution should MSD be unable to continue storage and distribution of the NTD drugs down to the district level.

b. The NTDCP should be supported to harmonize the drug and service reporting Summary reports between regions receiving support from different implementing partners with different disease foci, as well as the coordination of campaigns to minimize the duplication of efforts and costs in delivering and retrieving NTD drugs from the lowest levels.

2. mHealth

a. Operations research should be conducted to test the best approach for implementing mHealth reporting, based on Tanzania's specific country context. The specific approach should be determined in coordination with OR in other priority countries (see global chapter).

b. To reduce the burden of reporting and increase the quality and use of reporting, the NTDCP's earlier pilot of mHealth (cell phone) reporting should be leveraged to implement a new system across Tanzania. The piloted project was popular with the NTDCP program, but may have been too resource intensive as it relied on QWERTY (Android) phones rather than simpler systems utilizing the most basic phones. Based on country-specific information, the best approach to supporting NTD reporting with mobile technology is a SMS-based system that leverages users own phones. In Tanzania, the preliminary recommendation is that the system should be implemented at the health facility/sub-district level. The number of volunteer CDDs is too high to be easily manageable, particularly when training is limited and turn-over tends to be high. These conclusions will need to be tested and validated through Operations research.

3. Performance-Based Incentives

a. Operations research should be conducted to test the best approach for implementing PBI, based on Tanzania's specific country context. The specific approach should be determined in coordination with OR in other priority countries (see global chapter).

b. OR would include pilot testing support and incentive measures to identify and implement the most effective interventions aimed at motivating CDDs and FLHWs to increase coverage, increase reporting timeliness and accuracy, and improve on the collection and return of NTD drugs. Possible options include airtime incentives for timely, accurate mHealth reports from CDDs and FLHWs, and Mpesa (mobile money) reimbursements for CDD transport (i.e. via boda-boda, dala-dala, or bus). Airtime and network support could also be applicable to district NTD coordinators.

4. Guidelines & Materials

a. The national leadership team should hold annual (group) review meetings with all district NTD coordinators in each zone. Formalized pre-MDA group meetings would provide a forum for NTDCP core leadership to reinforce drug management and reporting skills, SOP requirements, and service delivery protocols with district NTD coordinators. Post-MDA sessions with the same representatives would enable the core team to review data and performance metrics with the district NTD coordinators, including coverage, drug management, reverse logistics, and adverse drug reactions (ADRs) and serious adverse

events. These meetings would facilitate greater communication and stronger links between these levels.

b. The NTDCP should coordinate with all implementing partners to ensure standard curriculum, materials and duration of training are used in all regions of Tanzania.
c. The NTDCP should incorporate the key drug management messages (i.e. which forms to use, quantification and return of unused drugs) in the short booklets distributed to FLHWs and CDDs at the time of the training.
d. The NTDCP should work with all their key implementing partners to agree to support the new, integrated registers and report formats for NTDCP reporting. This may require some level of negotiation regarding the level and complexity of data required by each partner.
e. Until such time as a mHealth reporting system can be implemented (and which would automatically generate quantifications/distribution lists), the NTDCP should be supported to develop a basic quantification (plasticized) wall chart for national dissemination at the training for the next MDA.
f. The NTD Summary Report format, and the training, should be updated to accurately capture "Unused" drug balances in order to reduce wastage and expiration.
g. SOPs should be put in place and reinforced through trainings to emphasize 1) the necessity of reverse logistics, 2) advance notification by district teams to the health facilities of when to expect NTD drug deliveries to facilitate identification of additional storage space if needed.

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