



# Implementing an Early Warning System for TB Medicines: Global Report

May 2017



**USAID**  
FROM THE AMERICAN PEOPLE

**SLAPS**   
Systems for Improved Access  
to Pharmaceuticals and Services

# Implementing an Early Warning System for TB Medicines: Global Report

Wonder Goredema  
Kelly Sawyer  
Salama Mwatawala  
Chinwe Owuna

May 2017



**USAID**  
FROM THE AMERICAN PEOPLE

**SIAPS**   
Systems for Improved Access  
to Pharmaceuticals and Services



This report is made possible by the generous support of the American people through the US Agency for International Development (USAID), under the terms of cooperative agreement number AID-OAA-A-11-00021. The contents are the responsibility of Management Sciences for Health and do not necessarily reflect the views of USAID or the United States Government.

## **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.

## **Recommended Citation**

This report may be reproduced if credit is given to SIAPS. Please use the following citation.

Goredema, Wonder, K. Sawyer, S. Mwatawala, and C. Owuna. 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.

Systems for Improved Access to Pharmaceuticals and Services  
Pharmaceuticals and Health Technologies Group  
Management Sciences for Health  
4301 North Fairfax Drive, Suite 400  
Arlington, VA 22203 USA  
Telephone: 703.524.6575  
Fax: 703.524.7898  
E-mail: [siaps@msh.org](mailto:siaps@msh.org)  
Website: [www.siapsprogram.org](http://www.siapsprogram.org)

## CONTENTS

Acronyms .....	iv
Acknowledgments.....	v
Executive Summary .....	vi
Introduction.....	1
Background.....	1
Intervention.....	2
Goal and Objectives.....	4
Methodology.....	5
Results.....	6
Document Review and Interviews.....	6
Beneficiary Experiences and Perspectives .....	7
Achievements.....	7
Availability of TB Medicines .....	12
Online Experience and Satisfaction Surveys.....	13
Challenges, Lessons Learned, and Sustainability.....	16
Challenges.....	16
Lessons Learned .....	16
Sustainability and Country Ownership.....	17
Limitations .....	18
Conclusion and Recommendations.....	19

## ACRONYMS

DRC	Democratic Republic of the Congo
EWS	early warning system
GDF	Global Drug Facility
LMIS	logistics management information system
MOH	Ministry of Health
NTP	National TB Control Program
PSM	procurement and supply management
SIAPS	Systems for Improved Access to Pharmaceuticals and Services
TB	Tuberculosis
TWG	technical working group
USAID	US Agency for International Development

## ACKNOWLEDGMENTS

We would like to express appreciation to the National TB Control Programs (NTPs) and tuberculosis (TB) stakeholders and partners of Bangladesh, Democratic Republic of the Congo (DRC), Kenya, Myanmar, Nigeria, Philippines, South Sudan, Tajikistan, Tanzania, Uganda, Zambia, and Zimbabwe for their collaboration and support in implementing and evaluating the impact of QuanTB and related TB technical assistance. We would like to acknowledge the country NTP managers, QuanTB users, and NTP decision makers for their support and participation in the review, including Dr. Gabriel Akang, Azhee Akirin, Pharms Ekpenoh Akpanowo, Mr. Shah Alam, Kennedy Amadi, Cédric Andres, Mr. Arnyl Araneta, Pharm Bunmi Aribeana, Dr. Rhoda Atteh, Dr. Si Thu Aung, Dr. Georges Bakaswa, Mr. Samuel Balyejussa, Browan Bariki, Dr. Vikarunnessa Begum, Mr. Oktam Bobokhojaev, Mr. Armando Castillo, Dr. Md. Abdul Hamid, Dr. Rhehab Chimzizi, Khoudia Diokhane, Mr. Masimba Dube, Mr. Jover Francisco, Dr. Anna Marie Celina Garfin, Soso Getsadze, Dr. Ogtay Gozalov, Mohammed Ibrahim, Dr. Md. Quamrul Islam, Zahedul Islam, Jamilya Ismailova, Zhildiz Issikeeva, Gulnora Jalinova, Dr. Nathan Kapata, Dr. Carlistus Khayunga, Mr. Morton Khunga, Mohammad Kibria, Dr. Joseph Kuye, Dr. Hickson Lasu, Dr. Adebola Lawanson, Mr. Martin Likambo, Dr. Irina L'Iverko, Sophie Logez, Dr. Joseph Lou, Ms. Yu Par Min Lwin, Johnson Lyimo, Dr. Asif Mujtaba Mahmud, Mavluda Makhmudova, Dr. Enos Masini, Dr. Htet Myet Win Maung, Chiagozie Mgbemena, Alson Mhazo, Jumanne Mkumbo, Elena Mochinova, Alessio Mola, Dr. Frank Mugabe, Phne Louise Mulimbi, Dr. Beatrice Mutayoba, Dr. Richard Muthoka, Ms. Victoria Nakiganda, Dr. Vital Nkake, Annette Kasi-Nsubunga, Pharms Linus Odoemene, Alhassan Shaibu, Daniel Onwuh, Dr. Ruth Orillaza-Chi, Ms. Marie Kristine Padilla, Job Van Rest, Dr. M A Hamid Salim, Dr. Charles Sandy, Ladi Stephen, Dr. Sabera Sultana, Dr. Mary Rosary Taguinod-Santiago, Ms. Liza Talukder, and Md. Rosidur Zaman. We also acknowledge the staff of the global TB stakeholder and partner organizations that participated in this review.

We thank the Systems for Improved Access to Pharmaceuticals and Services (SIAPS) field technical advisors who contributed to this evaluation through fieldwork, data collection, providing information, and making technical contributions, including Hlaing Aung, Serge Kalume, Maya Kavtaradze, Isaac Linatoc, M.H.M. Mahmudul Hassan, Princess Christine Mangao, Charles Njuguna, and Maria. A. Ochigbo.

Last but not least, thanks are given to Niranjana Konduri for support throughout the planning and implementation of the review.

Wonder Goredema was the technical lead and coordinator of the review.

## EXECUTIVE SUMMARY

As part of its mission to improve the availability of TB medicines, the US Agency for International Development (USAID)-funded SIAPS Program, implemented by Management Sciences for Health, provided technical assistance to NTPs in 14 USAID-focus countries to improve TB procurement and supply management (PSM). This included the use of the QuanTB early warning system (EWS) to improve forecasting, supply planning, and monitoring of availability, stock-outs, and expiries. SIAPS in-country and regional technical advisors for TB assisted the NTPs to adopt, institutionalize, and implement the tool. To ensure country ownership and sustainability, SIAPS employed a systems strengthening approach that included obtaining the buy in of country NTPs, building their institutional and human resource capacity to improve data collection and quality and to regularly monitor stock status and supply chain risks using QuanTB, and strengthening the communication and coordination of NTP counterparts with local and global stakeholders in disseminating and using EWS information. 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. Currently in its fourth version, QuanTB is available in English, Russian, French, Spanish, Portuguese, and Chinese.

SIAPS conducted a review of the impact of the QuanTB implementation and related TB PSM technical assistance in 12 countries—Bangladesh, DRC, Kenya, Myanmar, Nigeria, Philippines, South Sudan, Tajikistan, Tanzania, Uganda, Zambia, and Zimbabwe. The review was conducted using data collected from background documents, reports, interviews with SIAPS staff and country beneficiaries, and online satisfaction and experience surveys. Objectives of the review included determining key achievements, experiences, and perspectives of in-country and global beneficiaries and challenges and lessons learned from the intervention.

Key themes that arose from the analysis included high satisfaction and confidence with QuanTB; a high level of perceived strengthening of the overall supply chain system for TB as a result of the tool and technical assistance; manageable costs of implementing the tool; improved decision making for quantification and supply planning as a result of the EWS and related SIAPS technical assistance; and reductions in wastage, expiries, and stock-outs of medicines.

Key achievements of SIAPS technical assistance and the implementation of QuanTB included:

QuanTB was adopted and institutionalized in 10 countries.

- Countries' NTP institutional and staff capacity was enhanced for more frequent, effective, and efficient quantification coupled with vigilant stock management, which resulted in improved availability of medicines to meet the evolving needs of NTPs.
- EWS data and dashboards on stock-outs of TB commodities helped improve forecasting and supply planning and inform timely, evidence-based decisions and corrective actions to close underlying PSM gaps, resulting in savings of limited resources.

- The logistics management information systems (LMIS) and data quality and reporting were improved for better decision making. Overall supply chain systems were also strengthened.
- Stock-out rates of TB medicines declined.
- As of March 2017, QuanTB had been downloaded more than 2,000 times worldwide by 134 countries or almost 70% of all countries in the world, showing widespread interest in the tool.



## INTRODUCTION

This report summarizes the information gathered as part of an evaluation of the implementation of an EWS for TB commodities and related TB PSM technical assistance in Bangladesh, DRC, Kenya, Myanmar, Nigeria, Philippines, South Sudan, Tajikistan, Tanzania, Uganda, Zambia, and Zimbabwe.

### 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. Successful treatment of the disease requires patients to have continuous access to quality TB medicines and related commodities. However, this remains a challenge despite improvements in global donor support for PSM of TB commodities. 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 USAID-funded SIAPS Program has provided technical assistance to NTPs in 14 USAID-focus countries since 2013. SIAPS regional or in-country technical advisors collaborated with NTPs to address challenges that hamper uninterrupted access to TB medicines. SIAPS identified a number of issues in TB pharmaceutical management at the country level that contribute to quantification errors, late procurement, and stock-outs and treatment interruptions. Key challenges were related to inadequate capacity and the lack of reliable tools to link enrolled and forecasted TB case data with medicine data (stock, expiry, consumption) and accurately forecast TB commodity needs for different scenarios (e.g. planned versus actual case enrollment, planning for enrollment of new medicines, costs of regimens, orders, services). There was no reliable medicine pipeline data (many countries had data from the central store but not from TB facilities in the provinces), and countries had neither tools nor a functional EWS to regularly monitor availability, stock-outs, and expiry.<sup>1</sup> Deficiencies in country management information systems resulted in a lack of reliable information for decision making. There were also issues related to late procurement, unknown lead times, and medicine distribution and delivery. These challenges were particularly problematic in countries where the NTP is not a Global Fund Principal Recipient or does not manage the procurement process. There was also poor coordination among agencies involved in procurement (i.e., the Global Fund, Global Fund Principal Recipients, Global Drug Facility (GDF), Ministry of Health (MOH), and NTPs). Poor tracking of orders from the GDF or other suppliers led to delays in custom clearance and distribution, which compounded the problem of stock-outs. NTP capacity for PSM within TB programs was weak at the country level.

---

<sup>1</sup> Systems for Improved Access to Pharmaceuticals and Services Program TB Core Work Plan: Direct Assistance to USAID priority countries February 1, 2014–September 30, 2015 (additional FY13 funding). Submitted to the U.S. Agency for International Development by the Systems for Improved Access to Pharmaceuticals and Services (SIAPS) Program. Arlington, VA: Management Sciences for Health.

## **Intervention**

To address these challenges, SIAPS established and implemented a regional systems strengthening technical assistance approach<sup>2</sup> that involved collaborating with NTPs. The main focus of the approach was the establishment and implementation of a reliable EWS that was based on improved inventory management, data collection, and reporting using QuanTB, a downloadable, electronic forecasting, supply planning, and EWS tool that performs complicated calculations. A user-friendly dashboard shows key quantification and supply planning information and alerts on risks of stock-outs or expiries. QuanTB was reviewed with representatives of eight countries (DRC, Kenya, Malawi, Nigeria, South Sudan, Swaziland, Tanzania, and Zambia) that participated in a regional training workshop on TB medicine management in Swaziland in May 2013 to obtain their buy-in and get feedback on the tool. Based on the feedback, the tool was modified to include needed data elements and frequency of reporting for the EWS<sup>3</sup>, and version 1 of the tool was finalized and disseminated in 2013. SIAPS in-country and regional TB technical advisors helped countries institutionalize and implement QuanTB as the national EWS and as a forecasting and supply planning tool for TB commodities. SIAPS also assisted countries to identify and improve other supply chain management gaps, such as data collection and reporting, inventory management, forecasting, supply planning, and communication with procurement agencies. Countries were supported to use QuanTB EWS alerts to monitor TB stock status and expiry of TB commodities at least once every quarter and ensure that corrective actions were taken based on the reports to avoid stock-outs and to coordinate and monitor timely order procurement and distribution through the entire supply chain. SIAPS also helped NTPs develop strengthening plans for data quality assurance and monitor performance of the PSM systems.<sup>4</sup>

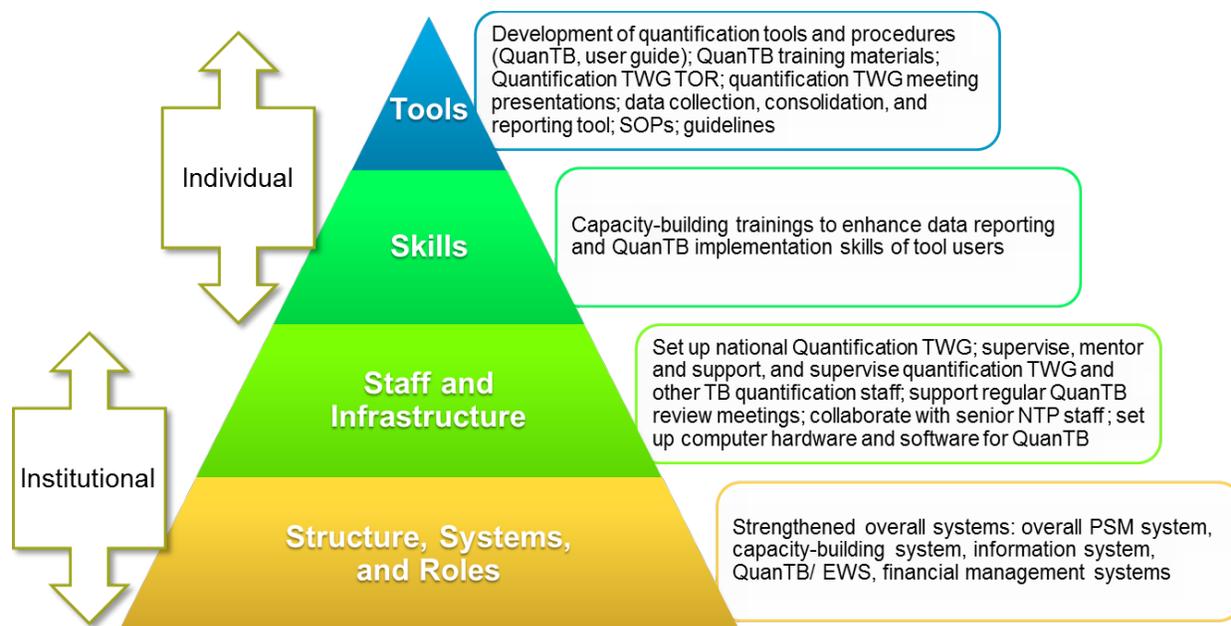
The institutional and individual capacity of the NTPs were systematically enhanced to address all levels of the capacity-building hierarchy and ensure timely reporting of valid data; updating of QuanTB files; the generation of accurate forecasts, supply planning information, and EWS alerts; and the dissemination and use of the results for informed decisions and remedial actions (figure 1).

---

<sup>2</sup> Systems for Improved Access to Pharmaceuticals and Services Program TB Core Work Plan: Direct Assistance to USAID priority countries February 1, 2014–September 30, 2015 (additional FY13 funding). Submitted to the U.S. Agency for International Development by the Systems for Improved Access to Pharmaceuticals and Services (SIAPS) Program. Arlington, VA: Management Sciences for Health.

<sup>3</sup> SIAPS. 2013. SIAPS TB Core quarterly report: April–June 2013. 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.

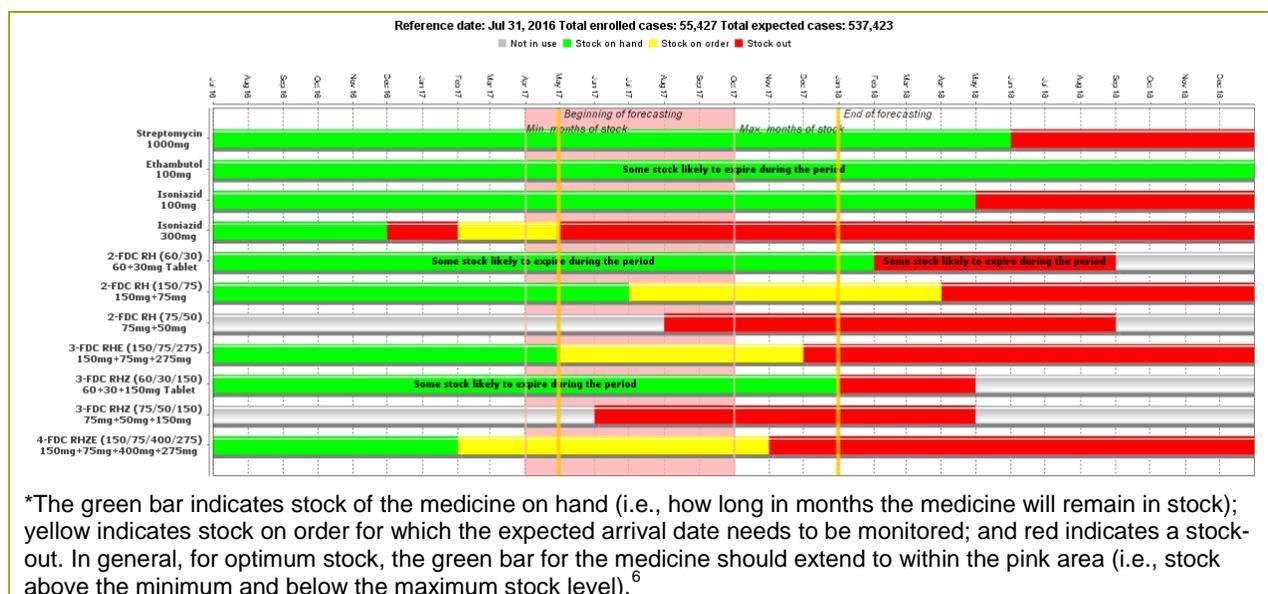
<sup>4</sup> Systems for Improved Access to Pharmaceuticals and Services Program TB Core Work Plan: Direct Assistance to USAID priority countries February 1, 2014–September 30, 2015 (additional FY13 funding). Submitted to the U.S. Agency for International Development by the Systems for Improved Access to Pharmaceuticals and Services (SIAPS) Program. Arlington, VA: Management Sciences for Health.



**Figure 1. Systemic institutional and human resource capacity building in quantification<sup>5</sup>**

To ensure country ownership and sustainability, the implementation strategy included obtaining buy-in from country NTPs, building country staff capacity to implement the EWS, and working with countries to ensure regular monitoring of TB medicine stocks. Local dissemination of forecasting and EWS results was promoted by strengthening in-country stakeholder PSM platforms and supporting ongoing data sharing with the GDF and global-level partners for further technical support. SIAPS also collaborated with the Stop TB Partnership's GDF in training staff and consultants and obtaining feedback to improve the tool.

<sup>5</sup> Adapted from Potter C, Brough R. Systemic capacity building: A hierarchy of needs. *Health Policy and Planning* 2004; 19(5): 336–34.5



**Figure 2. Sample QUANTB dashboard\***

The tool was implemented with additional TB technical assistance, such as strengthening data quality and the LMIS; contributing to development of PSM plans for Global Fund grant applications or Global Fund new funding model applications; developing national strategic plans; revising national treatment guidelines; improving coordination among NTPs, other MOH agencies, donors, and TB stakeholders and partners; and addressing other TB supply chain bottlenecks.

SIAPS also worked with selected countries to develop country-level TB supply chain indicators that were then tracked and reported through quarterly reports. The indicators were first piloted in Tanzania and Nigeria. Trends of stock-out rates of TB medicines were used, among other things, to assess the achievements and overall impact of this intervention on the performance of the TB supply chain system.

Between 2015 and 2016, SIAPS conducted an evaluation of the intervention in 12 of the 14 countries that it supported. Mozambique and Uzbekistan were excluded because there were challenges collecting data due to language problems and non-availability of key in-country NTP personnel due to competing priorities.

## Goal and Objectives

The goal of the evaluation was to review the impact of implementing SIAPS TB technical assistance and QUANTB in the selected countries. Specific objectives were to determine:

- Key achievements or results of implementing SIAPS QUANTB technical assistance and QUANTB
- Experiences and perspectives of in-country and global beneficiaries
- Challenges and lessons learned from the intervention

This report summarizes key aspects and results of the evaluation.

<sup>6</sup> *ibid*

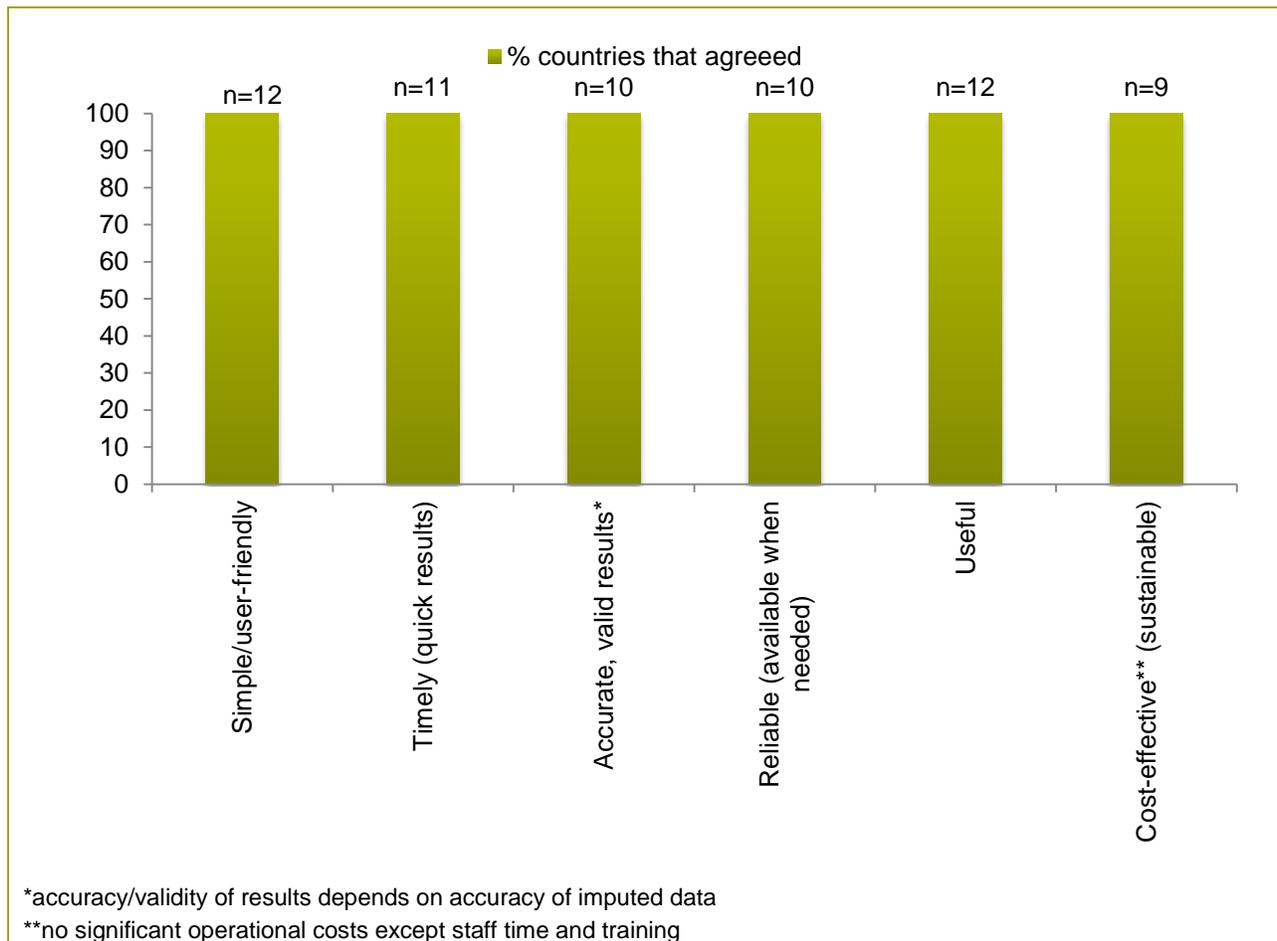
## METHODOLOGY

Data were collected for the analysis using various methods. A review of relevant background documents and reports was undertaken, followed by interviews with SIAPS home office TB staff and field-based TB technical advisors using a self-administered questionnaire with 11 open-ended questions. Next, face-to-face, telephone, and Skype interviews with in-country beneficiaries (i.e., users of QuanTB and the EWS and/or recipients of SIAPS technical assistance) were conducted to gather input and perspectives on QuanTB and SIAPS technical assistance. Beneficiaries were interviewed by SIAPS field advisors who administered a questionnaire for active users of the system that included 26 open-ended and multiple choice questions with follow-up questions as needed. In addition to the beneficiaries, SIAPS regional advisors interviewed senior NTP decision makers using 28 open-ended and multiple choice questions with follow-up questions as needed. Country beneficiaries and global partners completed separate online experience and satisfaction surveys. The online surveys had 16 Likert-type scale multiple choice questions. The data were analyzed by content (mostly qualitatively) and by prevalent themes around key achievement areas.

## RESULTS

### Document Review and Interviews

Thirteen of the 24 prospective respondents to the questionnaire for QuanTB users (54%) representing 7 of the 12 countries (58%) were available to be interviewed, while 10 of the 24 prospective respondents to the questionnaire for NTP senior decision makers, also representing 7 countries, were interviewed. In addition, all 8 SIAPS TB field technical advisors (2 regional and 6 in-country) were interviewed.



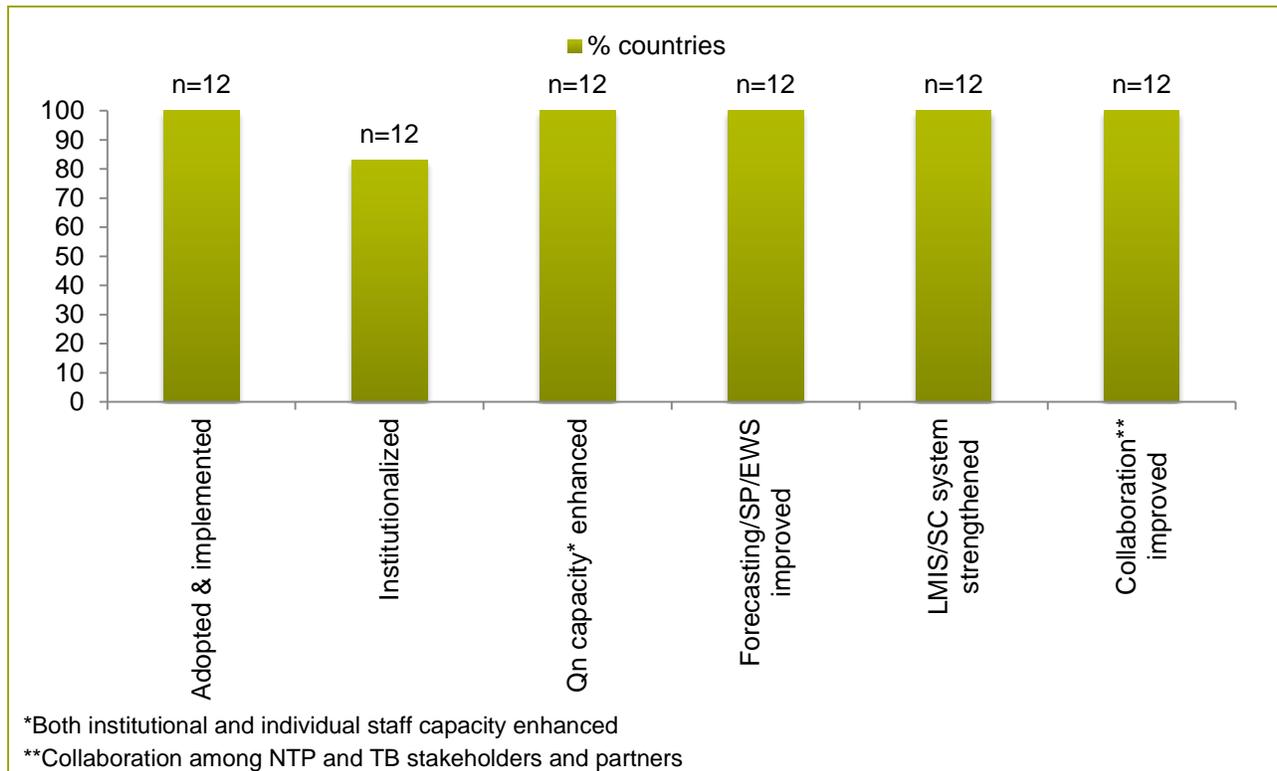
**Figure 3. Attributes of QuanTB**

## Beneficiary Experiences and Perspectives

As shown in figure 3, key attributes<sup>7</sup> of QuanTB were rated highly by beneficiaries in the countries that are implementing the tool. Users at different levels of the supply chain system, including NTP decision makers in all 12 countries, found QuanTB to be a simple, user-friendly, timely, useful, and cost-effective tool that produces accurate, valid, and reliable forecasts and EWS alerts for supply planning at fairly reasonable, sustainable costs, assuming that complete and accurate case and logistics data are used. In most countries, the available epidemiologic surveillance systems and LMIS have provided fairly complete and accurate data to generate valid QuanTB outputs.

## Achievements

SIAPS TB technical assistance, the implementation of QuanTB, and related TB PSM activities improved quantification and procurement; strengthened supply chain systems; and contributed to improved procurement and supply planning, improved availability, reduced stock-outs, and decreased expiry and wastage of TB commodities in all 12 countries (figure 4). The NTPs use QuanTB dashboard information to identify and address challenges in recording and reporting logistics and case data, TB supply chain management, and patient management.



**Figure 4. QuanTB/SIAPS TB technical assistance achievements**

<sup>7</sup> Adapted from CDC Guidelines for Evaluating a Public Health Surveillance System. Available at: <https://www.cdc.gov/mmwr/preview/mmwrhtml/rr5013a1.htm>.

Key achievements include:

- *Adopted and institutionalized QuanTB:* The percentage of countries implementing QuanTB increased from approximately 30% at the end of 2014 to 100% by mid-2015, and most of the implementing countries reported their use of QuanTB data for medicines tracking and decision making through SIAPS field technical advisors (figure 5). Reporting rates have since declined with the closing of some SIAPS country programs and regional field support. Ten of the 12 countries that were included in this review institutionalized QuanTB as the national quantification tool. Bangladesh and DRC were working toward institutionalizing the tool at the time of the review. As of March 2017, QuanTB had been downloaded more than 2,000 times worldwide (including 340 times from October to December 2016 alone)<sup>8</sup>. This shows there is widespread interest in the tool.
- *NTP institutional and individual capacity increased for more frequent, effective, and efficient quantification, coupled with vigilant stock management, which has resulted in improved availability of the right types and quantities of medicines to meet the evolving needs of NTPs:* Country quantification systems were progressively strengthened through systemic institutional and individual capacity building and improved data quality, reporting, and access. More than 250 NTP and country staff were trained (table 1) to enhance their quantification capacity and skills and supported to participate in regional or global TB supply chain events, where they shared experiences and learned from other country NTP staff and global TB PSM stakeholders.

**Table 1. QuanTB Trainings by Country\***

Year	Country	Number of Participants		
		F	M	Total
2014–2016	Philippines	Data not available	Data not available	16
2016	Uganda	Data not available	Data not available	5
2016	Nigeria <sup>9</sup>	6	9	15
2015	Myanmar <sup>10</sup>	Data not available	Data not available	22
2015	DRC <sup>11</sup>	4	13	17
2015	Bangladesh	Data not available	Data not available	9

<sup>8</sup> SIAPS. 2016. TB Core quarterly report: October–December 2016. 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.

<sup>9</sup> Ochigbo M. 2016. *3 day training on the use of GDF Quantification and Pipeline monitoring tool (QuanTB) to mitigate wastage based on EWS. Applied Quantification Training August 17–19, 2016.* 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

<sup>10</sup> do Valle Bastos G, Owunna C, Zagorski A. 2015. *Systems for Improved Access to Pharmaceuticals and Services Program Trip Report Yangon and Naypyidaw, Myanmar January 27–February 7, 2015.* 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.

<sup>11</sup> Kanjinga K, Sawyer K, Mwatawala S. 2015. *Systems for Improved Access to Pharmaceuticals and Services Program Trip Report Kinshasa, Democratic Republic of the Congo April 28–May 12, 2015.* 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.

## Results

Year	Country	Number of Participants		
		F	M	Total
2015	Zimbabwe <sup>12</sup>	5	7	12
2015	South Sudan <sup>13</sup>	3	7	10
2015	Nigeria <sup>14</sup>	16	9	25
2014–2015	Tajikistan	Data not available	Data not available	9
2014	Kenya <sup>15</sup>	Data not available	Data not available	15
2014	Tanzania <sup>16</sup>	Data not available	Data not available	15
2014	Tanzania, Zimbabwe, Ethiopia <sup>17,18,19</sup>	4	14	18
2013	Bangladesh	Data not available	Data not available	9
2013	Uganda <sup>20</sup>	4	5	9
2013	Bangladesh <sup>21</sup>	4	22	26
2013	DRC, Kenya, Malawi, Nigeria, South Sudan, Swaziland, Tanzania, and Zambia <sup>22</sup>	9	10	19
Total		55	96	251

\*The table may be missing data on some in-country trainings that may not have been reported or captured in SIAPS quarterly progress reports or activity trip reports.

<sup>12</sup> Mwatawala S, Njuguna C. 2015. *Systems for Improved Access to Pharmaceuticals and Services Program Trip Report Harare, Zimbabwe, May 21–31, 2015*. 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.

<sup>13</sup> Mwatawala S, Njuguna C. 2015. *Systems for Improved Access to Pharmaceuticals and Services Program Trip Report Juba, South Sudan, July 19–25, 2015*. 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.

<sup>14</sup> Owunna C, Oumer A. 2015. *Systems for Improved Access to Pharmaceuticals and Services Program Trip Report Abuja, New Karu, Nigeria, July 8–21, 2015*. 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.

<sup>15</sup> Systems for Improved Access to Pharmaceuticals and Services. 2015. *Systems for Improved Access to Pharmaceuticals and Services Program Quarterly Report: Project Year 4, Quarter 1: October 2014–December 2014*. 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.

<sup>16</sup> Systems for Improved Access to Pharmaceuticals and Services. 2014. *Systems for Improved Access to Pharmaceuticals and Services Program Quarterly Report: Project Year 4, Quarter 1: October 2014–December 2014*. 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.

<sup>17</sup> Systems for Improved Access to Pharmaceuticals and Services. 2014. *Strengthening Pharmaceutical Systems Program Quarterly Report: Project Year 3, Quarter 2: January 2014–March 2014*. 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.

<sup>18</sup> Owunna C, Mazibuko G. 2014. *Systems for Improved Access to Pharmaceuticals and Services Program Trip Report Dar es Salaam, Tanzania, January 29–February 9, 2014*. 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.

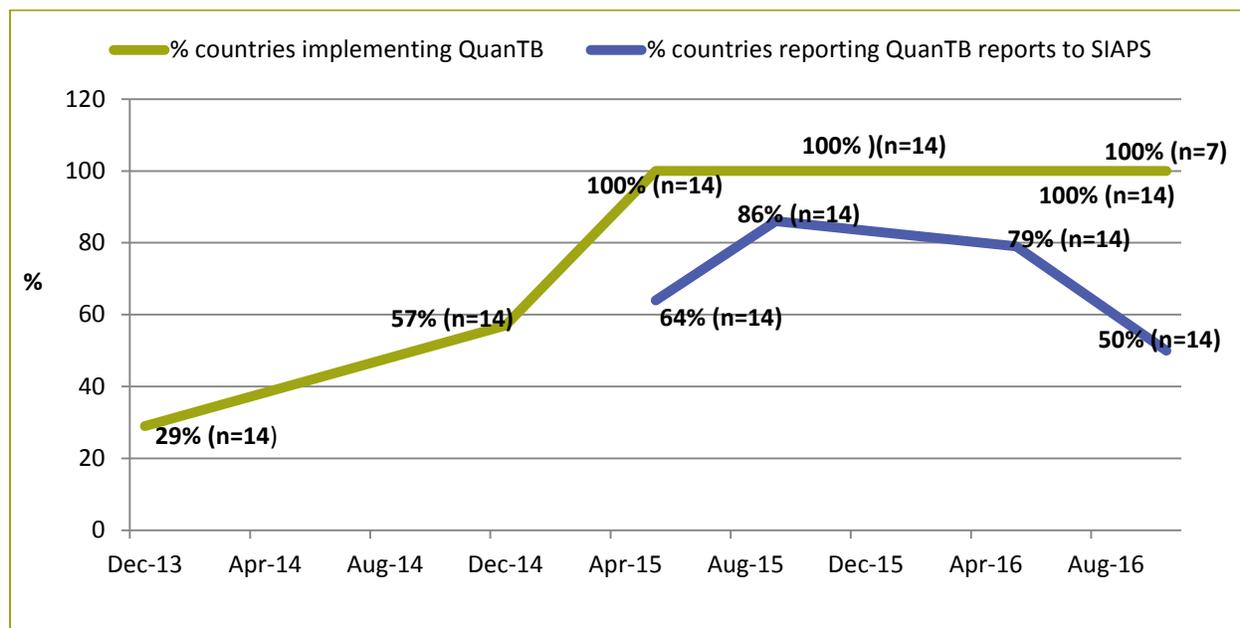
<sup>19</sup> Owunna C, Mwatawala S, Mazibuko G. 2014. *Applied TB Quantification Technical Meeting*. Submitted to the US Agency for International Development by the Systems for Improved Access to Pharmaceuticals and Services (SIAPS) Program. Arlington, VA: Management Sciences for Health.

<sup>20</sup> Kanjinga K, Mwatawala S, Owunna C. 2013. *Systems for Improved Access to Pharmaceuticals and Services Program Trip Report, Kampala, Uganda, November 18–22, 2013*. 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.

<sup>21</sup> Duarte K, do Valle Bastos G, Reciolino LF. 2013. *Systems for Improved Access to Pharmaceuticals and Services Program Trip Report, Dhaka, Bangladesh, August 24–September 12, 2013*. 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.

<sup>22</sup> SIAPS. 2013. SIAPS TB Core quarterly report: April–June 2013. 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 5 shows the tool implementation results from the 12 countries included in this review.



**Figure 5. QuanTB: Progress of country adoption and reporting**

- Forecasting and supply planning improved:* The EWS provided access to key data and dashboards on stock-outs and wastage of TB commodities, thereby allowing timely, data-based decisions and corrective actions that result in savings of limited resources. When QuanTB is updated regularly, information on available stock based on actual cases, expected enrollment, and actual physical stock status (not averages) and EWS alerts when the stock level is below the minimum or above the maximum and on impending expiries or stock-outs is helpful during program scale up and phasing TB regimens or medicines in or out<sup>23</sup>. QuanTB is updated routinely (in most cases quarterly) with logistics and case data and is used to generate more reliable forecasts, supply plans, and EWS dashboards than were available before the tool. NTPs can generate different forecasting scenarios and easily determine how much stock will be needed or how much will expire based on the expected enrollment. Supply planning has improved, and traditional supply plans that had a number of equal shipments per forecasting year have since been replaced by more accurate, staggered QuanTB-based supply plans for each category of TB medicines. The EWS has helped address stock-out, expiry, and storage space problems. EWS results are discussed in appropriate TB PSM quantification technical working group (TWG) or partner coordination meetings and applied in procurement, supply chain management, planning and budgeting, resource mobilization, and supply chain performance monitoring and improvement. EWS dashboard alerts have informed NTP decisions and corrective actions to minimize or prevent stock-outs, overstocks, or expiry (e.g., modifying order quantities, modifying orders to include batches with longer expiry dates, rescheduling or canceling pending shipments,

<sup>23</sup> SIAPS. 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.

redistributing supplies within or among countries). For example, Bangladesh saved approximately USD 900,000 by cancelling and deferring shipments<sup>24</sup>. By postponing pending shipments of supplies, Ethiopia, Nigeria, Tanzania, Kenya, and Zimbabwe saved more than USD 7.1 million between December 2014 and June 2016. By transferring excess stock at risk of expiring to other countries in need, these five countries saved an additional USD 1.4 million during the same period<sup>25</sup>. In Tajikistan, results of the first national QuanTB forecasts and EWS alerts in 2014 indicated excess stock due to parallel procurement by three TB partners. With SIAPS technical assistance, the NTP and TB partners collaborated and coordinated with the GDF to revise and redistribute some of the country's pending orders to other countries, resulting in savings from averted wastage of approximately USD 1,165,000<sup>26</sup>. Tanzania used EWS alerts to identify a pending stock out of RHZE and borrowed supplies worth USD 115,000 from Malawi and Zimbabwe while awaiting a GDF shipment. The country also postponed a GDF shipment of overstocked second-line medicines worth USD 326,934 due to slow enrollment of multidrug-resistant TB patients. Delivery of a GDF shipment of pediatric TB medicines worth USD 41,318 was also postponed due to slow uptake of pediatric medicines<sup>27</sup>. NTPs used the EWS to monitor performance of their TB supply chain systems by tracking key stock status indicators such as months of usable stock on hand, percentage of commodities out of stock, procurement lead times, and months of stock of expected shipments. Some country QuanTB-based PSM plans for Global Fund grant applications have been approved without major queries, unlike before implementation of the EWS and SIAPS technical assistance (e.g., Myanmar, 2016<sup>28</sup>).

- *Overall supply chain systems strengthened and data quality and reporting improved for better decision making:* The use of EWS data helped NTPs identify weaknesses in TB patient management, TB recording and reporting practices, and inventory management. Supply chain system functional areas were strengthened, including:
  - Governance: The NTP PSM/quantification TWG structure and roles were improved and terms of reference, quantification tools, guides, procedures, and presentation templates were developed.
  - Capacity building: NTPs' institutional and human resource capacity for quantification and stock status monitoring improved, as did quantification systems and staff skills and tools.

---

<sup>24</sup> Goredema W, et al. 2016. *Implementing QuanTB to Improve Forecasting, Supply Planning and Early Warning System for TB Medicines: Bangladesh 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.

<sup>25</sup> Mwatawala S, et al. 2016. Benefits of Implementing Early Warning System in Improving Information for Decision Making in Five African Countries. Poster presented at the 47th Union World Conference on Lung Health, Liverpool, UK: October 26–29, 2016.

<sup>26</sup> Goredema W, Kavtaradze M. 2016. *Implementing QuanTB to Improve Forecasting, Supply Planning and Early Warning System for TB Medicines: Tajikistan 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.

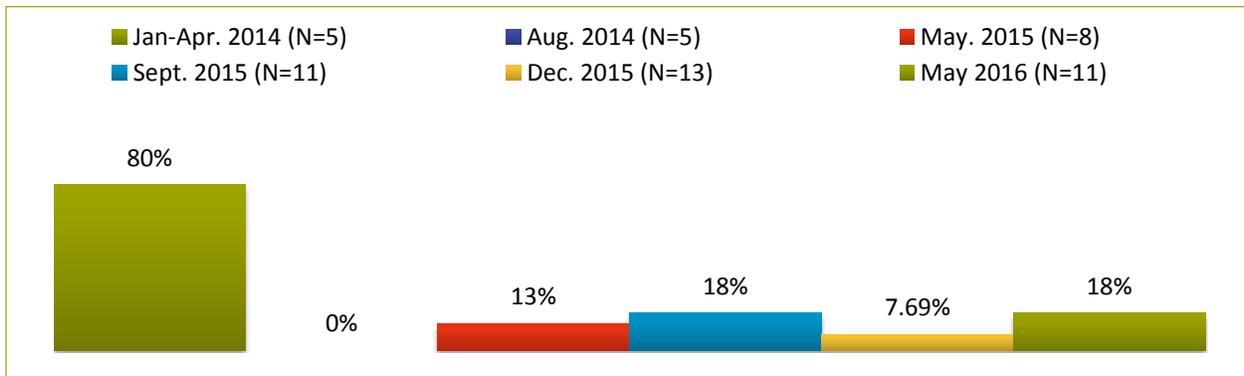
<sup>27</sup> Goredema W, Mwatawala S. 2016. *Implementing QuanTB to Improve Forecasting, Supply Planning and Early Warning System for TB Medicines: Tanzania Report*. Submitted to the US Agency for International Development by the Systems for Improved Access to Pharmaceuticals and Services (SIAPS) Program. Arlington, VA: Management Sciences for Health.

<sup>28</sup> Goredema W, Aung H. 2016. *Implementing QuanTB to Improve Forecasting, Supply Planning and Early Warning System for TB Medicines: Myanmar 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.

- Information systems: EWS data are used in evidence-based decision making. Some countries (e.g., Kenya, Tanzania, Zimbabwe) have integrated QuanTB with their web-based district health information systems. This is expected to add to the benefits of QuanTB by improving the visibility of stock status across all levels of the country supply chain system.
- Financial management systems: Cost analysis, budgeting, and overall financial management systems have been enhanced through better estimation of country needs and less wastage. QuanTB data are used in developing PSM plans to mobilize resources through funding grant applications, including when emergency funding is needed to prevent stock outs, and to support GDF procurement requests.
- TB PSM services: Forecasting, supply planning, and monitoring of the TB stock pipeline is now simpler, faster, more accurate, effective, reliable, and efficient. The procurement and order scheduling is improved, more rational, and better informed by QuanTB reports.
- *TB stakeholder communication and collaboration improved:* Strong collaboration has been established among NTPs; other MOH bodies; and local and global TB stakeholders and partners, such as the GDF, Global Fund, World Health Organization, and international donors. SIAPS support helped connect NTP PSM staff from different countries, thereby facilitating exchange of stocks.

**Availability of TB Medicines<sup>29,30</sup>**

Figures 6, 7, and 8 show the trend of stock-out rates of TB medicines.



**Figure 6. Percentage of countries with at least one first-line medicine out of stock**

<sup>29</sup> SIAPS. September 2016. *SIAPS TB quarterly report: QuanTB and early warning system rollout and implementation (draft)*.

<sup>30</sup> SIAPS. 2016. Technical Brief: QuanTB. 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.

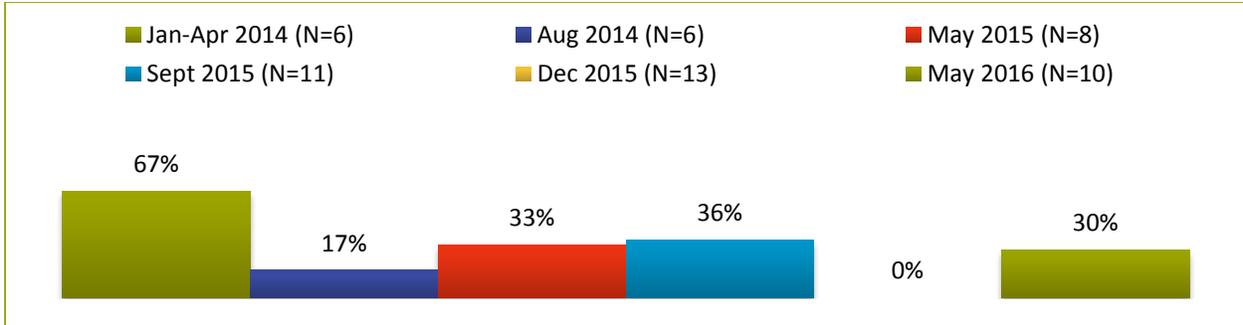


Figure 7. Percentage of countries with at least one second-line medicine out of stock

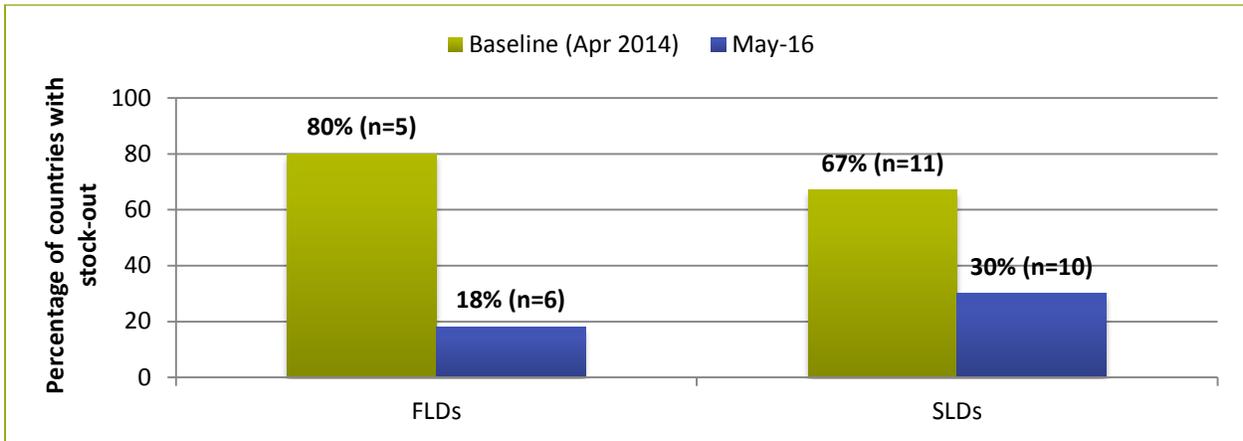


Figure 8. Countries that reported a stock-out of at least one TB medicine

The percentage of countries with at least one first-line medicine out of stock decreased from 80% in the quarter ending April 2014 to 18% in May 2016. The percentage of countries with at least one second-line medicine out of stock decreased from 67% in the quarter ending April 2014 to 30% in May 2016. This trend points to the success of implementing QuanTB and related TB technical assistance.

## Online Experience and Satisfaction Surveys

### Country Beneficiary Survey

Among 32 prospective respondents from 12 countries, 16 completed the online survey. More than 93% were 30 years of age or older and had at least 4 years of experience working in TB control and/or PSM. They primarily use QuanTB either in the NTP headquarters (94%) or for PSM work (6%).

Approximately 94% of respondents felt that QuanTB was a simple and user-friendly tool and were confident with the results and reports generated by the tool; the rest of the respondents were neutral. Respondents found the following reports most important for their work: QuanTB dashboard (75%), detailed medicines report (50%), summary report (69%), order and costs report (38%), and case report (31%).

Approximately 88% of respondents said they had been adequately oriented or capacitated on QuanTB, while approximately 6% were neutral. The same proportion was satisfied with the support that the NTP, SIAPS, and other TB partners provide, while the rest were neutral. More than 50% of respondents felt they had adequate resources to use QuanTB (i.e., budget, staff, computers, electricity, e-mail, phone), while less than 7% disagreed and the rest remained neutral.

Nearly all respondents felt that the tool has helped them or the NTP make timely decisions to improve quantification, forecasting, procurement, or supply planning for TB commodities. Approximately 70% felt that QuanTB has helped them or the NTP make timely decisions to minimize stock-outs, overstocking, expiry, and/or wastage of medicines. Nearly all respondents felt that QuanTB and SIAPS technical assistance have strengthened overall supply chain systems for TB and were satisfied with the assistance provided by SIAPS technical advisors, their participation in country monitoring missions, and their facilitation of quantification trainings. Overall, approximately 94% of respondents were satisfied with the tool.

These online beneficiary survey results strongly corroborate the experiences and perspectives on attributes of the tool and achievements reported through interviews with in-country QuanTB beneficiaries.

### ***Global TB Partners Survey***

All eight prospective respondents from global TB partner organizations responded to the survey. However, only six submitted complete responses and two submitted partial responses. All were between 30 and 49 years of age and had four or more years of experience working in TB control and/or PSM. Half of the respondents primarily use QuanTB in GDF/Stop TB Partnership work; one uses it for work through the Global Fund and another works in conjunction with an international TB partner. Below are the results from the six complete responses.

All respondents felt that the QuanTB reports were valuable for their work except the cases report (83% of respondents felt this report was valuable for their work) No respondents indicated problems with understanding and using relevant QuanTB reports and information for decision making in their work. All six complete responses indicated satisfaction with the whole QuanTB tool. Five of the six complete responses reflected satisfaction with the EWS component of the tool; one respondent was neutral. All respondents found QuanTB information and SIAPS TB technical assistance helpful for country monitoring missions; tracking TB stock status; sharing data with stakeholders; and addressing forecasting, procurement, and supply planning challenges. Two-thirds of respondents agreed that QuanTB information and related SIAPS TB technical assistance had improved their organization's decision making in forecasting, procurement, and supply planning for TB. The most frequently cited examples of areas of improved decision making based on QuanTB information were stock monitoring and the use of EWS alerts to avert or minimize stock-outs and expiry of TB medicines, coordination between the NTP and suppliers in rescheduling orders and delivery, management of expiration dates of pending orders, and redistribution of TB medicines within countries to minimize or prevent stock-outs, overstocking, and expiry.

Of the five respondents who indicated satisfaction with the EWS component of the tool, three were satisfied with the funding gap analyses for TB grant proposals that countries have conducted using QuanTB information and related SIAPS TB technical assistance; two were neutral. Five of the six complete responses reflected satisfaction with the technical assistance provided by SIAPS regional and country technical advisors, their participation in country monitoring missions, and quantification trainings; one was neutral. Four of the six respondents agreed that QuanTB and SIAPS technical assistance had strengthened their country's TB supply chain system; the rest were neutral. These results corroborate the beneficiary perspectives and attest to the importance, acceptance, and usefulness of QuanTB to NTPs and the global TB control community.

## CHALLENGES, LESSONS LEARNED, AND SUSTAINABILITY

### Challenges

- *Data quality and reporting issues:* Late and incomplete reporting of case and LMIS data required for QuanTB, low LMIS reporting rates, and delays in getting patient or LMIS data from the peripheral levels of the supply chain were challenges.
- *Human resources and capacity issues:* Staff engagement and commitment to adopt the new tool and EWS was a challenge in some countries because staff had competing commitments.
- *High staff attrition* due to departure or transfer of trained NTP staff to other MOH departments, which necessitated ongoing staff capacity building and training
- *Programmatic:* Rapid or slow uptake of some TB medicines due to improperly managed program scale up or transition from old to new medicines resulted in shortages or overstocks and wastage of commodities.
- *Lack of rapid response mechanisms in the case of overstocks or potential expiries:* The late execution of action items identified through the EWS to prevent risks to the system can be a challenge. Requests for postponement and cancellations of orders may come too late for any action to be taken by the supplier. The inability of one country NTP to know other countries' stock situations in the event of stock-outs or overstock of TB medicines adversely affects the implementation of country-to-country transfers.
- *Funding:* Delayed disbursement of funds for procurement of TB medicines led to late procurements.

### Lessons Learned

- As with other SIAPS pharmaceutical system strengthening technical assistance interventions, critical elements for success included advocacy, collaboration, capacity building, integration with existing systems, and the availability and use of data for informed decision making. Displaying the results in graphs and dashboards simplified the information, improved user friendliness, and enhanced understanding of the EWS. The availability of useful EWS results motivated TB stakeholders to collaborate in applying the information in decision making and remedial actions.
- Late and incomplete reporting of data required for the QuanTB EWS affects the accuracy of decisions made to reduce TB supply chain risks. It is critical to ensure timely reporting of quality data that feeds into QuanTB to achieve accurate and valid EWS results that can inform decisions and remedial actions. Some countries are addressing the challenge of data quality and reporting by integrating TB patient and medicine data into a web-based district health information system.

- Capacity-building refresher trainings on QuanTB and on improving data quality and reporting issues are needed on an ongoing basis. They help to address the adverse impact of ongoing staff attrition. There is a need to include funding for ongoing human resource capacity building in routine MOH plans and in grant application proposals, such as the Global Fund.
- In-country IT capacity-building is crucial to readily address software problems as needed.
- For improved coordination, collaboration, and results, TB partners supporting the implementation of QuanTB or related activities should consider embedding in-country field advisors within the NTP. Strong partnerships with in-country TB stakeholders and partners are key, particularly in countries where the technical assistance provider has no in-country office or technical advisor to provide direct technical assistance on the ground.
- There is a need to improve sharing of TB stock status information among countries to inform faster decision making and the exchange of stock among countries in the event of stock-outs or overstocks. The East, Central, and Southern African health communities initiated an effort in collaboration with SIAPS and the Challenge TB Program to develop a supply chain portal that would facilitate a TB commodity stock status information exchange among countries<sup>31</sup>.
- Unfulfilled procurement commitments can lead to stock-outs.

For more information, see the country-specific reports, which are available at <http://siapsprogram.org/quantb-implementing-an-early-warning-system-for-tb-medicines/>.

## **Sustainability and Country Ownership**

The implementation of QuanTB is aligned with the US Global Health Initiative, country health goals, and SIAPS's overall pharmaceutical system strengthening approach and core operating principles. The approach is locally led, starting with advocacy to obtain full buy in, collaboration, and leadership of local NTPs, and builds on and strengthens existing forecasting, supply planning, and overall supply chain systems by building the capacity of local institutions, organizations, and staff. The approach also promotes local stakeholder communication, collaboration, and coordination by involving both NTP beneficiaries of the intervention and other local and global TB stakeholders in disseminating and applying the generated forecasting and EWS information in decision making and by sharing the data with the GDF and other global partners for further technical support. The tool strengthens key supply chain system building blocks and promotes performance monitoring and improvement through continuous tracking of stock status indicators. Country adoption and institutionalization of the tool ensures that the intervention will continue beyond SIAPS technical assistance support. Beneficiaries and global partners find the tool to be simple, user-friendly, useful, and important for their work. Users are satisfied with the support provided by the NTP, SIAPS, and other collaborating partners. There were significant improvements to the overall TB control structures and systems, governance, and technical structures, such as PSM coordination groups and quantification TWGs. Most beneficiaries felt the cost of implementing this tool is manageable, as only minimal resources are required for ongoing

---

<sup>31</sup> Mwatawala S, et al. 2016. Benefits of Implementing Early Warning System in Improving Information for Decision Making in Five African Countries. Poster presented at the 47th Union World Conference on Lung Health, Liverpool, UK: October 26–29 2016.

staff capacity building and the costs are included in routine budgeted country work plans or applications for donor funding support, such as Global Fund grants. All this ensures ownership and sustainability of the intervention.

## **Limitations**

There was a 50% response rate of country beneficiaries and 75% response rate of global partners to the online surveys (for fully completed questionnaires), mainly due to prospective respondents being busy with competing priorities. However, each of the 12 countries was represented by either an in-country or regional SIAPS technical advisor, and the response rate for in-country interviews was approximately 60%, with 10 of the 12 countries represented by at least one QuanTB user and/or NTP decision maker. The evaluation was qualitative based on perspectives and experiences of respondents, so the number of respondents may not be that relevant. The sample of 12 countries was representative of the 14 USAID-focus countries, and the respondents were drawn from people who use QuanTB in their day-to-day practical work, as well as senior officials that apply QuanTB information in decision-making and planning and implementation of remedial actions. The information that was gathered via online surveys corroborated the information gathered via in-depth interviews, adding validity and credibility to the important findings of this evaluation for TB PSM.

## CONCLUSION AND RECOMMENDATIONS

NTPs and local and global TB stakeholders have used QuanTB EWS data to improve forecasting and supply planning, prevent expiries and stock-outs, and increase access to TB commodities. The pharmaceutical systems strengthening approach that was employed bolstered the local ownership, leadership, institutionalization, effectiveness, and sustainability of the intervention. The declining trend of stock-out rates of TB medicines shows that the QuanTB EWS is contributing to achieving the goal of ensuring an uninterrupted supply of TB medicines. However, continued investment is needed to address the remaining gaps. Therefore, TB stakeholders and partners should continue to collaborate and coordinate in utilizing available resources to sustain the use of QuanTB.