Implementing QuanTB to Improve Forecasting, Supply Planning, and Early Warning Systems for TB Medicines: Kenya Report

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About SIAPS

The goal of the Systems for Improved Access to Pharmaceuticals and Services (SIAPS) Program is to ensure the availability of quality pharmaceutical products and effective pharmaceutical services to achieve desired health outcomes. Toward this end, the SIAPS result areas include improving governance, building capacity for pharmaceutical management and services, addressing information needed for decision-making in the pharmaceutical sector, strengthening financing strategies and mechanisms to improve access to medicines, and increasing quality pharmaceutical services.

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CONTENTS

ACRONYMS

CSC	Commodity Security Committee
EWS	early warning system
GDF	Global Drug Facility
KEMSA	Kenya Medical Supplies Authority
M&E	Monitoring and Evaluation
MOH	Ministry of Health
NTLD-P	National Tuberculosis, Leprosy and Lung Disease Program
NTP	National TB Control Program
SIAPS	Systems for Improved Access to Pharmaceuticals and Services
TB	tuberculosis
USAID	US Agency for International Development

ACKNOWLEDGMENTS

The Systems for Improved Access to Pharmaceuticals and Services (SIAPS) Program would like to express appreciation to the National Tuberculosis, Leprosy and Lung Disease Program (NTLD-P) for its cooperation and commitment in strengthening the forecasting, supply planning, and early warning system (EWS) in Kenya. The authors acknowledge the National TB Control Program (NTP) and tuberculosis (TB) stakeholders and partners, including the Kenya Medical Supplies Authority (KEMSA); the Centre for Health Solutions - Kenya; the Centers for Disease Control and Prevention; the World Health Organization; and the Global Fund for their support. In particular, the authors would like to acknowledge Dr. Richard Muthoka (Senior Program Officer, NTLD-P) for his support and for providing his perspective as a beneficiary of the QuanTB tool and SIAPS technical assistance.

INTRODUCTION

This report summarizes the information gathered as part of a review of the implementation of QuanTB and related technical assistance to strengthen TB pharmaceutical management in Kenya.

Background

TB is a preventable and curable infectious disease that ranks alongside HIV/AIDS as a leading cause of death worldwide. If untreated, the disease can be debilitating and can kill approximately 50% of those infected. Proper forecasting, supply planning, and stock monitoring are key to ensuring an uninterrupted supply of TB commodities to meet the evolving needs of TB programs as treatment is scaled up and treatment regimens change. The US Agency for International Development (USAID)-funded SIAPS Program has provided technical assistance to NTPs in 12 USAID-focus countries since 2013. SIAPS regional or in-country technical advisors have collaborated with NTPs to address challenges that hamper uninterrupted access to TB medicines, such as the lack of reliable information for effective decision making in TB supply chain management, an EWS to prevent stock-outs or expiries, and supply chain system monitoring mechanisms, as well as limited institutional and human resource capacity in these areas. The support included the use of QuanTB—an electronic forecasting tool and EWS that transforms complicated calculations into a user-friendly dashboard that displays key quantification and supply planning information and alerts on risks of stock-outs or expiries[1]. Implementation of the tool was complemented by other SIAPS TB technical assistance activities, such as quantification capacity-building training and participation in country monitoring missions.

Kenya is a low-income country in East Africa with a 2015 population of approximately 46.1 million and a life expectancy at birth of 59.9 years for males and 63.4 years for females[2]. TB is a major cause of morbidity and mortality, particularly among those 15 to 44 years of age[3]. In 2014, the prevalence of TB was 266 per 100,000 population, and 89,294 TB cases were reported[4]. The health system is organized into central, provincial, and district levels. In 2014, the public health expenditure comprised approximately 61.3% of the total health expenditure[5]. The responsibility for health care lies with the Ministry of Medical Services (curative service) and the Ministry of Public Health and Sanitation (preventive and promotive services). The country's health management system consists of eight administrative provinces and 47 districts. Health management responsibilities are split between the Provincial Health Management Team (part of the Ministry of Public Health and Sanitation) and the Provincial Medical Services Management Team (part of the Ministry of Medical Services) and their subsidiaries at the district level. The service delivery system includes national teaching and referral hospitals, provincial hospitals,

[1] SIAPS Program. 2013. *QuanTB User's Guide.* Submitted to the US Agency for International Development by the Systems for Improved Access to Pharmaceuticals and Services (SIAPS) Program. Arlington, VA: Management Sciences for Health.
[2] World Development Indicators. Available at: http://data.worldbank.org/indicator.
[3] NTLD-P website. Available at: http://nltp.co.ke/tb-control-in-kenya/.
[4] WHO Global TB Report Kenya Country Profile. Available at: https://extranet.who.int/sree/Reports?op=Replet&name=%2FWHO_HQ_Reports%2FG2%2FPROD%2FEXT%2FTBCountryProfile&ISO2=KE&LAN=EN&outtype=html
[5] World Development Indicators. Available at: http://data.worldbank.org/indicator.

district and subdistrict hospitals, health centers, and dispensaries[6].The health system is funded mainly through the government's public health budget and through development assistance, including Global Fund grants. In 2011, development assistance comprised approximately32.3% of central government expenses[7].

Key Gaps that Necessitated QuanTB Implementation

- *Inadequate forecasting and supply planning capacity:* Inadequate technical skills and tools to forecast and plan for the supply of TB medicines resulted in under- or overestimation of TB medicines. The process took too long using Excel spreadsheets, and the results were less accurate than the QuanTB results.

- *Lack of a stock status monitoring system and EWS*: The lack of a monitoring system for stock status and pipeline management of TB medicines was a challenge. There was also no proper EWS to prevent stock-outs or overstocks and expiry of TB medicines. As a result, there were overstock situations and expiries in some cases and stock-outs in others.

- *Data quality and reporting issues:* There have been challenges with the quality and timeliness of reports sent from health facilities to the national level.

- *Challenges in monitoring TB patient enrollment:* Although the TB program has the TIBU tool (TIBU, meaning "to treat" in Swahili, is a web-based solution integrated with mobile technology that was developed by TB CARE I and launched in November 2012[8]) to collect case data, there was a need for a tool that could link patient enrollment data with TB medicine stock data and facilitate the early detection of potential stock-outs, overstocks, and expiry of TB medicines and related commodities.

The implementation of QuanTB helped to address these gaps.

Goal and Objectives

SIAPS conducted an evaluation of its TB technical assistance and the QuanTB implementation in Kenya. Specific objectives were to determine:

- Key achievements or results of the SIAPS QuanTB technical assistance in Kenya
- Experiences and perspectives of the beneficiaries of the NTLD-P
- Challenges and lessons learned

This report summarizes key aspects and results of the Kenya analysis.

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[6] Luoma, Marc, Julie Doherty, Stephen Muchiri, Tiberius Barasa, Kate Hofler, Lisa Maniscalco, Charles Ouma, Rosalind Kirika and Josephine Maundu. August 2010. *Kenya Health System Assessment 2010*. Bethesda, MD: Health Systems 20/20 project, Abt Associates Inc.

[7] WHO Country Cooperation Strategy Kenya. Available at: http://apps.who.int/iris/bitstream/10665/246158/1/ccs-ken-eng.pdf.

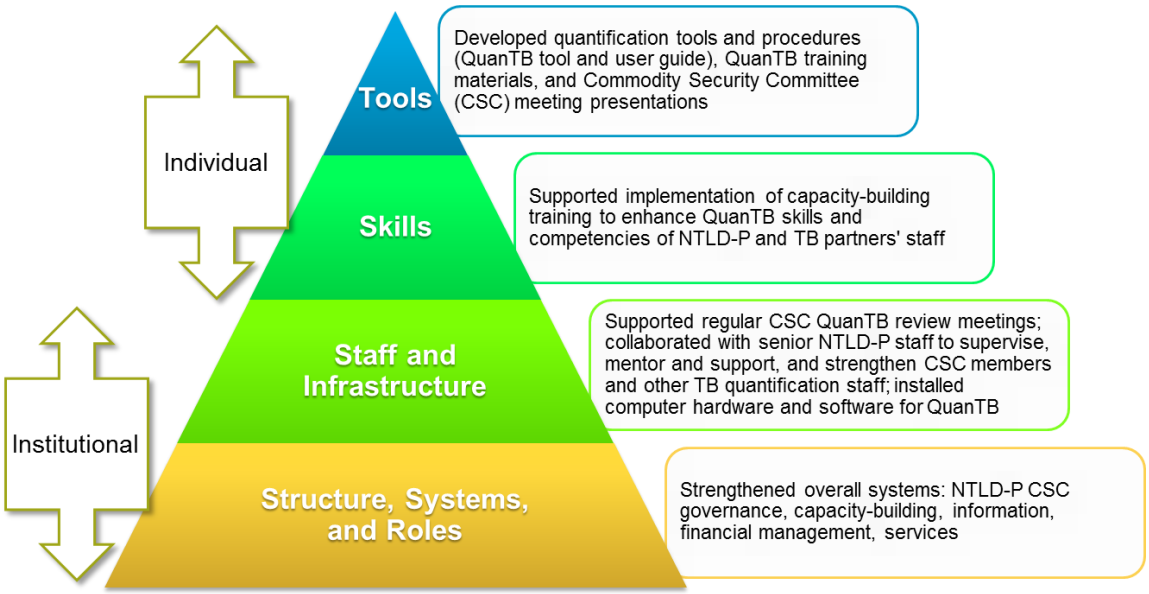
[8] TIBU Poster. Available at: http://healthmarketinnovations.org/sites/default/files/TIBU%20Use%20of%20Innovative%20Technology.pdf.

METHODOLOGY

Data were collected through a review of relevant background documents and reports; interviews with SIAPS TB staff; and remote data collection through telecommunication with SIAPS TB field advisors (using a questionnaire for SIAPS field advisors) and with local beneficiaries of the technical assistance (using one questionnaire for active QuanTB users and another for senior NTLD-P officials and decision makers). Data were analyzed by content (mostly qualitatively) and by prevalent themes surrounding key achievement or success areas. In addition, online experience and satisfaction surveys were completed by country beneficiaries and global partners. Results of the online surveys have been reported separately[9].

Strategic Approach

SIAPS developed QuanTB to promote a systems strengthening approach to TB medicine management[10]. As shown in figure 1, implementation of the tool is expected to strengthen the country quantification system through systemic institutional and individual capacity building. Optimum capacity in all levels of the hierarchy is key to ensuring timely reporting of valid data; timely updating of QuanTB files; and the generation of accurate forecasts, supply planning information, and EWS alerts. The information informs proper decision making and development and the implementation of remedial actions through a technical working group or partner coordination forum.



[9] Goredema W, Sawyer K, Mwatawala S, Owuna C. 2017. *Implementing an Early Warning System for TB Medicines: Global Report.* Submitted to the US Agency for International Development by the Systems for Improved Access to Pharmaceuticals and Services (SIAPS) Program. Arlington, VA: Management Sciences for Health.
[10] SIAPS Program. 2013. *QuanTB User's Guide.* Submitted to the US Agency for International Development by the Systems for Improved Access to Pharmaceuticals and Services (SIAPS) Program. Arlington, VA: Management Sciences for Health.

Figure 1: Systemic institutional and individual capacity building in quantification[11]

Interventions

Key interventions implemented in Kenya included:

- *Capacity building:* Key NTLD-P and partner staff were trained on quantification of TB medicines using QuanTB.

- *Ongoing implementation of QuanTB for quantification, stock status monitoring, and as an EWS:* The country is using QuanTB as the main tool for forecasting and planning supplies of TB medicines, ongoing tracking of stock status, generating EWS alerts, and taking appropriate actions to prevent or minimize risks such as overstocking and expiry of medicines.

- *Provision of technical assistance through Global Drug Facility (GDF) monitoring missions and program review:* This has strengthened quantification and the TB supply chain system.

[11] *Adapted from:* Potter C, Brough R. Systemic capacity Building: A Hierarchy of needs. Health Policy and Planning 2004; 19(5): 336-345

RESULTS AND DISCUSSION

Process

SIAPS has provided TB technical assistance to Kenya since March 2014. The country has used QuanTB since April 2014. The Ministry of Health (MOH)/NTLD-P implements the tool with technical assistance from SIAPS and in collaboration with key local TB partners and stakeholders, including KEMSA, the Centre for Health Solutions - Kenya, the Centers for Disease Control and Prevention, and the World Health Organization. The country is currently using QuanTB for forecasting, procurement, supply planning, cost analysis, introduction of new medicines or regimens, and as an EWS. The QuanTB process is as follows: The NTLD-P pharmacist receives patient data from facility reports, mainly through the TIBU system and stock on hand data from KEMSA. The pharmacist then extracts and uses relevant raw data to update QuanTB, executes the forecast, and shares the generated reports for use in discussions at monthly Commodity Security Committee (CSC) meetings. The CSC is the NTP's national quantification coordination forum. The committee makes decisions, agrees on action points, assigns responsibilities, and disseminates agreements to all stakeholders. The NTLD-P pharmacist is responsible for report generation and dissemination of the agreed-upon action points and responsibilities. QuanTB reports are generated monthly. QuanTB is currently used only by the NTLD-P at the national level; it has not yet been rolled out to the facility level.

Beneficiary Experiences and Perspectives

Key attributes of QuanTB were rated favorably. An NTLD-P senior official considers the tool to be a simple, user-friendly, timely, reliable, and useful tool compared to the Excel spreadsheets previously used. He noted that when all data are available, the process of quantification or generating EWS dashboards can take less than one hour. Reflecting on how QuanTB has improved the speed and timeliness of forecasting and procurement decision making, he noted: *"Reports can be done more frequently. Review of quantification can even be done monthly, quarterly as the program chooses"*. The NTLD-P is confident that the data used to regularly update QuanTB files are accurate because the tool uses case data and Kenya has an excellent case finding and reporting system. According to the official, each quarter the TIBU system captures all patients put on treatment for both multidrug-resistant TB and drug-sensitive TB, making it possible to have actual enrolled cases per quarter. KEMSA conducts monthly physical stock counts for TB medicines and other programs, which provide accurate data on stock on hand, including expiry dates. The quality of data used for QuanTB inputs is regularly monitored, and the patient numbers in TIBU are verified by the Monitoring and Evaluation (M&E) department. There are also some built-in data quality checks when keying data into TIBU. KEMSA conducts monthly stock takes to ensure that actual stock on hand is used instead of accepting the book balance. While previous tools quantified medicines individually, QuanTB can use parameter data to immediately provide quantities needed, pipeline information, and dashboard alerts for all medicines. According to the NTLD-P, QuanTB has never experienced bug problems or a system crash. The dashboards have alerted decision makers to potential stock-outs and overstocks, and a number of corrective actions are being taken based on QuanTB

outputs. The official noted that the availability of data on enrolled cases makes it easy to compare expected cases with enrolled cases and helped correct projected trends. QuanTB has made NTLD-P forecasting more accurate and efficient. The NTLD-P feels that it can sustain the use of QuanTB because key NTLD-P staff have been trained and the tool does not require an internet connection. However, funds may be needed for ongoing training as new staff become involved in the process.

Accomplishments

Key accomplishments and results of the QuanTB implementation in Kenya to date include:

- *Adopted and institutionalized QuanTB:* With ongoing SIAPS technical assistance, the NTLD-P has adopted and fully institutionalized QuanTB as the national quantification tool for TB medicines.

- *Enhanced local quantification capacity and skills*: SIAPS provided technical assistance to the NTLD-P to developing training materials and to train and capacitate the senior pharmacist and 10 CSC staff on using QuanTB to quantify TB medicines. Since April 2014, SIAPS has supported the NTLD-P in convening regular CSC meetings. SIAPS and senior NTLD-P staff supervise, mentor, and support CSC and other TB quantification staff on an ongoing basis. As a result of continuous capacity building, the CSC is able to update QuanTB data and generate forecasts with less and less SIAPS support. As part of the ongoing effort to enhance local capacity to manage TB medicines, SIAPS supported the pharmacist-in-charge to participate in the TB regional meeting in Zanzibar, Tanzania, in December 2012. SIAPS also supported three NTLD-P staff (NTLD-P head, pharmacist-in-charge, and M&E staff) to attend the Global TB Supply Chain Meeting in Bangkok, Thailand, in March 2015. This allowed NTLD-P staff to share experiences related to the TB supply chain, learn from others, discuss and prioritize their key TB supply chain challenges, and agree on potential solutions.

- *Improved forecasting and supply planning*: QuanTB forecasts and supply plans are reviewed monthly to adjust for updated patient enrollment numbers, stock on hand, and expiry dates. SIAPS also assists with conducting actual forecasting and supply planning of TB and related medicines. As mentioned above, the results are more timely, accurate, and reliable than the quantification results prior to QuanTB. Quantities for procurement are easily determined, and orders are placed to ensure an uninterrupted supply of TB medicines. Implementation of the tool also helps to review trends in actual enrollment of TB cases and to take necessary steps to minimize the risk of stock-outs or overstock of certain medicines when TB cases increase or decrease. Examples of how the NTLD-P has used QuanTB information to make decisions to improve forecasting, procurement, supply planning and in-country logistics include the quantification of bedaquiline and companion medicines in December 2015, with an order placed to the GDF the same day. Reviews of procurement quantities are done quickly. Recently, the program was able to review quantities of old pediatric formulations to be procured after the delivery schedule for the new formulations was adjusted from June to September 2016. This was done

within hours. QuanTB has been the source of quantification reports used for procurement. QuanTB contributed to improved projection of TB cases. By comparing the actual number of enrolled cases with expected cases for each quarter, the NTLD-P has been able project the number of expected cases.

- *Implemented the QuanTB EWS to prevent stock-out and wastage of TB medicines:* SIAPS provided technical assistance to establish the EWS for TB medicines and provided ongoing technical assistance for monthly monitoring of TB stock status using QuanTB. This support includes reviewing and analyzing QuanTB outputs and using QuanTB dashboard alerts to propose corrective actions. The QuanTB EWS stock status monitoring activities have informed several TB supply chain decisions and been used to monitor TB program performance and make corrective actions to mitigate stock-outs by alerting the GDF whenever critical stock levels are reached. Similarly, actions to prevent wastage and expiration were initiated. For example, monitoring expiries allowed 14,000 vials of kanamycin worth USD 7,380 to be donated to Uganda to prevent expiry. An emergency procurement of 1,000 levofloxacin 250mg packs and 1,000 levofloxacin 500mg packs was initiated based on EWS reports. QuanTB dashboards are also used to brief senior MOH officials on the country stock situation. QuanTB forecasting and EWS reports have been used to justify funding requests to donors, including the GDF and the Global Fund. In 2014, QuanTB reports were used to convince the Government of Kenya to set aside USD 3 million for the procurement of TB medicines following the devolution of government. QuanTB data provided good evidence to give to the GDF to substantiate country fears of the adverse impact of stock-outs or expiry of medicines if shipments were not fast-tracked or delayed. QuanTB also enabled the NTLD-P to easily monitor medicine availability in complex, multidrug TB treatment regimens. In addition, QuanTB has been the source of quantification reports used for procurement. The NTLD-P has used QuanTB to determine the procurement of new pediatric formulations during the phase-in phase-out period. The country worked with the GDF to initiate procurement or expedite pending orders of levofloxacin[12,13].

[12] SIAPS. Sept. 2015. SIAPS TB Quarterly Report: QuanTB and Early Warning System Roll-out and Implementation. Submitted to the US Agency for International Development by the Systems for Improved Access to Pharmaceuticals and Services (SIAPS) Program. Arlington, VA: Management Sciences for Health

[13] SIAPS. May 2016. SIAPS TB Quarterly Report: QuanTB and Early Warning System Roll-out and Implementation. Submitted to the US Agency for International Development by the Systems for Improved Access to Pharmaceuticals and Services (SIAPS) Program. Arlington, VA: Management Sciences for Health.

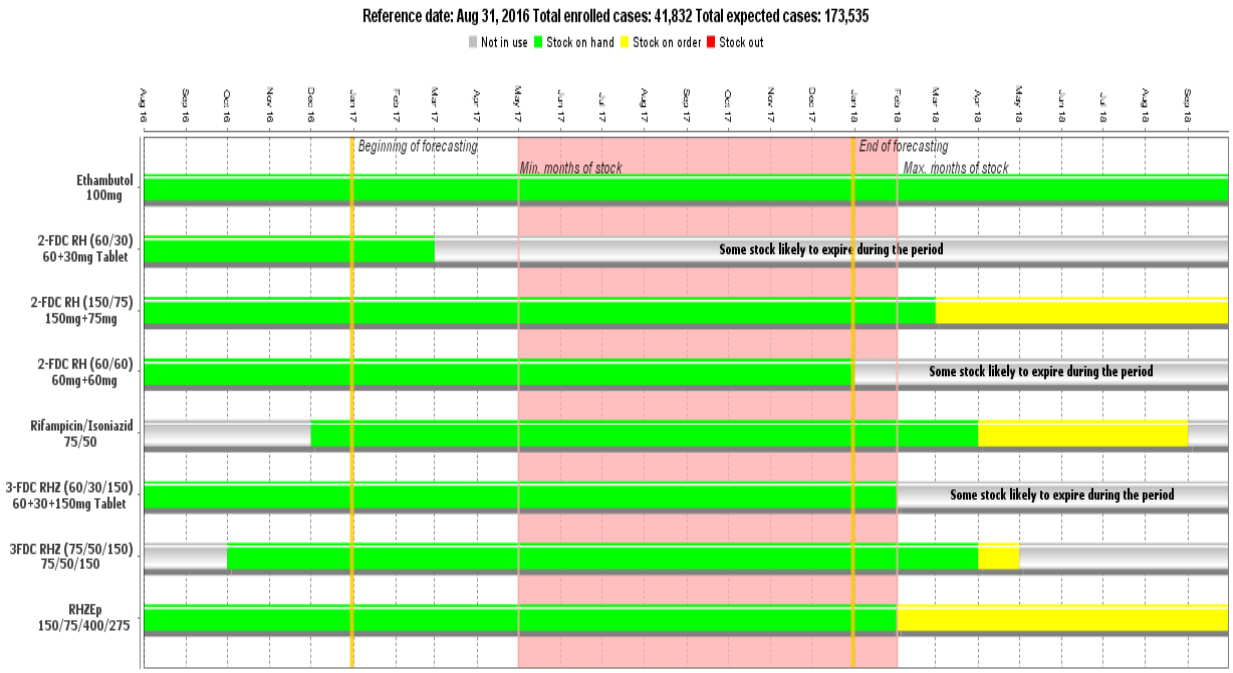


Figure 3. Sample QuanTB dashboard

Trends of Stock-outs of TB Medicines

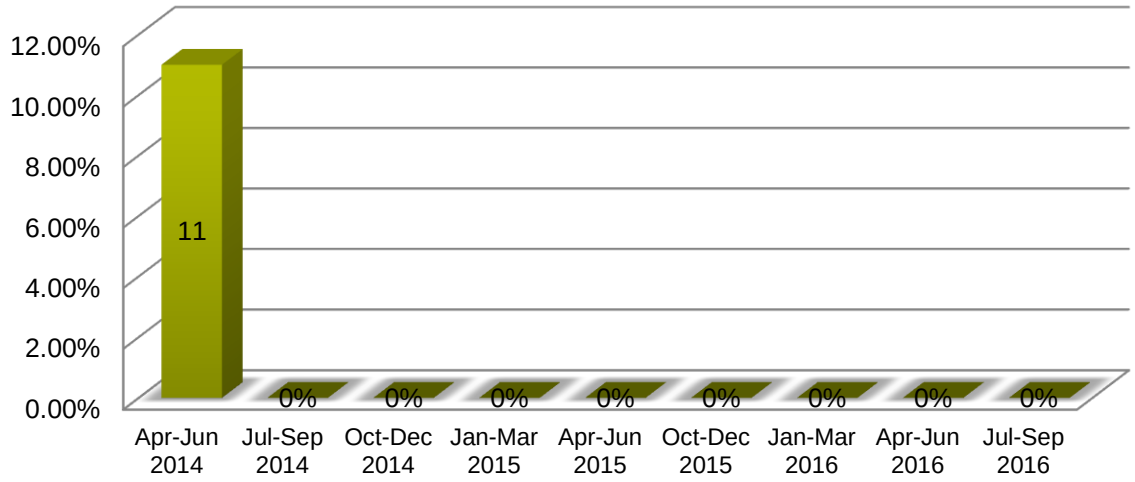


Figure 4. Percentage of stock-outs of first-line TB medicines[14]

[14] KEMSA (Kenya Medical Supplies Authority) monthly stock status report.

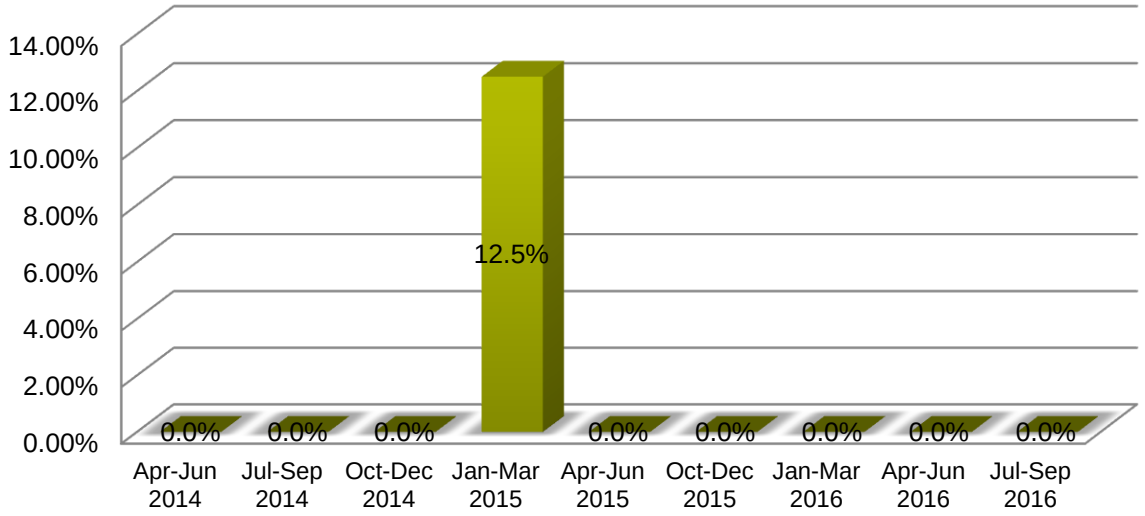


Figure 5: Percentage of stock-outs of second-line TB medicines[15]

At the time of the evaluation, there had been no stock-out of first-line medicines since July 2014 and a stock-out of only one second-line medicine (levofloxacin) since March 2015.

- *Systems strengthened:* The implementation of QuanTB and SIAPS TB technical assistance activities have strengthened key functional areas of supply chain systems for TB control, including:

    - *Governance:* The CSC uses EWS reports to develop action points and make key decisions on commodity supplies.

    - *Capacity building:* The NTLD-P's institutional and human resource capacity for quantification and stock status monitoring has improved.

    - *Information systems:* EWS reports have enabled evidence-based decision making. The EWS has also strengthened information systems by linking patient- and stock-related data, which facilitates the early detection of potential stock-outs, overstock, or expiry of TB commodities. SIAPS is currently providing technical assistance to the NTP to implement an electronic system for reporting peripheral use of commodities through the web-based DHIS2 platform. This is expected to improve the visibility of inventory in lower levels of the supply chain and augment the benefits of the QuanTB EWS.

    - *Financial management systems:* EWS reports have been used to mobilize resources, particularly when emergency funding is needed to prevent imminent stock-outs. Cost analyses, budgeting, and overall financial management systems have also been enhanced through better estimation of national needs and less wastage.

[15] GDF order tracking system.

  - *Services:* Quantification can be done easily, and the process has become more efficient. Staff can use the tool to execute accurate quantification and generate stock status reports when needed. Procurement and supply planning—monthly EWS reports inform decisions on when commodity shipments will be needed and when to place orders. Scheduling of deliveries for pending supplies is now done efficiently using QuanTB v3. All this has improved the availability of TB medicines and TB control services.

- *Improved collaboration:* Strong collaboration has been established among Department of Health/NTLD-P, SIAPS, and other partners in Kenya. Good coordination and collaboration was also established among the NTLD-P, GDF, and other local and global TB stakeholders. SIAPS support has helped connect NTLD-P pharmacy staff with other countries' NTP pharmacy staff, thereby facilitating the exchange of stock.

Overall, SIAPS TB technical assistance and implementation of the QuanTB EWS have contributed to reduced stock-outs, improved procurement planning, and reduced expiries and wastage. Between January 2015 and August 2016, stock-outs decreased from 11% to 0% for first-line medicines and from 12.5% to 0% for second-line medicines.

Key Challenges and Lessons Learned

Challenges

- *Data quality and reporting*: There were low logistics management information system reporting rates and delays in obtaining lower-level data. This is being addressed by incorporating reporting of peripheral use of commodities into DHIS2.

- *Human resources and capacity:* Very few staff have been trained to use the tool. To address this, the NTLD-P is working with SIAPS to implement a capacity building plan to train additional staff.

Lessons Learned

- QuanTB has greatly improved quantification and pipeline monitoring. The introduction of version 3.0 has been a major improvement in supply planning.

- Strong partnerships with in-country partners are key to leveraging resources and coordinating support to the MOH, particularly in countries where there is no in-country SIAPS technical advisor or SIAPS office.

- Regular monitoring of TB stock levels against patient enrollment is key to ensuring early identification of potential wastage or stock-outs of TB medicines.

- Capacity-building refresher trainings on QuanTB and on improving data quality and reporting are needed on an ongoing basis. These trainings help to address human resource issues and the adverse impact of ongoing staff attrition.

- To achieve the best coordination, collaboration, and results, TB partners supporting the implementation of QuanTB should consider embedding in-country field advisors within the NTLD-P.

- There is a need to include budgets for ongoing human resource capacity building in routine MOH plans and in grant application proposals such as the Global Fund.

Gaps for Future Consideration

- Continue to build in-country capacity and experience to implement the tool. Implement ongoing staff capacity-building refresher trainings to mitigate the impact of staff attrition.

- Build in-country IT capacity to address QuanTB software problems as they arise.

- Continue to improve data quality and data reporting from the periphery and include lower-level data when updating QuanTB.

- QuanTB modifications should include a simple module that focuses on the health facility level that could help improve inventory management at that level.

CONCLUSION

With USAID/SIAPS technical assistance, the Kenyan NTLD-P has successfully institutionalized and implemented the QuanTB EWS using a locally led, effective, and sustainable approach to improve forecasting, monitor stock, track expiries and stock-outs, make informed decisions, and take appropriate actions to close underlying procurement and supply management gaps. Forecasting and budgeting of TB medicines is now easier. The trend of stock-out rates of TB medicines is a good indicator of the achievements of implementing the tool and related TB technical assistance. However, continued investment is needed to address the remaining gaps. Therefore, the NTLD-P should continue to engage and collaborate with local stakeholders and partners to ensure the effective and efficient use of available resources to sustain the use of the QuanTB EWS.