



**TB Pharmaceutical Management in Bangladesh
June 24–July 12, 2012: A Rapid Assessment Report**

October 2012



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SIAPS 
Systems for Improved Access
to Pharmaceuticals and Services

TB Pharmaceutical Management in Bangladesh, June 24–July 12, 2012: A Rapid Assessment Report

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The SLAPS logo consists of the word "SLAPS" in a bold, green, sans-serif font. To the right of the text is a stylized blue graphic of a person with arms raised in a 'V' shape, suggesting movement or achievement.

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About SIAPS

The goal of the Systems for Improved Access to Pharmaceuticals and Services (SIAPS) Program is to assure 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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Key Words

MSH, TB Pharmaceutical Management, National Tuberculosis Program, BRAC, Damien Foundation, GDF, GLC, DOTS first-line and second-line TB medicines

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ACRONYMS AND ABBREVIATIONS

AMC	average monthly consumption
BDT	Bangladeshi taka
BRAC	Bangladesh Rural Advanced Council
CMSD	Central Medical Stores Depot
CP	continuation phase
DF	Damien Foundation
DGFP	Directorate General of Family Planning
DGHS	Directorate General of Health Services
DOTS	directly observed treatment, short course
FDA	fluorescein diacetate
FDC	fixed-dose combination
FEFO	first expiry, first out
GDF	Global Drug Facility
GFATM	Global Fund to Fight AIDS, Tuberculosis and Malaria
GLC	Green Light Committee
ICC	inventory control card
IP	intensive phase
M&S	monitoring and supervision
MDR-TB	multidrug-resistant TB
MINSL	minimum stock level
MIS	management information system
MOHFW	Ministry of Health and Family Welfare
MSH	Management Sciences for Health
NGO	nongovernmental organization
SIAPS	Systems for Improved Access to Pharmaceutical Services
SOP	standard operating procedure
SPS	Strengthening Pharmaceutical Systems
SS	Shasthay Shebika
TB	tuberculosis
TLCA	tuberculosis and leprosy control assistant
USAID	US Agency for International Development
USD	US dollar
WHO	World Health Organization

BACKGROUND

The Strengthening Pharmaceutical Systems (SPS) Program and now Systems for Improved Access to Pharmaceutical Services (SIAPS) Program have been working in Bangladesh since 2009, providing technical assistance to the Directorate General of Family Planning (DGFP) under the Ministry of Health and Family Welfare (MOHFW) of the Government of Bangladesh to improve procurement management systems for reproductive health commodities, build up existing distribution and management information systems (MISs), and increase local capacity to strengthen health systems. Based on the successful interventions in DGFP implemented by SPS, the US Agency for International Development (USAID)/Bangladesh requested the assistance of SIAPS to strengthen the pharmaceutical management system of the National Tuberculosis Program (NTP) in Bangladesh.

Current Status of Partners and Programs

A number of nongovernmental organizations (NGOs) and institutes have been recognized as official partners of the NTP. The relationship between the NTP and most of these partner agencies is governed through a memorandum of understanding. Some agencies, such as Management Sciences for Health (MSH), the World Health Organization (WHO), and University Research Co., support the NTP by providing technical assistance. The main implementing NGOs with the NTP in Bangladesh are the Bangladesh Rural Advanced Council (BRAC), the Damien Foundation (DF), Health Education and Economic Development, Lutheran Aid to Medicine in Bangladesh, the Leprosy Relief Association, Rangpur Dinajpur Rural Services, the Smiling Sun Franchise Program, and the Urban Primary Health Care Project II.

Purpose of Trip

The USAID-funded SIAPS project in Bangladesh is working toward improving access to and availability of quality pharmaceuticals and effective pharmaceutical services. The main objectives this assessment will support are—

- Strengthening of supply chain management systems of the MOHFW and component procurement entities with a particular focus on improving the tuberculosis (TB) supply chain management systems
- Increasing transparent and evidence-based decision making with a specific focus on improving TB-related data collection and analysis

The SIAPS program started in October 2011 and to date has focused on working with the DGFP and Directorate General of Health Services (DGHS). Two SIAPS/Bangladesh TB staff came on board in April 2012. One of the first activities necessary to begin implementing support to the NTP is this assessment.

Scope of Work

Following is the set of key activities to be undertaken when conducting the proposed rapid assessment on TB pharmaceutical management systems used in Bangladesh—

- Study pharmaceutical management guidelines and standard operating procedures (SOPs) and any other useful documents related to TB pharmaceutical management that are currently used by the NTP for managing the TB pharmaceutical supply chain.
- Undertake a preliminary survey of current systems and procedures used by the NTP for procuring the country's needed TB medicines, focusing on supplier selection methods, tendering, medicine prices, quality assurance, and supply lead times. Identify key weaknesses of current procurement systems, and recommend interventions for improving medicine procurement.
- Assess current methods used for medicine storage at the Central Medical Stores Depot (CMSD), identify any weaknesses in storing medicines, and recommend steps for improving CMSD and NTP Central Warehouse medicine storage practices.
- Assess current methods used for quantifying first- and second-line TB medicine needs at central level, estimating procurement quantities in relation to pharmaceutical budgets, storage capacity, pipeline monitoring, and other supply chain constraints. This approach will be extended to cover similar operations at lower levels of the system, such as regional stores, hospitals, and TB dispensaries.
- Study current methods used for controlling medicine inventories at central level and how they link with the procurement system. As a part of this activity, current operating procedures used for making routine decisions, such as when to order, how much to order, and methods for setting buffer stocks, will be studied. This activity will be extended to cover inventory management practices and order initiation methods used at regional medicine stores, hospitals, and TB dispensaries. On completion of this activity, major deviations from accepted inventory control practices will be noted and recommendations made for strengthening inventory management at all levels of the TB pharmaceutical supply system.
- Study systems currently used for distribution of TB medicines from central CMSD/NTP Central Warehouse to facilities at lower levels of the pharmaceutical supply chain, note any weaknesses, and make recommendations for improving the current distribution system.
- Study the current TB pharmaceutical MISs, including the use of pharmaceutical management indicators for evaluating key functional areas of the overall TB pharmaceutical supply system.
- Prepare a comprehensive set of TB pharmaceutical management indicators that would be helpful in describing current performance regarding availability of TB medicines at

different levels of the supply system, maintenance of stock levels, supply lead times, efficiency of storekeeping practices, procurement, quality assurance, and medicine use practices.

- Study human resources and the organizational structure currently used for maintaining the TB pharmaceutical supply system and identifying broad training needs.

ACTIVITIES

As part of this assignment, a rapid assessment of the pharmaceutical supply system currently used for managing, first- and second-line TB medicines in Bangladesh was undertaken in June 2012. It was a rapid assessment rather than a comprehensive formal survey of the Bangladeshi TB pharmaceutical management system. The latter would have taken a much longer time to complete, and the time allocated for this assignment did not permit such an undertaking. The main objective of carrying out a rapid assessment is to describe how the current TB pharmaceutical supply system operates, identify its strengths and weaknesses, and help identify a set of useful interventions for strengthening the performance of TB pharmaceutical management operations at different levels of the supply system.

This trip report describes the work undertaken in Bangladesh from June 24 to July 12, 2012. Activities completed during this three-week assignment were mainly focused on visiting the CMSD and the NTP and making field visits to a few TB pharmaceutical stores located at district and subdistrict (Upazila) levels and to a few DOTS centers in the districts of Manikganj and Gazipur. During these field visits, much useful information was gathered on the operation of the TB pharmaceutical supply system by using a set of questionnaires and by extracting data from records and computerized databases maintained at facilities visited. The remainder of this report gives a detailed description of work completed, information gathered, and observations made during these visits.

Introduction to the TB Pharmaceutical Supply Systems

Limited time available for undertaking this assignment made it impossible to carry out a nationwide study on the management of TB pharmaceuticals in the country. Therefore, it was necessary to confine the study to Manikganj and Gazipur districts. A few storage and treatment sites located within these districts were visited during the field visits, and the assessment centered on management of first-line TB medicines.

Currently, the NTP is obtaining all first-line TB pharmaceuticals in the form of fixed-dose combination (FDC) medicines through the Global Drug Facility (GDF). No procurement unit currently operates within the NTP. Annual quantification of TB medicine needs is done with the assistance of the WHO for placing annual medicine orders with GDF for first-line medicines and with the Green Light Committee (GLC) for second-line (SL) medicines.

The NTP monitors pending medicine orders placed with the GDF using the GDF portal. About 30 percent of GDF shipments arrive by air at Dhaka airport, and the balance is received by sea and cleared through the port of Chittagong by the CMSD on behalf of the NTP. After port clearance, TB pharmaceuticals are first delivered to the CMSD because of limited storage capacity at the TB Central Warehouse at Shyamoli. The CMSD transfers medicines to the TB Central Warehouse at Shyamoli upon NTP request; medicines are in turn distributed from Shyamoli to the 64 districts. Thus, TB medicines are stored at two separate central-level locations in Dhaka because of limited storage capacity at Shyamoli.

From the NTP Central Warehouse, TB medicines are distributed to district level on a quarterly basis through NGO partners. (See figures 1 and 2 describing the flow of medicines and pharmaceutical management information in districts supported by BRAC and the DF.) In practice, medicines bypass the district drug warehouse and are taken directly to the drug warehouse maintained at each Upazila in BRAC-operated districts. From here, TB medicines are issued monthly to Shasthay Shebika (SS) or family health workers through a set of subcenters operated by the implementing NGO. SSs are DOTS providers who are expected to directly observe the intake of TB pharmaceuticals by all patients registered under them. In addition to medicines issued to the SS, a very small quantity of medicines is also retained at the Upazila Health Complex for providing medicines to new patients for about three days, until they are assigned to a DOTS provider closest to their place of residence. DOTS providers are compensated 500 taka (BDT) (approximately 6 US dollars [USD]) upon completion of a patient's treatment.

In the case of DF-operated districts, TB medicines are first delivered to the corresponding DF project office for storage, until they are subsequently distributed to stores at Upazila level. (See figure 2 for details.)

Multidrug-resistant tuberculosis (MDR-TB) cases are treated at six hospitals throughout the country. The NTP manages two chest hospitals in Dhaka and Chittagong, and the DF manages four hospitals in Dhaka and Rajshahi divisions. Currently no hospitals are located in the Khulna, Rangpur, Barishal, or Sylhet divisions. The four DF hospitals serve the populations residing in 26 districts while patients from all other districts are seen at the NTP hospitals. Any patient in the country may choose to be admitted at the National Institute of Diseases of the Chest and Hospital though patients are advised to be admitted at the nearest hospital.

The Rapid Assessment

Because a different set of NGOs has been assigned the task of delivering TB services in different districts, a description relating to the management of TB pharmaceuticals in 2 of 64 districts in Bangladesh may not be representative of how TB pharmaceuticals are managed throughout the entire country; different divisions and districts may use slightly different approaches to perform key pharmaceutical management functions. Still, the description of how TB pharmaceuticals are currently managed and resulting management problems identified through this rapid assessment could be considered fairly representative of what is occurring in other districts of Bangladesh. Hence, results of the study will be useful for identifying key TB pharmaceutical management problems and in developing a set of interventions for addressing key supply chain problems.

The first district visited was Manikganj, located about 70 kilometers from Dhaka City. This district has seven Upazila Health Complexes and 960 DOTS providers. The second district visited was Gazipur, located 40 kilometers from Dhaka City. This district has 1,165 DOTS providers. Both these districts depend heavily on agriculture.

The TB pharmaceutical supply system has four different operational levels as depicted in figures 1 and 2, which show the flow of medicines from pharmaceutical suppliers to the lowest level of the supply system, namely, DOTS providers, through many intermediary levels of storage.

The TB pharmaceutical supply system is rather complex, because medicines have to flow through four different operating levels where medicines are stored, distributed, and used for treating TB patients. Furthermore, it is important to note that it is a public-private partnership, in which the MOHFW procures and provides TB pharmaceutical and laboratory supplies, while the operations below district level are maintained by NGO partners. TB medicines should be made available to patients on a continuous basis until they complete their treatment. TB pharmaceuticals must be in stock at all times and at all treatment facilities to accomplish this. Effective systems and procedures for inventory control, storekeeping, and gathering and processing pharmaceutical management information need to be in place at all levels of the system to make this possible. When these systems are lacking or poor, it leads to overstocking, stock-outs, poor medicine quality, and poor pharmaceutical management information for monitoring and evaluating performance, thus engendering waste and higher operating costs.

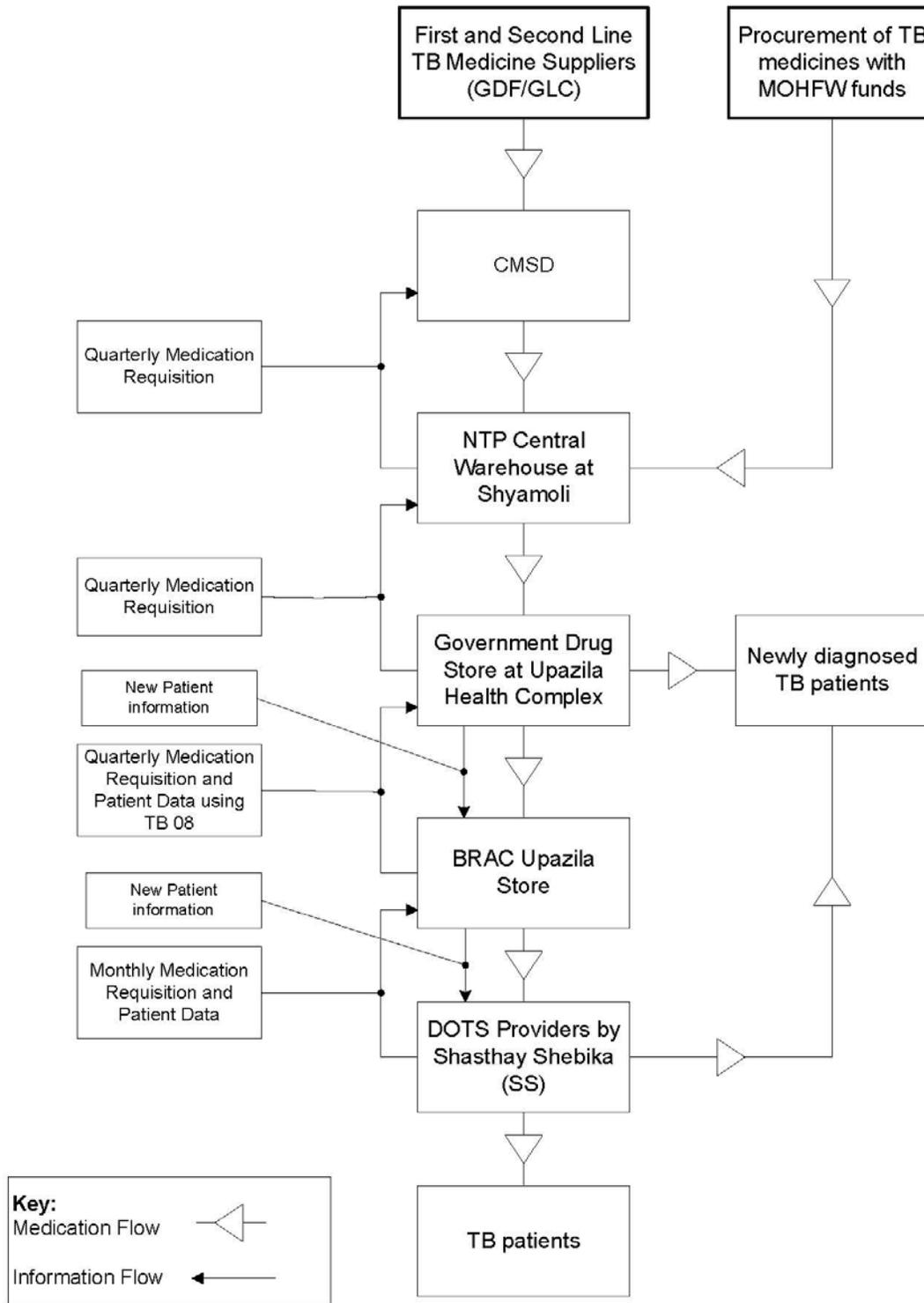
To help in observing and describing key operational characteristics of the supply system during this rapid assessment of TB pharmaceutical management systems in Bangladesh, the following units and facilities within the MOHFW and NGO facilities were visited at central, district, Upazila, and DOTS center levels—

- Drug Management Unit of the NTP
- CMSD in Dhaka
- NTP Central Warehouse at Shyamoli
- Shibalaya Upazila DOTS center in Manikganj District
- Kapasia Upazila DOTS center in Gazipur District
- BRAC TB Drug Store at Shibalaya Upazila in Manikganj District
- BRAC TB Drug Store at Sreepur Upazila in Gazipur District
- DF Head Office in Dhaka

The pharmaceutical supply cycle has four key management functions: selection, procurement, distribution, and use (see figure 3). Information relating to these four key functional areas was gathered. Details on important findings are described in the “Key Findings” section of this report. Information was gathered on the following key pharmaceutical management functions—

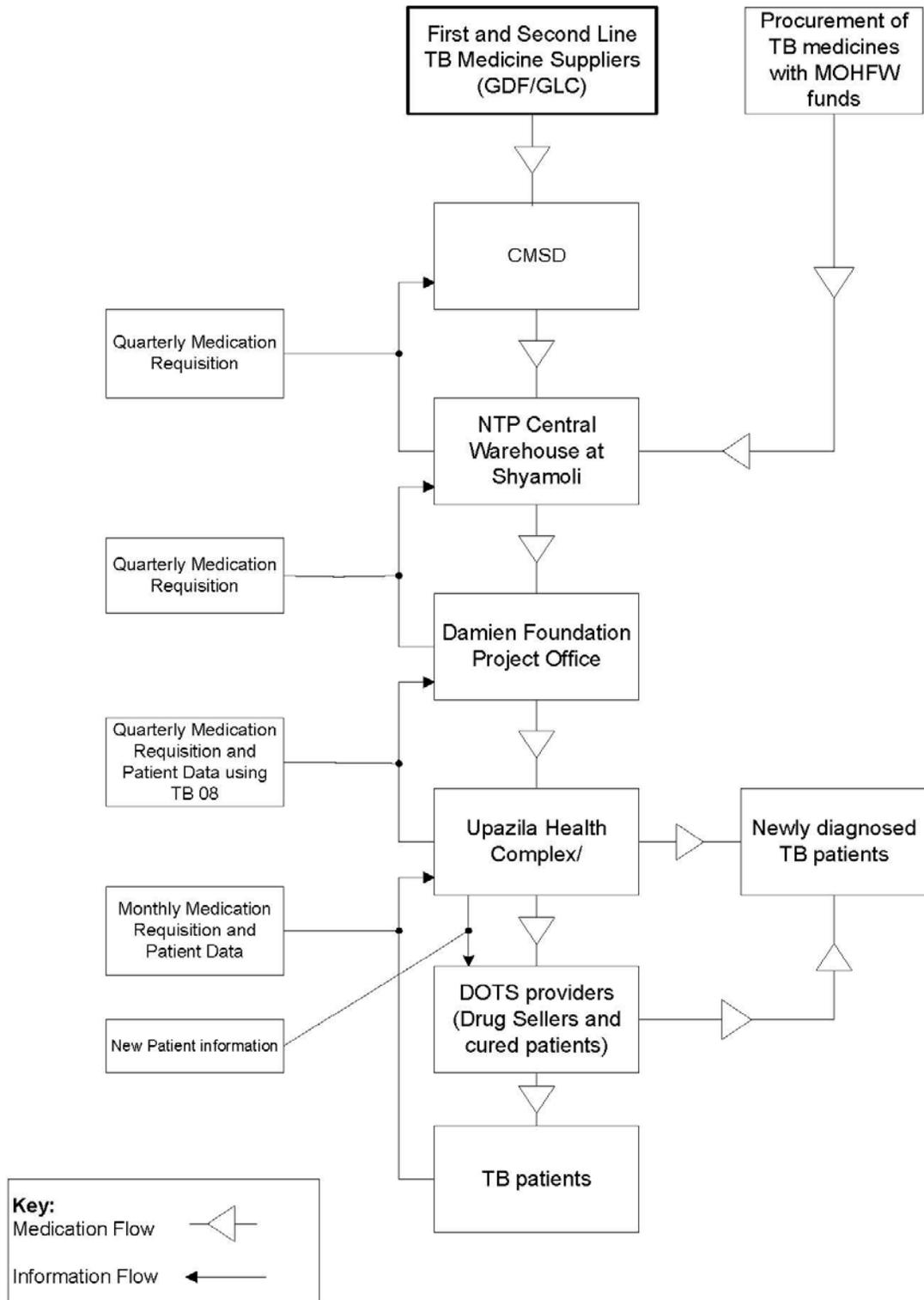
- *Pharmaceutical selection*: types of pharmaceuticals, dosage forms, and specifications of first-line and second-line TB pharmaceuticals used in Bangladesh
- *Procurement*: the method used by NTP for procuring first-line TB medicines through GDF, monitoring order status, and the method used for port clearing
- *Inventory control*: use of push or pull systems, methods for quantifying TB pharmaceutical needs, use of inventory control systems, and methods of order initiation

- *Medicine use*: standard dosing regimens recommended and used by health workers for treating TB patients on first- and second-line TB medicines
- *MISs*: description of pharmaceutical management reports and indicators developed for monitoring and the evaluating performance of the TB pharmaceutical supply system on a regular basis
- *Monitoring and supervision*: Systems and procedures used by the NTP for monitoring performance of the TB pharmaceutical supply system at different levels of the system, and methods used for supervising those performing key pharmaceutical management functions



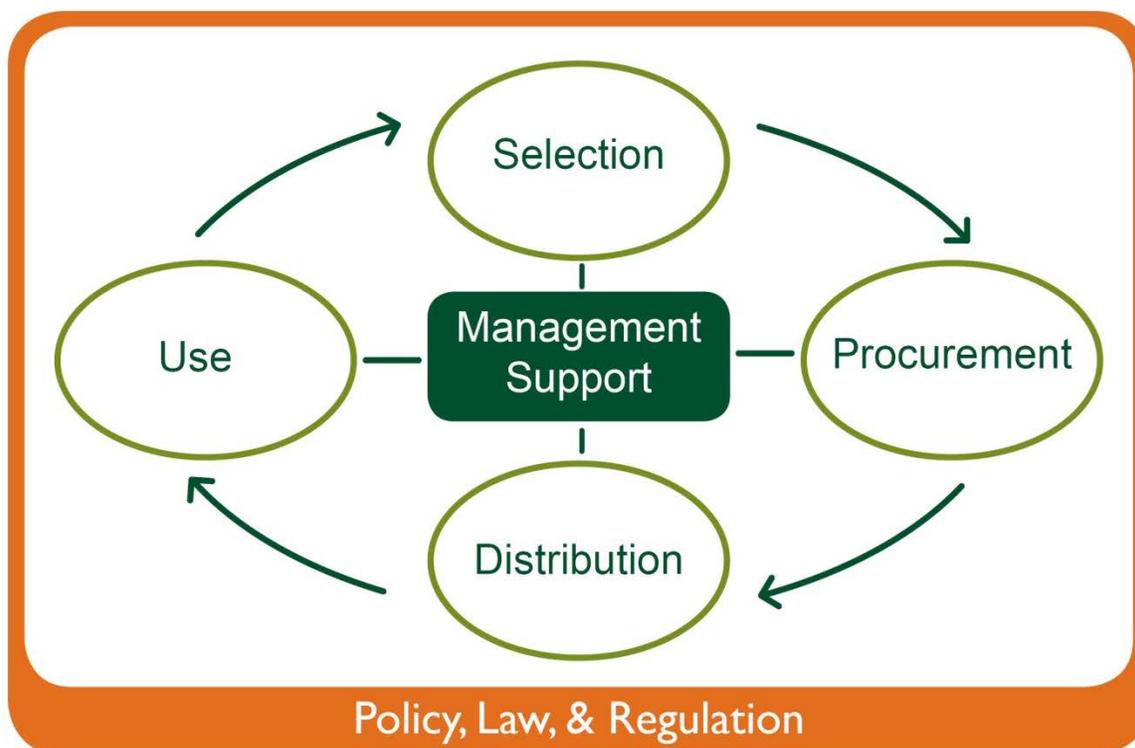
Note: Diagram is based on findings from two BRAC-operated districts visited; information provided by NTP/MSH staff and may not be fully representative of systems used on a national level.

Figure 1. TB pharmaceutical supply system in BRAC-operated districts



Note: Diagram is based on the TB pharmaceutical distribution systems used in districts operated by the DF, based on information provided by the Country Director of DF in Bangladesh.

Figure 2. TB pharmaceutical supply system in DF-operated districts



Source: Center for Pharmaceutical Management. 2011. *Center for Pharmaceutical Management: Technical Frameworks, Approaches, and Results*. Arlington, VA: Management Sciences for Health.

Figure 3. Pharmaceutical Management Cycle

TB Pharmaceutical Selection and Procurement

Selection is the first key pharmaceutical management function described under the pharmaceutical management cycle (figure 3). Currently, the NTP is undertaking this function in collaboration with GDF and GLC. All TB medicines for providing first-line and second-line treatment are included in the Bangladesh and WHO Essential Medicine Lists.

Procurement is the second of the four key functions in the pharmaceutical supply cycle. Usually, poor procurement practices have a major negative impact on the rest of the supply system. Hence, it is important that this function is given high priority. A good public sector procurement unit should be capable of achieving the following—

- Obtaining favorable prices for pharmaceuticals procured
- Ensuring that pharmaceutical products procured meet acceptable quality standards
- Ensuring that pharmaceutical suppliers deliver medicines within lead times specified in the supply contract
- Maintaining an efficient tendering process, being transparent, and assessing performance regularly by using a suitable set of procurement indicators

A professional team of procurement staff who are well trained, motivated, and supervised must be engaged to meet these requirements.

The major procurement functions for the NTP are undertaken by the GDF for first-line medicines, and by the GLC for second-line medicines for treating MDR-TB. Funds for procuring first-line and second-line TB medicines are provided through the Global Fund to Fight AIDS, Tuberculosis and Malaria (GFATM).

Procurement of TB medicines should be less demanding for the NTP because the GDF and GLC are the procurement agents and responsible for key procurement functions of supplier selection, tendering, assessing good manufacturing practices, testing medicines, establishing quality standards, and liaising with manufacturers and making shipping arrangements. This leaves the NTP with the following key procurement and related tasks:—

- Quantifying annual TB medicine needs in collaboration with WHO
- Preparing and submitting medicine orders to the GDF and GLC
- Monitoring pending shipments through the GDF portal
- Arranging for emergency orders if and when needed
- Undertaking port clearing
- Notifying the appropriate procurement agent of any quality failures and rectifying such problems
- Undertaking local procurement of TB medicines to meet shortages
- Liaising with the GDF and GLC regarding procurement-related issues and providing appropriate information

Procurement of TB medicines is undertaken annually. The procurement lead times, starting from the time of placing the purchase order to receiving supplies in Bangladesh at central level are long and variable. See the “Key Findings” section for indicators developed for procurement lead times.

The important steps and timing of key activities normally completed during a procurement cycle for first-line medicines follow—

- Start quantification of first-line TB medicine needs with technical assistance provided by WHO and finalization of annual procurement quantities.
- Obtain approval and finalization of medicine order by MOHFW.
- Receive the medicine shipment at the port.
- CMSD undertakes port clearing.
- Medicines transported to CMSD and taken into stock.

As mentioned previously, procurement lead times are quite long and variable, which has made the task of managing TB medicine inventories even more difficult. Hence, reducing and controlling procurement lead times are important goals for the NTP.

Quantification of Pharmaceutical Needs

Currently, the NTP undertakes annual quantification of TB medicine needs using spreadsheets provided by the GDF, under technical assistance provided by WHO/SEARO. This morbidity-based method of quantification takes into account the number of TB patients to be treated by category for the planning period; treatment regimens used; and an annual adjustment to cover consumption during the lead-time period, a buffer stock, and the stock on hand at time of ordering.

Distribution

The third key pharmaceutical management function is distribution. Several subfunctions, such as storage, transport, inventory management, and maintenance of pharmaceutical management information systems fall under this important function. These are described later in this report in relation to what was observed at central and Upazila levels during field visits.

Inventory Management

Making proper decisions on when to order and how much to order are two very important routine decisions required for maintaining a proper balance between ordering costs, stockholding costs, and stock-out costs. Poor inventory control will invariably lead to frequent stock-outs, high levels of medicine waste caused by expiry, and unnecessary blocking of capital. Waste could be minimized and availability of medicines could be significantly improved if an effective inventory control system were in place.

According to the SOP manual prepared by the NTP for managing TB medicines, orders should be worked out biannually at Upazila level. According to the SOP, requirements for each medicine are calculated by multiplying the number of cases in the last quarter (by category) by the number of treatment doses and average units per dose, which will give the working stock or running requirement. This figure is multiplied by three to obtain the stock for two quarters plus a one quarter buffer stock. By subtracting the stock on hand at the time of the indent from the multiplication product, the medicine requirement for each item for the half-year will be obtained. Quantification of reagents and consumables is done in a similar manner.

However, this system is not currently used. Instead, district staff calculates medicine needs by multiplying the number of cases in the last quarter (by category) by the number of treatment doses and average units per dose to obtain working stock or running requirement. This figure is then multiplied by two to obtain the stock for the next quarter plus a one quarter buffer stock. By subtracting the stock on hand at the time of the indent from the multiplication product, the medicine requirement for each item for the quarter is obtained. For this purpose, Upazila staff use the Form TB-08 to work out the Upazila medicine needs on a quarterly basis. (See annex C for an example.) Form TB-08 is user-friendly and appears to be working well.

Pharmaceutical Management Indicators

Currently, no indicators are used on a regular basis for assessing how well medicine inventories are controlled at different levels of the supply system. Therefore, it was not possible to use a set of existing indicators to comment on the performance of the system. Failure to use management indicators is a big weakness, because a good set of indicators would serve as a useful tool for NTP senior managers to remotely monitor performance of the supply system on a regular basis.

The following set of 10 pharmaceutical management indicators were selected for assessing performance of the inventory control and related management systems at facilities that were visited. However, indicators 6 and 7 included in table 1 could not be worked out for Upazila level because of lack of data and time constraints in extracting data needed.

Table 1. Pharmaceutical Management Indicators

No.	Indicator	Significance
K-1	Percent of medicines available on day of visit	Measures availability of a TB medicine at a given point in time
K-2	Percent of time out of stock for a product within a year or any other selected period of time	Measures availability of a medicine over a given period, say 12 months
K-3	Percent of annual issues lost because of expiry or damage	Measures the effectiveness of inventory control and storekeeping practices
K-4	Minimum (nonzero) stock level recorded during the 12-month period under study in terms of average monthly consumption (AMC)	A check on whether the buffer stock levels are adequate
K-5	Maximum stock level recorded during the 12-month period under study in terms of AMC	Useful in checking whether the medicine has been overstocked
K-6	Percentage difference between quantity ordered and quantity actually received	Measures the extent of rationing (or excess) supplies provided by an upper-level facility; best if there is no difference
K-7	Lead time in days between an upper- and a lower-level facility for supplying a medicine	Measures the difference between expected and actual lead times; lead time should be minimized
K-8	Percent of available shelf life of a medicine in months at the time of receipt	Shows how long the medicine could be used before its expiry; ideally, this should be longest possible time
K-9	Percentage of maximum shelf life of a product at time of receiving the medicine	Highlights the risk of medicine expiry and shows whether supplier has adhered to terms contained in the procurement contract
K-10	Percent difference between quantity on the stock record and a physical count of the product	This ideally should be zero; measures the accuracy in maintaining stock records

Indicators K-1 to K-10 were worked out for central level (CMSD and Shaymoli store) and Upazila drug stores for different time periods. It is important to note that not all Upazila facilities that were visited in the two BRAC districts provided data required for compiling these indicators. Thus, some indicators were developed for facilities in districts operated by the DF,

even though these facilities were not visited. These indicator values and what they depict are discussed under the section “Key Findings.”

Storekeeping Practices

Use of poor storage facilities and storekeeping practices will invariably lead to higher stockholding costs in terms of losses arising from medicine waste, medicine expiry, damage, and loss of medicine quality. Use of proper storage facilities, storage equipment, and storekeeping practices will help a great deal in reducing stockholding costs. Key storekeeping functions were observed and assessed at each TB drug store and treatment center visited. An account of these findings follows.

CMSD

It was not possible to visit the CMSD storeroom where TB medicines are stored. Such a visit needed an official clearance, which there was insufficient time to obtain. The following information regarding storekeeping practices at CMSD was obtained from CMSD staff officer Dr. Zahid.

Table 2. CMSD Warehouse Assessment

Key function	Need	Observations and assessment
Air conditioning of the store	To protect medicines	Storerooms are not air conditioned
Method of issuing medicines	To maximize shelf life	First-expiry, first-out (FEFO) system used
Monitoring temperature and humidity	To control storage conditions and protect medicines	Done
Arranging medicines according to expiry dates on shelves or pallets	To facilitate use of FEFO and reduce medicine expiry	Done
Stock records and computer systems	To ensure accountability and keep accurate stock management information	Manual bin cards and a computer system are in use
Use of bin cards	To ensure stock monitoring of batches	Bin cards not maintained per batch

NTP Central Warehouse

The NTP Central Warehouse is located at Shyamoli, about 7 kilometers from the NTP head office in Dhaka. This storage facility is headed by a medical doctor. In addition, it has a storekeeper and a group of seven persons working as porters and guards. It consists of two storerooms. The first is an air-conditioned storeroom of about 1,500 square feet from which medicines are issued to customers. The second is a brand-new store of about 2,000 square feet located on the second floor of the newly constructed 250-bed TB hospital adjoining the existing

central store. This new store is already functioning as a bulk store, even though it has not yet been officially opened. Its location on the second floor makes materials handling operations more difficult and costly. Both stores stock TB medicines and other supplies needed by the TB program. Because the Shyamoli store is too small to hold all TB medicines needed by the NTP, a small portion of the stock is held at the CMSD. Medicine stocks are transferred quarterly to the Shyamoli store from the CMSD. Table 3 describes important storekeeping functions at this store.

Table 3. Shyamoli Central TB Warehouse Assessment

Key function	Need	Observations and assessment
Air conditioning of the store	To protect medicines	The existing store is air conditioned, but the storeroom does not stay below 25 °C. The glass windows are broken at many places of the wall near the roof, and the main door stays open during distribution, allowing air to escape. This increases operating costs and also makes it difficult to maintain the temperature below 25 °C.
Monitoring and controlling store temperature and humidity	To protect medicines	Temperature is monitored and entered in a logbook at the beginning and end of the day at the old store. Average was 29+ °C. Humidity is not recorded even though the electronic meter records both temperature and humidity. The new store has not yet received a permanent electrical connection to operate an air conditioner.
Method of Issuing medicines	To maximize shelf life	Medicine batches are stored separately to facilitate use of FEFO for medicine issues.
Method of medicine storage	Medicines should be stored on pallets or racks above ground level	All medicine cartons are held on plastic pallets, and medicines are not stored on the ground in both stores.
Stock taking	Periodically reconcile physical counts with stock record balances	Done when needed, no designated time.
Writing off expired or damaged stocks from stock register and bin cards	To reflect true usable stock position at any time	No unusable stocks are included in stock records.
Stock records and computer systems	To ensure accountability and accurate stock management information	No computerized inventory control system is in use at this store. Only bin cards and a drug register is maintained per pharmaceutical item. No separate bin card is provided for each batch with different expiry dates of the same medicine.
Cleanliness	To protect medicines from insects and dust	Satisfactory

Upazila Level

A description of storekeeping practices in respect of major storekeeping functions observed at Upazila level during field visits follows.

Table 4. BRAC Drug Store at Shibalaya Upazila, Manikganj District

Key function	Need	Observations and assessment
Air conditioning of the store	To protect medicines	No air conditioning is available.
Good ventilation	To ensure cross ventilation, control temperature and humidity	An extractor fan is available.
Method of Issuing medicines	To maximize shelf life	FEFO
Monitoring temperature and humidity	To control storage conditions	Temperature is monitored once a day and was 29+ °C at time of visit.
Arranging medicines according to expiry dates on shelves or pallets	To facilitate use of FEFO	Done
Method of medicine storage	Medicines should be stored on pallets or racks above ground level	TB medicines are stored in a wooden lockable cabinet.
Stock taking	Periodically reconcile physical counts with stock record balances	Done when needed
Stock records and computer systems	To ensure accountability and accurate stock management information	A bin card and a drug register are maintained for each TB product. No computer is used.
Cleanliness	To protect medicines from insects and dust	Satisfactory.

BRAC Drug Store at Sreepur Upazila, Gazipur District

The store was well maintained using good storekeeping practices. However, the temperature of the store at the time of visit was 33 °C.

Upazila Drug Store at Kapasia Upazila, Gazipur District

In this particular Upazila, the bulk of TB medicines is kept at the Upazila Drug Store together with all other essential medicines. No stock records are maintained in this store, and the medicine store is in very poor condition. The storekeeper at this facility is very new and needs to be trained; the medicine store should be upgraded. If this is not possible, it would be better to store TB medicines at the BRAC drug store as in all other Upazilas visited. This store supplies TB medicines to the BRAC drug store on a monthly basis.

Distribution

From NTP Central Store to Upazila Level

BRAC is using a pull system for obtaining TB medicines needed for a district on a quarterly basis in districts in which it operates. The process and key activities used by BRAC for initiating medicine orders from Upazila level are described below.

The TB Leprosy Control Assistants (TLCAs) at Upazila level prepare a TB Drug Requisition Form (TB-08) at the beginning of a new quarter to requisition TB medicines from the central-level TB store at Shyamoli. (See annex C for a sample TB-08 form.) A TB-08 is prepared for each Upazila DOTS center in a district, and a TB-08 is produced for the district as a whole by aggregating needs of individual Upazilas. These forms are signed by the Civil Surgeon of the district prior to submitting it to the NTP Central Warehouse.

The Drug Requisition Form is handed over at NTP Shyamoli store on the day of collecting medicines, and usually the medicine consignment is ready to be transported to the district on the same day. Transport of TB medicines to district level is undertaken and funded by NGO partners to their respective operational districts using hired trucks.

When medicines arrive at the district drug store, they are not unloaded there, but the storekeeper of the district store usually signs the Delivery Note to acknowledge receipt of medicines at the district. This is later forwarded to Shyamoli Central Warehouse to acknowledge receipt of medicines.

Thereafter, medicines consigned to each Upazila DOTS center are unloaded at the corresponding NGO drug store. A small quantity of medicines is also provided to the Upazila DOTS center for treating new patients for two to three days, until they are assigned to a DOTS provider near their residence. From here, medicines are issued monthly to DOTS providers (SS) for treating TB patients.

BRAC makes an appointment over the phone with Shyamoli Central Warehouse and arranges a suitable day to collect the medicine order. Most NGOs collect medicines within the first three weeks of starting a new quarter. With such a system in operation, measuring the actual lead time between central and district levels for supplying medicines is rather difficult, because there is no record of the actual date of placing an order by phone. Based on this type of order processing system, the first three weeks of any new quarter appears to be a very busy time for the NTP storekeeper. Furthermore, NGOs sometimes have to visit Shyamoli Central Warehouse more than once during any given quarter if all the medicines, supplies, and lab items they need are not available for shipping in a single shipment.

In both districts visited, TB medicines are not stored at the district medicines warehouse but are first transported to the district NGO office and thereafter to individual NGO TB drug stores located at an Upazila, according to individual medicine needs.

The DF is operating a similar system to BRAC’s for distributing medicines, but some differences exist in the way its logistics system operates below district level. See figure 2 for details.

From Upazila NGO Drug Stores to DOTS Providers

TB medicines received from the NGO TB drug store are issued to NGO subcenters on a monthly basis. For example, Shibalaya Upazila has four subcenters; and 125 SSs currently serving as DOTS providers, after receiving training from BRAC. An SS is expected to obtain TB medicines needed on a monthly basis from the closest subcenter. DOTS providers (SS) are not compensated by BRAC, the NGO in this district for their work. However, they are provided certain products at a very low cost so they can make a living by selling these products at a profit to customers within their catchment areas. These products include lady’s comfort pads and simple medicines for treating headaches and stomach ailments. About 250 to 300 families are usually assigned to each SS. An SS is also provided BDT 500 per TB patient treated who completes treatment, since July 1, 2012, using funds received through GFATM. Prior to this date, the rate paid per patient was only BDT 150.

Mrs. Tahema Begum, Mrs. Khadiya Aktar, and Mrs. Momtay Begum are currently operating in the Sreepur Upazila as SSs and were interviewed to gather information on how they serve TB patients. This information is included in table 5.

Table 5. SS Interview Results

Description	#1 SS	#2 SS	#3 SS
Number of households served per SS	250	250	250
Total number of current patients	5	2	2
Number of Category 2 patients	0	0	0
Maximum number of TB patients treated at a time over last 12 months	13	8	15
Source of TB medicines	Monthly from BRAC substore		
Medicine management documents	None, only a medicine box with patient name		
Treatment documents	A Patient treatment card checked off daily		
Medicine storage	Medicines kept in BRAC safety bag		
Stock-outs experienced over last 12 months	None		
Location of daily treatment	Home of SS, unless patient is too sick to travel		
Search for defaulters	Yes	Yes	Yes
Participation at monthly meetings	Participates in monthly BRAC meetings, provides medicine and patient information, receives medicines for next month		
Salary	None, but an incentive of BDT 500 per cured patient		
Training	Provided by BRAC		
Key problems	Need face masks for SS, now only patients are provided with masks		

In Gazipur district, the flow of medicines is very similar to that described for Manikganj district.

Medicine Use

Last but not least is the fourth key pharmaceutical management function, medicine use. During the field visit, staff attached to DOTS centers were asked to describe standard treatment regimens they use for treating TB patients when using first-line medicines, according to the standard treatment guidelines provided to them. Regimens used are as follows—

- **New Smear-Positive Category 1 Patients**

2(HRZE)/4(RH)

- **Retreatment Category 2 Patients**

2(HRZE)S/1(HRZE)/5(RH)E

4-FDC: isoniazid 75 mg + rifampicin 150 mg + pyrazinamide 400 mg + ethambutol 275 mg

2-FDC: isoniazid 75 mg + rifampicin 150 mg

S 1 g

The daily dose of FDCs to be given to patients is decided according to three sets of patient body weight categories.

MDR-TB

Official Bangladeshi guidelines indicate that MDR-TB has a 24-month treatment regimen that is WHO and GLC approved. A 6(+)-month hospital-based intensive phase (IP) with kanamycin, ofloxacin, ethionamide, cycloserine, and pyrazinamide, followed by a 14-month DOTS monitored, home-based continuation phase (CP) with ofloxacin, ethionamide, cycloserine, and pyrazinamide. The two NTP hospitals where this treatment is followed are the National Institute of Diseases of the Chest and Hospital in Dhaka and the Chest Disease Hospital in Chittagong. Culture and drug sensitivity tests are performed monthly during IP and quarterly during CP. Transfer from IP to CP is contingent on having four consecutive negative culture tests; otherwise patients continue in the IP until conversion.

The DF provides MDR-TB treatment as operational research through three of its own hospitals and one Government of Bangladesh hospital. The DF uses a nine-month treatment regimen divided into a 4(+)-month hospital-based IP and five-month home-based CP with DOTS providers. Medications for the IP are kanamycin, clofazimine, gatifloxacin, ethambutol, isoniazid, pyrazinamide, and prothionamide and for the CP, gatifloxacin, ethambutol, clofazimine, and pyrazinamide. All patients are required to have a negative microscopy test and FDA stain to transfer from IP to CP. If conversion does not happen by the fourth month of IP, the patient remains in this treatment phase until conversion.

DF patients are monitored during the intensive phase monthly with microscopy and FDA (fluorescein diacetate) testing. Patients who convert are then monitored in CP at 6, 8, and 9 months to monitor TB positivity and are considered cured with continuous negative tests through the ninth month. Patients are considered to be a treatment failure if any of the tests during CP are positive. Cured patients are tested at 6, 12, 18, and 24 months post treatment to monitor treatment relapse.

Pharmaceutical Management Information Systems

A good MIS would be invaluable for maintaining an efficient TB pharmaceutical supply system from central level down to the level of treatment centers such as Chest Disease Clinics and DOTS Centers. An MIS and TB pharmaceutical management information would help pharmaceutical managers performing the four key functions depicted in figure 3 at different levels of the supply system to monitor operations and take early corrective action where needed.

TB pharmaceutical management information systems currently maintained at different levels of the TB pharmaceutical supply system are described below.

Central-Level NTP Central Warehouse

The NTP Shyamoli Central Warehouse produces a pharmaceutical management report on a quarterly basis containing information on stock balances and expiry dates for the Deputy Program Manager, Dr. Hamid, at NTP. No other reports are provided on a regular basis except for stock balances provided to WHO for undertaking annual pharmaceutical quantification.

Useful information relating to TB medicines is available at Shyamoli Central Warehouse, but unfortunately it has no proper information system for easy retrieval of even basic information. This makes data gathering a long and a tedious process, as experienced by the MSH team when gathering pharmaceutical management data for producing a set of indicators for this rapid assessment. This situation is not very satisfactory, and some simple information system should be immediately introduced for maintaining at least basic pharmaceutical management information. See annex B for a specimen Inventory Control Card (ICC) that could be used for maintain information on issues, receipts, expiry dates, days out of stock, and so forth. According to information received regarding operations at CMSD, the situation regarding pharmaceutical information management is similar.

District and Upazila Levels

The main pharmaceutical management information system operated at Upazila and district levels is the TB-08 form. It provides valuable information for each Upazila and for the entire district on the number and type of patients treated during the last quarter, stock on hand at the end of the quarter, and quantity of a medicine received from the NTP. This system is jointly maintained by the TLCAs from the MOHFW and the NGO operating in the Upazila.

A manual system is used to extract key information relating to TB patients from Patient Registers maintained at the Upazila level. The forms with this information are forwarded on a quarterly basis to the NTP at central level. As for medicines, the main document used is the TB-08, which is used for requesting medicines quarterly.

MSH Bangladesh is currently in the process of introducing e-TB Manager, a Web-based system for managing the TB program. This MSH-developed tool has been introduced at six Upazilas in six districts and is expected to be rolled out to another 20 Upazilas shortly. When e-TB Manager becomes fully operational, it will allow senior managers in charge of the TB program to access a wide range of and current information on patients and pharmaceutical management activities, which is currently lacking. Such an intervention will greatly facilitate the tasks of monitoring and supervising the TB program from different levels of the supply system.

DOTS Center Level

DOTS providers (SSs) supply information on TB medications given to individual patients assigned to them during a month. They also provide information on defaulting patients to their supervisors at Upazila level.

Human Resources

Table 6. Organizational Structures

TB management chain of command	Procurement
MOHFW	Procurement Unit
DGHS	Procurement and Supply Chain Management consultant
Director Mycobacterial Disease Control and Line Director TB, Leprosy	Procurement and Supply Chain Management Assistant
Program Manager (NTP)	
Deputy Program Manager (Procurement Logistic)	
Medical Officer	

Monitoring and Supervision

Monitoring and supervision (M&S) of pharmaceutical management activities are very important, especially because NGO partners are operating the supply system below district level. A well developed and properly functioning M&S system will keep senior managers at NTP well informed on the progress made in pharmaceutical management operations at field level.

Monitoring is the process of reviewing operational procedures at the facility on a routine basis to ensure that assigned activities are carried out as specified by the SOP manual for TB pharmaceutical management.

Supervision is the process of ensuring that personnel have the necessary knowledge and skills required to carry out their respective responsibilities effectively and providing immediate on-the-job training as needed. A method of supportive supervision as opposed to a system of policing would be useful. When using such a system, supervisors are expected to identify weaknesses or deviations from what is stated in the SOP and thereafter provide appropriate on-the-job training to strengthen pharmaceutical management activities.

The NTP has a limited number of staff to undertake M&S activities on a regular basis. Pharmaceutical management activities are not supervised separately but as part of supervising the TB program as a whole. Considering the importance of M&S, developing a complete system of M&S will be useful, to replace the one described in the current SOP when pharmaceutical management functions recommended in this report are implemented.

KEY FINDINGS

Following is a description of major findings and observations made in relation to all four key TB pharmaceutical management functions. These findings are based on interviews carried out at facilities such as the CMSD, NTP, TB Central Warehouse, District Civil Surgeon's Office, Upazila NGO drug stores, and DOTS providers visited.

In addition to information gathered during interviews, a set of pharmaceutical management indicators was produced to assess the performance of the TB pharmaceutical supply system. These are also presented in the following sections.

Selection

There appear to be no serious problems regarding the selection of TB medicines in terms of their specifications or dosage forms. FDCs used in Bangladesh are listed in the GDF medicine catalogue published for worldwide usage.

All TB medicine products for providing first-line and second-line treatment are included in the Bangladesh and WHO Essential Medicine Lists.

Procurement

An efficient procurement system should be capable of procuring medicines of acceptable quality, at reasonable prices, within specified procurement lead times for supporting the national TB program. Currently, the GDF deals with many aspects concerning quality assurance, thus greatly reducing the burden on the NTP. Some key findings relating to procurement are discussed below.

- TB medicines are procured and managed as a vertical program.
- Almost all needs of first-line TB medicines for adults, children, and diagnostic supplies are procured through the GDF using GFATM funds.
- All needs of second-line TB medicines for treating MDR-TB patients are procured through the GLC using GFATM funds.
- Some TB medicines are procured using MOHFW funds to meet the total medicine demand.
- The NTP is undertaking annual quantification of TB medicine needs using a morbidity-based approach, with technical assistance provided by WHO/GDF.
- The CMSD is undertaking port clearing operations for both sea and air shipments.

- **Indicator K-7:** The lead time from the time of placing the purchase order to time of clearing medicines through the port for some recent GDF supplies were as follows—

Air 105 days, two shipments
 Sea 312.5 days, two shipments

Lead times are high and variable based on limited data. In addition, these values exclude the lead-time component spent on order preparation and arranging funding needs, which is quite substantial. If this component is added, the actual lead times would be much longer.

Because the NTP mainly depends on one supplier for first-line medicines, namely GDF, any delays in supply lead times could severely affect medicine availability. Therefore, an early warning system to detect low stock levels such as a Minimum Stock Level (MINSL) at central level for controlling inventory would be very useful. See proposed ICC (annex B) for details.

- Because procurement of medicines is done through suppliers prequalified by GDF, the NTP is performing only a limited role in procurement.
- TB medicines have a long shelf life at the time they are received at CMSD. This is confirmed by Indicator K-8 (see table 7) for CMSD.
- TB medicines also have a large percentage of their maximum permissible shelf life left at time they are in the country. This is confirmed by indicator K-9 developed for CMSD. Indicators K-8 and K-9 are shown in table 7 for four products recently received at CMSD.

Table 7. Indicators K-8 and K-9 for CMSD

Indicator	Indicator description	Average	Maximum	Minimum
K-8	Available shelf life at time of receipt in months	22.40	38	16
K-9	Percentage of maximum available shelf life	85%	96%	70%

Distribution

NTP Central Warehouse

A medical store should satisfy at least four prerequisites for efficient operation. First is that it should have a proper store, with adequate storage capacity to store the required quantity of medicines, provide protection, and leave sufficient space for other functions, such as receiving, issuing, and proper materials handling. The second prerequisite is the use of proper storage devices and handling equipment and proper layout to maximize available storage capacity and improve productivity. The third prerequisite is the use of proper storekeeping practices to help minimize medicine waste and operating costs. The fourth is the need for a proper inventory

control system to accurately and timely record inventory transactions for use in making critical decisions on when to order and how much to order and in maintaining a useful pharmaceutical management information system. The situation prevailing at the NTP Central Warehouse at Shyamoli regarding these four key elements or prerequisites is discussed below.

Limited Storage Capacity

It has been necessary to store TB medicines in multiple storerooms and locations within Dhaka City because of limited storage capacity at Shyamoli. The situation is further complicated by the current inventory control and shipping schedule. Medicines are stored at two separate store rooms at Shyamoli and excess stocks at the CMSD. This practice makes it difficult to promote good storekeeping practices or to keep accurate stock records.

Some TB medicines have been moved to the newly constructed medicine warehouse located within the premises of the new 250-bed TB hospital. However, lack of a permanent power supply to the store there leaves insufficient power to run the air conditioners, and the new store is not fully functional.

The existing store at Shyamoli is air conditioned, but maintaining the storeroom temperature below 25 °C is difficult using the existing single air-conditioning unit. Broken panes of glass near the roof are allowing air to escape, and the storeroom door is open regularly to facilitate shipping and receiving. It would not cost much to repair the damaged panes of glass; hence, this repair should be undertaken immediately as a means of help bring down the store temperature to acceptable limits for medicine storage.

Storage Devices

The layout of the stores could be improved, and more thought should be given to the layout of the new store at Shyamoli, including the best type of devices to store medicines. Such interventions would have the potential to further increase the limited storage space by about 20 percent at least, compared to what is now available.

Storekeeping Practices

The storekeeper is recording the temperature of the storeroom on a daily basis only and not the relative humidity, even though an electronic device is available for this purpose.

Indicator K-3 for Shyamoli store shows percent of annual medicine issue lost because of expiry or damage has been relatively low. No TB medicines expired or were damaged during 2011 for both first-line and second-line medicines. However, so far in 2012, the following quantities were lost—

- HR (rifampicin + isoniazid) child = 535 percent (329,314 tablets)
- HRZ (rifampicin + isoniazid + pyrazinamide) child = 129 percent (634,252 tablets)
- Syringe = 92 percent (265,471 pieces)
- Cycloserine = 31 percent (62,000 capsules)

The few expired medicines were mostly caused by overestimation of needs. Other than that, these indicators show that storekeeping practices have been generally good.

Indicator K-10, the percentage difference between quantity on the stock record and a physical count of the product was zero for all products at Shyamoli, based on the stock taking done by the Shyamoli storekeeper at the end of June 2012. Hence, it appears that the stock records are being kept accurately.

Inventory Control

A bin card is maintained for each product in stock. However, a bin card is not maintained for medicine batches with different expiry dates. Such a practice would facilitate use of FEFO and thus help in reducing medicine expiry.

Following are some key indicators that were developed for assessing how well medicine inventories have been managed and how well medicines have been stored—

- Indicator K-1, 89 percent of nine first-line TB medicines and all four second-line medicines were available at the time of the visit to the NTP Central Warehouse at Shyamoli.
- Indicator K-2, the percentage days out of stock in 2011, was 29 percent for streptomycin and 58 percent for water. All other first-line products were in stock throughout 2011.
- During the first six months of 2012, all first-line products were in stock, that is, indicator K-2 was zero for all products.

Average of stock levels, their maximum and minimum values at central level (CMSD and Shyamoli stores) for first-line and second-line medicines recorded at the beginning of four consecutive quarters according to AMC are as follows (N = 13)—

Date	Average	Minimum	Maximum
January 1, 2011	10.78	0.19	57.64
July 1, 2011	9.70	0.72	35.58
December 31, 2011	13.86	4.22	47.44
July 1, 2012	9.37	0.99	26.30

The variability (difference between maximum and minimum value) is very high on all four days of taking stock. This implies that inventory control and quantification could be improved.

Computerized Inventory Control

At present, routine inventory transactions such as recording of receipts, issues, and stock balances are done manually using bin cards and a drug register. Although this manual system may serve the purpose if done accurately and on time, using a computerized system with a

suitable software package specially developed for managing medicines at medical stores would be better. Such an intervention would greatly facilitate the use of good inventory control practices and also provide much needed pharmaceutical management information that is presently lacking for good planning and control purposes.

Presently, no ICC is in use to record important information relating to a given product, such as lead times, level of buffer stocks, monthly consumption, AMC, expiry dates, and days out of stock. Without such basic information, it is difficult to control medicine inventories effectively.

Average Monthly Consumption

Computing an AMC value for a given TB medicine is a very useful way of controlling inventory. AMC can be used as an important input to operating an inventory control system for purposes of setting buffer stock levels, establishing maximum and minimum stock levels, working out a set of pharmaceutical management indicators, identifying medicines at risk of expiry and quantities likely to expire, and so on. However, currently this important bit of information is not computed at central or at Upazila levels for controlling inventory. A new value for AMC should be computed regularly, at least annually to reflect any change of consumption behavior and patterns, and used for operating the inventory control system.

Use of Inventory Control Limits

The manually driven inventory control system operating at the NTP Central Warehouse is currently not using any maximum or minimum stock levels for controlling inventory because key inventory control decisions such as when to order and how much to order are made at the time of undertaking procurement, using an annual procurement system. However, if a situation arises where central-level stocks suddenly become very low, no mechanism is in place to automatically trigger an emergency order and avert a possible stock-out in the near future. Hence, setting a $MINSL = AMC * LT$ would be most useful, where AMC is the average monthly consumption and LT is the expected procurement lead time in months.

Shelf Life of Medicines

As medicines are distributed from central level to lower levels of the supply system, it is important to ensure that they have adequate shelf life left when they reach lower levels. If only a limited shelf life is left at time of receipt, there is a higher risk of medicine expiry before consumption by patients. Indicators K-8 and K-9 are two complementary indicators that were developed for use at Upazila level for checking this condition, for a sample of four medicines, as shown in table 8.

Table 8. Indicators K-8 and K-9 for NTP Central Warehouse to Upazila Level

Indicator number	Indicator description	Gazipur-Shreepur	Faridpur	Mohanpur Rajsha
K-8	Available shelf life in months at time of receipt	21	31	31
K-9	Percent of maximum available shelf life in months at receipt	66%	79%	79%

Both indicators discussed above show that when TB medicines reach the Upazila level, they still have a substantial amount of shelf life left in them. This reflects well on key pharmaceutical management practices used at central level, such as procurement, storekeeping, inventory control, and distribution functions.

Human Resources for Pharmaceutical Management

No pharmacist is attached to this store. The present storekeeper has been working for nine years at this store. None of the staff members has received any formal training in pharmaceutical management.

NGO TB Drug Stores at Upazila Level

Medicine Availability

According to the BRAC storekeeper at Manikganj District, on most occasions, it has been possible to obtain all district needs of TB medicines by making one quarterly visit to the NTP Central Warehouse at Shyamoli. However, during certain quarters, it has been necessary to visit this store on more than one occasion because some items are out of stock. For example, NGOs collect lab supplies from the NTP Central Warehouse as late as June, even though the quarter has almost ended.

Indicator K-1, relating to availability of TB medicines at Upazila level at time of visit was as follows for some facilities at Upazila level—

- 83 percent, Gazipur, Shreepur (N = 6)
- 75 percent, Faridpur (N = 8)
- 83 percent, Mohanpur Rajshahi (N = 6)

Indicator K-2, the percentage of days out of stock in 2010 and 2011 is zero for all first-line products at Shreepur and Faridpur Upazilas. In the case of two pediatric FDCs and ethambutol 400 mg for Shreepur, no data were available to compile indicator K-2.

Indicators K-4 and K-5, minimum and maximum stock levels recorded in terms of AMC during 2011 at two Upazila stores are illustrated in table 9.

Table 9. Minimum and Maximum Stock Levels (Months of Consumption)

Upazila store	Indicator	Isoniazid + rifampicin+pyrazinamide + ethambutol	Isoniazid+ rifampicin	Streptomycin	Water	Syringe
Gazipur-Shreepur	Max K-5	4.63	7.16	3.81	3.81	8.00
Gazipur-Shreepur	Min K-4	0.09	0.14	0.95	0.95	2.00
Faridpur	Max K-5	8.66	7.55	6.36	0.46	32.72
Faridpur	Min K-4	0.02	0.003	0.08	10.06	0.02

Some maximum stock levels (K-5) of some products held at both Upazilas are too high for this level of the supply system. Stock levels over six months are excessive for this level of the pharmaceutical supply system. In contrast, minimum readings for indicator K-4 are quite low and look good, except in the case of water with 10.06 months of stock at Faridpur. Having low levels for K-4 is generally good, but having values that are too low also shows that the probability of stock-outs is high, thus indicating the need for a higher level of buffer stock.

Buffer Stocks

The policy of giving a 100 percent buffer stock to districts in excess of quarterly medicine needs, provides a liberal cushion against potential stock-outs, particularly because lead times for obtaining medicines from the NTP Central Warehouse is relatively short. Furthermore, NGOs are in the practice of borrowing any medicines that are running low in a given Upazila from a neighboring district or Upazila. These practices have gone a long way in limiting the extent of stock-outs.

Triggering Emergency Orders

Currently no formal mechanism exists to trigger an emergency order at Upazila level using a MINSL. If such an early warning system were in place, the TLCAs could make early arrangements to place an emergency order with the NTP or arrange for a small quantity of the medicine in question to be borrowed or transferred from a neighboring district having sufficient stocks.

Storekeeping

Observations during the field visit to Manikganj District indicated that the BRAC TB drug store at Shibalaya Upazila was well managed. The method used for distributing TB medicines to DOTS providers at village level through a set of NGO-operated subcenters appears to be working well, simple to operate, and effective.

For indicator K-3, no medicines were written off in 2010 or 2011 at Gazipur-Shreepur or Faridpur. However, Mohanpur Rajsha wrote off small quantities (< 1 percent) of each medicine because of damage in both years. Currently, no TB medicines have a shelf life of less than six months at any of the Upazila stores. These indicators confirm that storekeeping practices have been generally good.

It was not possible to gather sufficient information to produce indicators K-10 for the accuracy of record keeping, K-6 on the extent of rationing or oversupplying, and K-7 on ordering lead times at any of the Upazila level facilities because of lack of time and data.

e-TB Manager

The Web-based TB pharmaceutical management tool was developed by MSH for managing information relating to TB patients and medicines. It was first introduced at six pilot facilities in six districts in Bangladesh. Even though the tool is currently used at six pilot facilities, it appears that users are experiencing certain technical problems in making it fully operational. The fact

that signal strength is weak makes accessing the Web difficult at all times, which makes data entry very difficult and frustrating. Furthermore, frequent power cuts have not made this task any easier. Under these conditions, it would be useful to look into these technical problems in detail and convert the current version of e-TB Manager to an offline system that could batch process information offline and transmit data when operating conditions become favorable.

Human Resources for Pharmaceutical Management

At an Upazila, usually two TLCAs are in charge of pharmaceutical management, one from the MOHFW and the other from the affiliated NGO. In some Upazilas, only one person is available. In addition, a statistician is available to assist with any pharmaceutical management activities. These persons' performance could be improved if they could be provided some training in TB pharmaceutical management.

TB Medicine Use

It was not possible to visit a location where DOTS providers were administering TB medication to patients because of limited time available for conducting this rapid assessment. Hence, three DOTS providers (SSs) but no TB patients were interviewed. Information gathered during these interviews revealed that the correct regimen was being used for treating TB patients, based on their body weight. SSs were storing medicines at their homes in bags provided by BRAC. They were also maintaining patient records and marking daily doses administered to each patient on patient cards. Patient treatment cards are handed over to the BRAC office at Upazila level on a monthly basis to provide information on patients and medicine use.

General Management

The NTP Central Warehouse at Shyamoli is producing a pharmaceutical management report quarterly. This provides basic information to the NTP on individual medicines with respect to stock balances at the end of quarter and expiry dates. Although this report is good, it would also be useful if a few key pharmaceutical management indicators describing performance of key pharmaceutical management activities could be produced on a quarterly basis. Currently, no pharmaceutical management indicators are produced on a regular basis, except for those that have been developed as part of this rapid assessment.

Collaborators and Partners

The following collaborators and partners were associated in completing this assignment—

- Dr. Md. Ashaque Hussian, Director (Mycobacterial Disease Control) and Line Director TB/Leprosy
- Dr. Aung Kya Jai Maug, Country Director, DF, Bangladesh

Adjustments to Planned Activities or Additional Activities

No major adjustments were made to activities planned during this visit.

NEXT STEPS

Immediate Follow-up Activities

The MSH Senior Technical Adviser in Bangladesh and other MSH TB staff should thoroughly review the key findings of this rapid assessment of the TB pharmaceutical supply system in Bangladesh. Then it would be useful to review the set of recommendations and the plan of action proposed in this trip report for strengthening the management of TB pharmaceuticals. Thereafter, a decision should be made in consultation with the NTP, NGOs, and other major stakeholders regarding the feasibility of making an investment in strengthening TB pharmaceutical management, as outlined in this report.

Recommendations

Currently, NTP Bangladesh is receiving a great deal of financial and technical assistance from international organizations such as WHO, GDF, and GLC for operating the TB pharmaceutical supply system. These inputs have significantly reduced the burden for the NTP, especially with respect to the first two key functions of the pharmaceutical management cycle: selection and procurement. Providing good quality medicines at no cost to support the NTP is the main objective of such assistance. However, it is worth noting that building capacity among key local institutions in terms of improving technical and management know-how is also vital for the long-term sustainability of the TB program because one cannot predict how long international assistance will continue in the future. Therefore, it would be useful to think in terms of a long-term strategy for building capacity at the NTP and work toward this end from now on.

Bangladesh is using a public-private partnership for maintaining the NTP. The reported case detection rate is 64.80 percent for smear positive, the case notification rate for all forms of TB is 97/100,000 of population, and the cure rate reported for 2011 is 90.40 percent. The TB pharmaceutical management activities in Bangladesh appear to be progressing well.

The third and fourth key pharmaceutical management functions of the pharmaceutical management cycle have also been largely contracted out, because operation of the TB program below district level has been assigned to a set of NGO partners. Under this scenario, the key pharmaceutical management tasks undertaken currently by the NTP are as follows—

- Liaise with GLC/GDF/WHO on all issues relating to procurement and quantification of TB medicine needs.
- Provide TB medicines needed to support districts, Upazilas, chest disease hospitals and chest disease clinics from pharmaceutical stores at central level.
- Monitor and supervise pharmaceutical management operations at districts, Upazilas, chest disease hospitals, and chest disease clinics.

- Establish key policy guidelines for operating the TB program and pharmaceutical management functions and ensure their proper implementation.

This section of the trip report discusses recommendations for strengthening some of these NTP functions. During this visit, it was possible to undertake only a rapid assessment of the TB pharmaceutical supply system by sampling a few facilities in 2 of 64 districts. Hence, it is worth noting that recommendations given here are based on this limited exposure to field operations, what has been gathered through existing reports, and from knowledgeable persons working in TB pharmaceutical management.

TB medicines and supplies are stored and consumed at several levels in the pharmaceutical supply system, as shown in figure 1 and 2. Maintaining an effective TB program would not be possible without a supply system capable of delivering good quality medicines in correct quantities at times when they are needed by TB patients. Hence, maintaining an efficient supply system is an important prerequisite for the successful operation of the TB program as a whole.

One of the biggest weaknesses of the system is the fact that TB medicines are not stored in one location at central level under suitable storage conditions. This has created the following problems—

- It has made it much harder to maintain an effective pharmaceutical management information system. Even getting the total stock on hand at any given point in time at central level requires adding up stock balances at multiple locations. Data are available, but retrieving even basic information is difficult and time consuming.
- The system creates extra materials handling costs and an increased risk of damage and deterioration of medicine quality.

To overcome these problems, it is recommended that the NTP take the following steps toward strengthening stores management at central level—

- Make the new drug store at Shyamoli fully functional as soon as possible.
- Undertake a proper stores layout by carrying out a proper feasibility study for improved storage facilities and conditions by using the services of a medical stores expert, for gaining maximum available storage capacity.

The current SOP for managing medicines and supplies produced by the NTP is insufficient, because it is more or less provides only a list of operating guidelines. A proper SOP manual should include a minimum package of storekeeping activities that are needed, clearly spelling out each key function, a set of subfunctions according to the flow of work, use of any special tools such as computer aids, specifying why it is import to perform the function, who should perform the function, and when it should be performed.

Once such an SOP manual is made available, it will not only serve as a guide to storekeepers, but will also serve as a useful tool for providing training and supervising store management

operations. A proper SOP would help supervisors identify what activities need to be supervised at a given facility and provide on-the-job training as needed. Only then will supervisors be able to supervise effectively.

Hence, it is recommended that a proper SOP manual be prepared, covering key store operations at central level. For more details, see the proposed plan of action for strengthening TB pharmaceutical management activities in Bangladesh (table 10).

Bangladesh has access to good quality medicines through GDF and GLC. However, the quality of medicines could easily deteriorate if they are stored under poor conditions. A large proportion of all TB medicines are currently held for an extended time at central level. Hence, every attempt should be made to maintain the temperature of the central store within acceptable limits, by undertaking the type of minor repairs needed by the store as mentioned previously in this report. This is particularly necessary because FDCs, unlike loose TB medicines, tend to deteriorate more rapidly under poor storage conditions of high heat and humidity. However, in storage at district and Upazila levels, a medicine is stored for a much shorter time. Unfortunately, even though air conditioning all drug stores at these levels would be ideal, it is not practical to do so in the short run. Hence, other means should be considered for lowering storage temperatures at these facilities as well.

Not only is it important to establish good storekeeping practices, but also it is important to maintain a proper system for controlling inventory, a good pharmaceutical management information system, and a suitable set of pharmaceutical management indicators. These indicators could be similar to the ones produced for this rapid assessment.

An annual procurement system is now operated by the NTP for obtaining medicines from GLC and GDF. The only documents now in use at the central TB store is a bin card and a drug register. This system provides only basic information, such as amount issued, amount received, and the stock balance. However, this information alone is insufficient for maintaining an effective inventory control system. Hence, it would be useful to use an ICC in addition. An ICC has space to record information relating to a given product such as lead times, level of buffer stock, monthly consumption, AMC, expiry dates and days out of stock etc. As a first step it is recommended that an ICC be introduced in the form of a spreadsheet until such time as a proper inventory control package using a computerized database is introduced at Shyamoli. See annex B for a specimen ICC. In addition to gaining better control over inventory, an ICC will also serve as a valuable source of information for developing a set of pharmaceutical management indicators and a monthly stock report to be forwarded to NTP.

It appears that NTP is not receiving much information relating to pharmaceutical management activities from central and field levels. It is important for NTP to closely monitor and supervise pharmaceutical management operations at all levels of the supply system. Currently, an effective M&S system is lacking. This situation should be quickly rectified, especially because pharmaceutical management operations below district level are in the hands of three NGO partners. This makes it even more important to develop and install a suitable M&S system for TB pharmaceutical management. This will make field operations more visible to NTP managers

at central level. Hence, it is suggested that a comprehensive M&S system be developed and introduced for pharmaceutical management with the minimum of delay.

As part of the proposed M&S system, it would also be useful to use a set of pharmaceutical management indicators. Some indicators have been developed for this rapid assessment and some of these indicators should be continuously developed on a periodic basis. The experience in other countries shows that it is best to use only a small number of meaningful indicators to monitor performance. Introducing indicators will involve many persons concerned with pharmaceutical management; hence such a process will take some time to be completed. This would involve identifying a set of indicators, sources of data, tools for data entry, processing information, and disseminating indicators and how to interpret indicators for M&S operations.

A comprehensive TB pharmaceutical management information system is a vital component of the supply system that would help managers operating at different levels assess how key pharmaceutical management functions are being performed. This function is rather weak and should be greatly improved. This deficiency was experienced during the data collection phase of this assessment as well. As a first step, it would be useful to assess what type pharmaceutical management information would be useful and what is presently available. Only then will it be possible to assess the information gap that currently exists. Thereafter, rather than develop new systems, exploration is recommended of information systems developed by MSH on behalf of the Directorate General of Family Planning to determine the feasibility of using such software for TB pharmaceutical management (with necessary modifications). Such an approach when used effectively will save a lot of time, money, and effort.

The e-TB Manager is a powerful Web-based TB pharmaceutical management tool currently implemented at six Upazilas. However, it appears that its full potential is yet to be realized because of certain technical problems. It is recommended that these problems be resolved first by modifying its operation from an online data entry to a system of offline batch processing to overcome the problem of weak signal strength. Further, it would also be useful to review the progress made so far with respect to TB pharmaceutical management activities using e-TB Manager.

A series of recommendations have been made in this section of the report for strengthening pharmaceutical management at different levels of the supply system. These are further described in the proposed “Plan of Action for Strengthening TB Management in Bangladesh” (table 10). The recommendations contained here should be treated as a complete package of activities and should not be selectively implemented, if maximum benefits are to be realized.

All systems are as good as those who operate them. Therefore, it is important to ensure that the NTP has sufficient management and technical capacity for managing pharmaceuticals at all levels. Furthermore, an adequate number of trained personnel should be available to carry out these functions at different levels of the system. This is especially so because the NTP is highly dependent on GLC/GDF for pharmaceutical procurement and on three NGO partners for distribution and medicine use. At present the number of senior NTP staff working on pharmaceutical management activities is rather limited and is performing only a limited role. As a first step toward building capacity, staffing and training needs should be assessed. Thereafter, it

would be useful to provide system-specific training to pharmaceutical management staff, based on a set of pharmaceutical management SOPs.

It appears that the NTP is supported by many local and international partners and donors. International organizations such as GDF and GLC are providing all TB medicine needs while WHO and USAID through SIAPS are providing technical assistance in pharmaceutical management. On the distribution and medicine use side, the three NGOs are basically in charge of these two key functions. Hence, any attempt at introducing new systems and procedures would be quite challenging, because it will need the cooperation of many stakeholders.

The main objective of undertaking this assignment was to do a rapid assessment of the current TB pharmaceutical supply system and develop a suitable plan of action for strengthening the management of TB medicines. Such a draft plan of action is provided in table 10. It also includes some recommendations included in other recently completed assignments related to TB pharmaceutical management. This plan should form a basis for providing further technical assistance.

Based on the results of this rapid assessment, no major problems appear to exist relating to the TB pharmaceutical management systems currently in use. Most pharmaceutical management indicators that were developed covering many key areas confirm this thinking. Good quality medicines appear to be available in required quantities to DOTS providers without any major stock-outs or excessive waste on account of damage or medicine expiry. This is commendable. However, what needs to be done now is to build on current systems used for M&S and MIS, so that pharmaceutical management functions could be further strengthened. This appears to be the top priority going forward.

Proposed Plan of Action

Table 10. Strengthening TB Pharmaceutical Management in Bangladesh

Key function	Proposed interventions	Priority	Start date	Expected benefits
(1) Store management	Permanent power supply: Obtain a permanent power supply to the newly built drug store at Shyamoli as soon as possible and make this store fully functional.	High	July 2012	Significantly increasing the total storage capacity at the TB Central Warehouse, thus permitting improved storekeeping practices
	Minor building repairs at Shyamoli: Undertake minor repairs at the old store room at Shyamoli to prevent air leakages.	High	July 2012	Maintaining store room temperature and humidity within acceptable limits
	Assessment of store layout: Undertake a proper layout at Shyamoli stores, thus using the maximum available storage space. This should include a proper feasibility study by a medical stores specialist.	Medium	Oct. 2012	Increasing current storage capacity by at least 20 percent
(2) Inventory management	Use Excel spreadsheets for inventory control: Currently it is very difficult to retrieve any pharmaceutical management information at Shyamoli Central Warehouse. Hence, as a first step, introduce ICCs and Monthly Drug Management Report in Excel spreadsheets for TB products at Shyamoli, until a computerized inventory control system is implemented. See specimen ICC.	Very high	Aug. 2012	An ICC will provide better control over inventories, help in developing pharmaceutical management indicators, improve ease of data retrieval.
	Revise drug register format: Revise the format of the drug register from a portrait to a landscape format to provide more room for routine data entry. Currently, the column width is insufficient for some data entry columns.	Low	Dec. 2012	Easier data entry and improved clarity
	Computerizing NTP store: Computerize NTP Central Warehouse operations by selecting a suitable software package, or develop one locally that is suitable for pharmaceutical management. Such a package should contain maximum and minimum stock levels to facilitate effective control over medicine inventory.	High	Jan. 2013	Reliable and up-to-date pharmaceutical management information and improved inventory control. This should lead to lower operating costs and reduce stock-outs.

Next Steps

Key function	Proposed interventions	Priority	Start date	Expected benefits
(3) TB pharmaceutical management information system and indicators	Review existing MIS systems: Undertake an in-depth review of existing TB and related pharmaceutical MISs used at different levels of the supply system, including the e-TB manager and systems used by NGOs.	Very high	Sept. 2012	Will help assess what information systems currently exist and their capabilities.
	Assess ideal information needs: Identify what pharmaceutical management information is needed at different levels in consultation with NTP and other stakeholders.	Very high	Sept. 2012	Identify different information needs at different levels of the supply system.
	Assess information gaps: Assess major gaps from 1 and 2 above that are observed in operating the TB medicine MIS.	Very high	Sept. 2012	Identify what additional TB pharmaceutical management information is needed.
	Use spreadsheets for stock management: As a first step in strengthening the TB medicine MIS, introduce Excel spreadsheets for producing a small number of key indicators and pharmaceutical management reports at central and Upazila levels. This will help in improving NTP's ability to undertake M&S functions more effectively.	Very high	Aug. 2012	Production of regular reports and indicators will help NTP better manage the pharmaceutical supply system.
	e-TB manger: As a second step, explore the feasibility of using e-TB Manger or any other system for producing such information on a regular basis.	High	Oct. 2012	Better use of an existing Web-based tool
	Review Web-based systems for logistics MIS: Review Web-based information systems currently used for managing family planning materials, such as LMIS and Procurement Tracking tools developed by MSH.	High	Dec. 2012	Identify what similar existing tools could offer.
	Feasibility study for Web-based MIS: Explore feasibility of using above tools for managing TB medicines with appropriate modifications.	High	Dec. 2013	Modification of an existing tool developed by MSH locally would save time and money in software development, compared to developing another new tool from scratch.
	Assess additional MIS needs: If above systems could be easily adapted for TB medicines, identify what additional information and indicators are needed to meet specific needs of NTP and make appropriate changes to existing MSH software packages for use at central, district, and Upazila levels.	High	Mar. 2013	Will make existing tools more effective for managing TB medicines.

Key function	Proposed interventions	Priority	Start date	Expected benefits
(4) Human resources management	NTP capacity building: To improve TB pharmaceutical management from current levels, NTP should create a supply planning cell within NTP for dealing with MIS, M&S, and quantification issues and recruit additional staff and provide appropriate training to build capacity within NTP.	Very high	Sep. 2012	Without having the required number of trained staff, it will be difficult to fully implement the type of additional systems and procedures recommended in this report. Hence, developing human resources needs at NTP should be a top priority.
	Monitoring and supervision system development: Prepare a comprehensive system for M&S, including use of indicators, supervision checklists based on SOPs, on-the-job training, and use of supervision reports.	Medium	Mar. 2013	Use of effective M&S systems will provide NTP managers valuable feedback regarding pharmaceutical management activities in the field and the ability to provide on-the-job training.
	SOP development: Review and update the current TB Drug Supply Management SOP Manual produced by NTP to include new tools, systems, and procedures recommended here. The proposed SOP manual should be a proper SOP describing— <ul style="list-style-type: none"> • All key pharmaceutical management functions in detail • Responsible person for performing the key function • When the function should be completed • Type and sources of information required for completing the task • Any special management tools recommended and use of any documents or computer systems for entering and retrieving information 	Medium	Start Sept. 2012 and complete by Sept. 2013	Documenting in detail recommended methods for undertaking key pharmaceutical management functions will ensure proper use of systems and procedures recommended for TB pharmaceutical management. Further, it will serve as a useful training tool and help supervisors in providing on-the-job training when undertaking supervision.
	Pharmaceutical management training for frontline staff: Develop curricula for general training on TB pharmaceutical management to MOHFW and NGO staff currently engaged in pharmaceutical management activities at district and Upazila levels.	Medium	Dec. 2012	Properly trained pharmaceutical managers would be in a better position to manage TB pharmaceutical management activities.
	Pharmaceutical management training for senior staff: Develop curricula for conducting short awareness programs in TB pharmaceutical management for senior MOHFW and NGO staff at central, district, and Upazila levels and conduct a series of awareness programs.	Medium	Mar. 2013	Introducing key pharmaceutical management concepts through awareness programs to senior health managers will highlight the importance and effect of

Next Steps

Key function	Proposed interventions	Priority	Start date	Expected benefits
				pharmaceutical management activities on the TB program as a whole and provide better support to pharmaceutical management staff.
	SOP training curricula: Develop curricula for TB pharmaceutical management based on SOPs for providing training to MOHFW and NGO partner staff currently engaged in pharmaceutical management activities at district and Upazila levels and provide training.	Medium	Mar. 2013	In addition to receiving general training on pharmaceutical management, trainees could benefit a great deal through system-specific training based on SOPs. This will help them in carrying out their pharmaceutical management functions more effectively using proper methods.

The preceding plan in its present form provides only an outline of what needs to be done for strengthening TB pharmaceutical supply management. If a decision is made to go ahead with this strategy, it would then be necessary to work out in detail the scope of work to be included under each of these key functions listed in the initial plan described in table 10, levels of effort, and a suitable timeline for providing technical assistance.

Agreement or Understandings with Counterparts

No verbal or written agreements or understandings were reached with counterparts during this visit.

Important Upcoming Activities or Benchmarks in Program

To introduce pharmaceutical management systems recommended in this report at pilot facilities.

ANNEX A. LIST OF PERSONS CONTACTED

Dr. Md. Ashaque Hussian, Director (Mycobacterial Disease Control) and Line Director TB and Leprosy

Dr. Md. Abdul Hamid, Deputy Program Manager, Procurement and Logistics, NTP

Dr. Kamar Rezwan, NPO, WHO, TB Bangladesh

Dr. Siddeswar Mozumder, Civil Surgeon, Manikganj District

Dr. Syed Habibullah, Civil Surgeon, Gazipur District

Dr. Md. Wahiduzzaman Akhanda, DOTS-Plus Coordinator (MDR-TB)

Dr. Md. Abdur Rahman, Deputy Director, CMSD

Dr. Aung Kya Jai Maug, Country Director, DF, Bangladesh

ANNEX B. INVENTORY CONTROL CARD

Product Name:		4 FDC		Code:				Unit:		TAB		Card # :		1	
Strength:		200+0.4 mg													
Outstanding and Completed Orders							Outstanding and Completed Orders								
Order Date	Order #	Unit	Order Quantity	Quantity Received	Date Received	Lead Time in Months	Order Date	Order #	Unit	Order Quantity	Quantity Received	Date Received	Lead Time in Months		
31/12/2008	369	TAB	200,000	200,000	11/02/2009	1.4									0
31/3/2009	69	TAB	226,000	226,000	26/5/2009	1.87									0
30/6/2009	86	TAB	250,000	200,000	26/8/2009	1.9									0
30/9/2009	126	TAB	205,000	205,000	25/11/2009	1.87									0
						0									0
						0									0
						0									0
Inventory Control Variables															
AMC :		20,937		Lead Tim		6		Buffer Stock:		3					
Review Period (RP)		12		MAXSL:		439,682		MINSL:		125,623					
Expiry Dates of Current Batches: ----->															
Monthly Consumption Information															
Year	J	F	M	A	M	J	JL	A	S	O	N	D	Total		
2012	12,500	12,000	11,000	12,000	30,000	20,000	100	24,000	12,000	20,000	10,000	19,000	182,600		
DOS	12	0	0	0	30	23	20	0	0	0	15	0	100		
2013													0		
DOS	0	0	0										0		
2014													0		
DOS													0		
Instructions:															
Open an ICC for each TB product.															
Days out of stock															
AMC = (Average Monthly Consumption), is the value estimated for the facility using the recommended quantification methods															

ANNEX C. TB-08 FORM

TB 08

Requisition Form for Drugs

Year: _____ Quarter: _____

Name of Health Institution: _____

City/ District/ Upazila: _____

Name & Designation of the person filling in the form: _____

Name & Contact no. of the UHFPO/ Center chief: _____

Number of registered cases during the previous quarter		
Adults		Children (< 15 years)
Category I = (n)	Category II = (m)	Category I = (c)

Drug requirements estimation

Drug	Quantity required for one quarter			Total reqd quarterly (b) = 2 x (a)	Existing balance (c)	Amount to be supplied =(b)-(c)	Actual amount supplied	Remarks
	Cat I = (1)	Cat II = (2)	Total (a) = (1+2)					
4FDC	=n ₁ x 180	=n ₂ x 270						
2FDC (R150/ H75)	=n ₁ x 360	=n ₂ x 450						
2FDC (R60/H30 (Dispersible)	=c ₁ x 540							
Z 150 mg (Dispersible)	=c ₁ x 180							
H 100 mg								
R 150 mg								
H 300 mg								
R 450 mg								
Z 500 mg								
E 400 mg		= n ₂ x 450						
S 1 g		= n ₂ x 60						
inj. Water, 5 ml		= n ₂ x 60						
D/Syringe, 5cc		= n ₂ x 60						

¹ Multiply the number of patients (n₁/n₂) in each treatment category with the number needed for treatment of one patient.

² The quantity includes buffer stock (100%) for a quarter.

³ Indicate the remaining balance from the drug ledger at the end of the previous quarter.

⁴ Use this column to mention drugs with expiry less than 6 months (give name, quantity & exact date of expiry).

Prepared by: _____ Signed by UH&FPO/ Center chief: _____

Checked by: _____ Countersigned by Cs with Date: _____