



## Evaluation of a Surveillance System on Multidrug-resistant Tuberculosis in Bangladesh

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### Abstract

In 2017, the World Health Organization reported that 558,000 people were diagnosed with multidrug-resistant tuberculosis (MDR-TB) or rifampicin-resistant tuberculosis. In Bangladesh, the MDR-TB rate is 1.6% of new cases and 29.0% of previously treated cases. We evaluated the MDR-TB surveillance system to assess its simplicity, timeliness, data quality, stability, flexibility, and usefulness following the guideline of the United States Centers for Disease Control and Prevention. Stakeholders reported that the system was simple and useful for monitoring the program's performance. However, there was a need to improve the timeliness, data quality and overall coordination between health facilities and the National Tuberculosis Control Program (NTP). Data from all reporting centers did not reach the NTP timely. There were duplication of data and missing demographic characteristics. The surveillance system needs specific objectives, permanent funding and more attention from the government to ensure its stability. A unified electronic data entry mechanism can be achieved using the District Health Information System software in collaboration with the Management Information System of Directorate General of Health Service, Bangladesh National Tuberculosis Program with unique patient identification.

**Keywords:** multidrug-resistant tuberculosis, National Tuberculosis Control Program, surveillance, Bangladesh, United States Center for Disease Control and Prevention

### Introduction

In 2017, the World Health Organization reported 558,000 new cases of multidrug-resistant tuberculosis (MDR-TB) and approximately 230,000 related deaths.<sup>1</sup> Every year, 90 to 100 MDR-TB cases are reported in the United States.<sup>2</sup> However, most cases live in India, South Africa, China, and Russia.<sup>3</sup> In Bangladesh, the MDR-TB prevalence is 1.6% among new cases and 29.0% among previously treated cases.<sup>4</sup>

To address the MDR-TB problem in Bangladesh, the country obtained support from the Global Fund to Fight Against AIDS, Tuberculosis, and Malaria. This was a pilot project at the National Institute of Diseases of the Chest and Hospital (NIDCH). Enrollment of patients started in August 2008.<sup>5</sup> Several non-governmental organizations and institutes became official partners of the National Tuberculosis Control Program (NTP). The relationship between NTP and

most of these partner agencies is governed through a memorandum of understanding.

In Bangladesh, tuberculosis surveillance is conducted by the National TB Control Program in collaboration with 34 non-governmental organizations (NGO).<sup>5</sup> The NTP defines MDR-TB as tuberculosis that is resistant to isoniazid and rifampicin, the two most powerful first-line drugs used to treat tuberculosis.<sup>5</sup>

Surveillance can be used to identify public health emergencies, seasonal patterns of disease, monitor interventions, and document disease burden. The primary goal of the NTP MDR-TB surveillance system is to prevent the emergence of resistance to second-line drugs and transmission of drug-resistant tuberculosis.<sup>6</sup> The objective of this study was to evaluate the MDR-TB surveillance system in Bangladesh in terms of simplicity, timeliness, data quality, stability, flexibility and usefulness. This first-

time evaluation will help to improve the quality of the surveillance system.

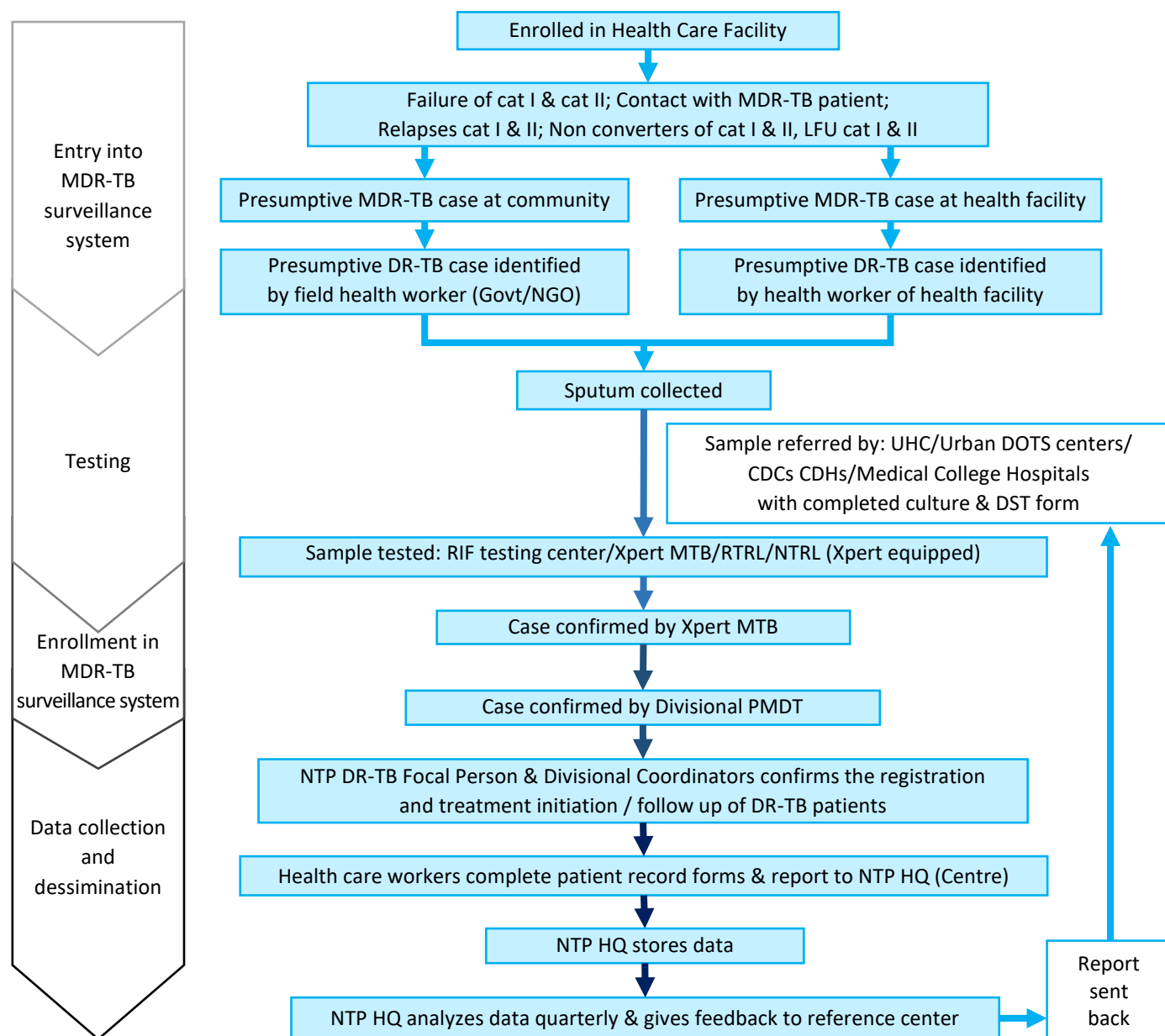
## Methods

We followed the United States Centers for Disease Control and Prevention (U.S. CDC) 2001 guidelines for assessment using a mixed methods approach.<sup>7</sup> The evaluation obtained surveillance data between 2008 and 2015 from the NTP and interviewed the key focal persons and laboratory personnel at surveillance sites.

## Key Informants

Stakeholders were those who received data from the surveillance system and who provided input on the system attributes to be evaluated. The major

stakeholders were the MDR-TB focal persons at the NTP, NIDCH, National Tuberculosis Reference Laboratory (NTRL), programmatic management of drug-resistant tuberculosis coordinator, Regional Tuberculosis Reference Laboratory, NGO partners and relevant staff at the surveillance sites. Face-to face interviews were conducted with directors and key staff of these organizations to understand how the data were used and if the evaluation would be beneficial to their program. Based on stakeholder engagement, interest and evaluation objectives, the following attributes were assessed: simplicity, timeliness and data quality (quantitative variables) as well as stability, flexibility, and usefulness (qualitative variables).



cat: category. LFU: lost to follow up. DR-TB: drug resistant tuberculosis. NGO: non-government organization. UHC: Upazilla Health Complex. CDC: chest disease clinic. CDH: Chest Disease Hospital. DST: drug susceptibility testing. RIF: resistance to rifampicin. MTB: *Mycobacterium tuberculosis*. RTRL: Regional TB Reference Laboratory. NTRL: National TB Reference Laboratory. NTP: National TB Control Program. HQ: headquarters. PMDT: Programmatic Management of Drug-resistant TB

**Figure 1. Flow chart of data for surveillance of MDR-TB by the Bangladesh National Tuberculosis Control Program**

## Selection of Site

We included four of the six sentinel hospitals in the MDR-TB surveillance system for the evaluation. The NIDCH is the referral hospital for MDR-TB and was chosen purposively. Three other sites, namely Chittagong, Sylhet and Rajshahi, were selected randomly. Direct observation was done only at the NIDCH.

## Data Sources and Data Collection

We interviewed 35 key informants face-to-face using a pretested semi-structured questionnaire. The key informants were surveillance-related NTP personnel, focal persons of partner organizations, medical officers, public health nurses, district coordinators, laboratory personnel, and data entry officers. Interviews with three District Coordinators of Chittagong, Sylhet, and Rajshahi were conducted over the phone and by email using open-ended questions to assess their district's surveillance system. Meetings were held with staff from the surveillance sites and relevant NGO partners to evaluate the case identification process, sample collection process, sample storage, transportation procedure, and reporting system. Consent was obtained before starting each interview.

We randomly selected 10 out of 85 MDR-TB cases reported from the NIDCH and laboratory register books of the National Tuberculosis Reference Laboratory between January and April 2016. We also

received an aggregated dataset of MDR-TB cases from January 2008 to December 2015 from the NTP. We examined the drug-resistant tuberculosis (DR-TB) form 06 for patient ID and disease type; DR-TB form 05 for laboratory ID, sample collection date, and demographic history of patients, and DRTB 02 form for the unique register number, treatment outcome and radiological investigations. We matched all datasets and laboratory registers using the unique patient identification number to obtain demographic characteristics, date of sample collection, feedback result of sample test, and treatment outcomes. We also asked stakeholders to provide comments and recommendations about their surveillance system.

## Statistical Analysis

Quantitative data were entered into a Microsoft Excel spreadsheet (version 2013). We checked the dataset for discordant data and resolved any discrepancies. We calculated frequencies and proportion for the institutes of respondents and study attributes and presented descriptively in the tables and figures.

## Results

We approached 35 staff from the four study sites and all agreed to be interviewed (Table 1). Among them, 46% were focal persons from different hospitals and organizations, 17% were lab technicians, 17% were public health nurses, 11% were data entry operators, and 9% were medical officers or consultants.

**Table 1. Respondent's institutions for evaluation of MDR-TB surveillance system, Bangladesh, 2016**

Serial no.	Institute	Number of respondents n (%)	Focal person n (%)	Medical officer n (%)	Nurse n (%)	Lab technician n (%)	Data entry operator n (%)
1	National TB Control Program Headquarters (NTP HQ)	11 (31)	7 (64)	2 (18)			2 (18)
2	National Institute of Diseases of the Chest and Hospital (NIDCH)	10 (29)	1 (10)	1 (10)	6 (60)		2 (20)
3	National TB Reference Laboratory (NTRL)	7 (20)	1 (14)			6 (86)	
4	Bangladesh Rural Advancement Committee	3 (8)	3 (100)				
5	Damien Foundation	1 (3)	1 (100)				
6	Challenge TB (US Agency for International Development)	1 (3)	1 (100)				
7	Bangladesh Institute of Research & Rehabilitation in Diabetes, Endocrine and Metabolic Disorders (BIRDEM) Hospital	1 (3)	1 (100)				
8	TB Hospital, Shyamoli	1 (3)	1 (100)				
<b>Total</b>		<b>35 (100)</b>	<b>16 (46)</b>	<b>3 (9)</b>	<b>6 (17)</b>	<b>6 (17)</b>	<b>3 (11)</b>

The percent in the 'number of respondents' column represents column percentage, while others percentage in other column represent row percentages.

## Simplicity

All NTP personnel, focal persons, and data entry operators reported that sample collection and transportation was easy and convenient. Simplicity was demonstrated by 76% of the data arriving at the NTP via a standard form. A coordination meeting among the eight stakeholders was held to simplify, coordinate, and streamline processes such as data and sample collection, logistics, and administration issues. However, 82% of the stakeholders sent data in a paper format, while 18% sent their data electronically (either format is acceptable).

## Timeliness

Seventy percent of GeneXpert results were reported between 2 and 3 days, which met the programmatic management of drug-resistant tuberculosis guidelines. Additionally, 60% of monthly and quarterly reports were received by the NTP within 7 days, which is the recommended timeframe for sending the reports (Table 2).

**Table 2. Timeliness of GeneXpert test reports and monthly and quarterly reports of MDR-TB surveillance system, Bangladesh, 2016**

	Duration (days)	Percentage <sup>†</sup>
<b>GeneXpert report received by patients</b>	2–3*	70
	6–10	20
	>10	10
<b>Monthly and quarterly reports received by NTP headquarters</b>	1–7*	60
	8–30	20
	>30	20

<sup>†</sup>Based on stakeholder's report. \*Recommended time.

NTP: National TB Control Program.

## Data Quality

Ten MDR-TB case records were randomly selected and checked for data quality. Tuberculosis disease type, treatment history, laboratory identification number, registration number, date samples were collected and received, and address of the referring health authority were 100% complete (Table 3). The variable with the lowest completeness was the patient's contact number. Stakeholders reported few duplicate cases and any identified duplicates were removed. Training for national and subnational staff conducting surveillance was routinely conducted by the NTP and 81% of respondents confirmed that training was provided to surveillance staff. A training logbook was cross-checked, revealing that three training sessions were conducted in each quarter. This aligned with the programmatic management of drug-resistant tuberculosis guideline.

**Table 3. Completeness of case record forms for selected variables of the MDR-TB surveillance system, Bangladesh, 2016**

Variable	Completeness (%)
Registration number	100
Patient ID	100
Disease type	100
Date of sample collection	100
Address of referring health authority	100
HIV status	90
Date GeneXpert report sent	90
Laboratory investigations	90
Demographic characteristics	84
Patient's contact number	60

## Stability

We assessed the stability of the surveillance system based on long-term financial support and involvement by partners. Among 34 partners (i.e., Global Fund to Fight Against AIDS, TB & Malaria and United States Agency for International Development), most (61%) stakeholders reported having long-term financial support.

## Flexibility

As the surveillance system is dependent on financial donations, expansion for new sites is difficult. This difficulty arises from the need to establish more laboratories equipped with a GeneXpert machine for MDR-TB testing. In addition, securing funding for additional staff and attracting qualified staff for surveillance activities pose challenges. Data are archived on a single desktop computer managed by one person, limiting flexibility because the computer is not connected to a network and access to the database must be through this desktop computer only.

## Usefulness

Data from the MDR-TB surveillance system was used to monitor program-based activities. The data described the burden of MDR-TB by reporting the age group with the highest prevalence and trends in mortality and morbidity. In Bangladesh, 0.7% of new cases and 11% of previously treated cases were treated with the second line anti-TB drugs. According to Bangladesh TB report 2017, the treatment success and death rates of MDR-TB were 74.3% and 10.3%, respectively.<sup>6</sup> Based on these statistics, policy makers could take initiatives to reduce MDR-TB infection transmission and treatment costs. For example, the data facilitated and targeted distribution of medicines to areas with a higher prevalence of MDR-TB. Moreover, they could identify training needs for physicians and resources needed.

## Discussion

The MDR-TB surveillance system was useful for prevention and control tuberculosis in Bangladesh. Despite MDR-TB not being a notifiable disease and having no formal surveillance system in Bangladesh, the MDR-TB surveillance system became part of the tuberculosis surveillance system. Utilizing sentinel hospitals to monitor the disease, the system demonstrated good data quality with minimal missing values and duplicate records. Data were timely reported for proper strategic preventive and control actions. For example, the NTP surveillance identified people with MDR-TB, allowing for prompt isolation and treatment in hospitals. In addition, MDR-TB patients could be monitored to ensure that they continue their treatment. Moreover, the data informed the demand of NTP services, guiding drug provision and laboratory testing capabilities.

When the MDR-TB surveillance system in Bangladesh started, they used the World Health Organization definition for MDR-TB. A simple programmatic approach for the MDR-TB surveillance case definition played an essential role for case detection by using a standard format from the central office through assigned focal persons, much like an umbrella scheme. This is an advantage because standard reporting made data easy to analyze, centralized reporting allowed automatically collating of data from all sentinel sites, and thus stakeholders could obtain complete and updated information on the MDR-TB situation.

Almost all the variables in the MDR-TB reporting form were complete. A few gaps in exposure and demographic variables did not present a problem for describing the burden or providing adequate MDR-TB treatment. Stakeholders mentioned that approximately 1% of patient data was duplicated, but we could not verify this number. Monthly and quarterly reporting was timely for most of the sentinel sites. This assists with timely policy making, allocation of resources, and treatment of patients.

We compared our study favorably with the two publications that used the U.S. CDC guidelines to evaluate the MDR-TB surveillance.<sup>8,9</sup> Both studies concluded that the system was useful, and its quality was good. Further, the authors concluded that private doctors needed to be sensitized about MDR-TB in order to increase public and private collaboration. As in our study, these studies did not assess quantitative attributes such as sensitivity and specificity. These limitations are similar with a study from Yemen.<sup>8</sup> In our study, we did not specifically compare the involvement between public and private sectors in the

surveillance. This is a disadvantage because some private hospitals in Bangladesh do not report MDR-TB cases. However, studies from Yemen and Pakistan reported on the both public and private reporting of MDR-TB cases. We also could not compare different tuberculosis reporting systems within the same country as was done in a study from Thailand.<sup>10</sup>

## Limitations

Our study had the following limitations. Time constraints did not allow us to have detailed discussions with NTP staff. We also could not visit all surveillance sites. However, we did use direct observations and conducted intensive meetings with stakeholders.

## Conclusion

The MDR-TB surveillance system provided useful data that described the burden of disease, monitored trends, and evaluated program demands for resources in order to manage MDR-TB patients. However, concerns remain about the flexibility and stability of the program.

## Recommendations

Given these operating conditions, we recommend that the hospitals should use a single electronic platform such as the district health information system used throughout Bangladesh. In addition, each patient should have a unique identification to decrease the number of duplicates. There is a need to improve timeliness, data quality, and overall coordination among the NTP. Increasing the number of MDR-TB surveillance sites to cover the whole country would exhibit the true burden of disease.

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## Conflict of Interest

There was no conflict of interest.

## Suggested Citation

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