

Assessment of the status of tuberculosis infection control measures in public and private tertiary care hospitals and specialized chest diseases hospitals, Bangladesh: Implementation of the National Guidelines for Tuberculosis Infection Control

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Key Words

Tuberculosis Infection Control, Facility Assessment, National Tuberculosis Control Program (NTP), Health Care Worker (HCW), Ventilation, N95 respirator

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List of Acronyms

ACR	Annual Confidential Reports
ACSM	Advocacy, Communication and Social Mobilization
AFB	Acid-Fast Bacillus
CDC	Center for Diseases Control
CDH	Chest Disease Hospital
CPR	Clinical Prediction Rule
HCW	Health Care Worker
IC	Infection Control
JIMCH	Jahurul Islam Medical College Hospital
KII	Key Informant Interview
LTBI	Latent Tuberculosis Infection
MDR	Multi-Drug Resistant
MTLCH	Mymensingh TB & Leprosy Control Hospital
NIDCH	National Institute of Diseases of the Chest and Hospital
NTP	National Tuberculosis Control Program
NTRL	National Tuberculosis Reference Laboratory
PTB	Pulmonary Tuberculosis
PWD	Public Works Department
RMCH	Rajshahi Medical College Hospital
RTRL	Regional Tuberculosis Reference Laboratory
SBMCH	Sher-E-Bangla Medical College Hospital
TB	Tuberculosis
TB-IC	Tuberculosis Infection Control
UVGI	Ultra-Violate Germicidal Irradiation
USA	United States of America
WHO	World Health Organization

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Executive Summary

Transmission of tuberculosis (TB) from patients to health care workers is well documented. In middle- and lower-income countries, the estimated prevalence of latent tuberculosis infection among health care workers is 54%. The Bangladesh national TB infection control guideline has been developed in 2011. To date, there is limited or no published report on the implementation of the national TB infection control guidelines. To assist the National Tuberculosis Control Program (NTP) in strengthening their effort in implementation of the national TB infection control guidelines, it is important to understand the challenges and opportunities at the hospital levels in implementing the guidelines.

The objective of this study was to assess the status of infection control measures in public and private tertiary care hospitals and specialized chest diseases hospitals. We were focusing on assessment of the implementation of managerial activities, administrative controls, environmental controls and personal protective measures of TB infection control guidelines.

This was a descriptive study. We examined the facility level TB and infection control practices in the public and private tertiary care hospitals and specialized chest diseases hospitals from February 2018 to June 2018. We used the facility assessment tool recommended by national TB infection control guidelines. At each health facility, we collected data from general TB wards, MRD TB wards, adult medicine wards, emergency wards, waiting areas outside the X-ray rooms and outpatient areas. We completed structured assessment forms for each hospital/health facilities through observation. We recorded TB infection control practices, protective measures, ventilation, and availability of resources to reduce person to person/nosocomial TB transmission in the TB patient's areas. We also explored about infection control measures from wide range of hospital staff including hospital directors; heads of the TB wards, medicine wards, diagnostic unit, and nurses through key-informant interviews (KII).

Among the health facilities assessed, none of the health facilities had any tuberculosis infection control committee or body in place and TB infection control plan was also not available. There was no TB screening for health care workers existed in the facilities we examined. None of the interviewed healthcare workers received any training on TB infection control. There was no triage checklist found in any facilities. No separation of TB patients observed and reported in tertiary care hospitals. Usually, nurses provided counseling to TB patients on cough etiquette and

treatment compliance. All doctors and nurses were aware of N95 respirators use. None of them received any training on N95 respirator use and fit testing. Ultra-violet germicidal irradiation (UVGI) lights were available in most of the chest disease hospitals but almost half of them were non-functioning. Negative pressure ventilation through exhaust fans was available and functioning in three chest disease hospitals. All facilities had adequate ceiling fans in the wards. No risk allowances were available for doctors and nurses of tertiary care hospitals. However, the doctors and nurses of chest disease hospitals received BDT 250-450 per month as a risk allowance.

1. Background

Globally, tuberculosis (TB) is the leading infectious cause of death in human [1] caused by *Mycobacterium tubercle bacillus* [2]. In developing countries, counting Bangladesh; TB is the prime cause of morbidity and mortality [2]. In 2017, the total TB incidence cases were 364,000 and TB mortality rate was 36 cases per 100,000 population in Bangladesh [3].

Pulmonary TB (PTB) is an airborne disease; PTB patient expels droplet nuclei through coughs, sneezes, talks or spits, saliva; people can inhale these contaminated droplets [4]. TB transmission appeared to be high among the healthcare workers (HCWs) in the hospitals or facilities [5]. HCWs are at utmost risk as they have high level of direct contact with patients with infectious TB in the hospitals, which have limited or no implementation of infection control measures [6, 7]. A recent study identified that 54% of the health care workers are infected with latent tuberculosis infection (LTBI) in Bangladesh[8].

In the late 1980s and early 1990s, outbreaks of MDR-TB in hospitals in the United States of America (USA) and Europe motivated the international health agencies such as Centers for Disease Control and Prevention (CDC), USA and World Health Organization (WHO) to develop infection control healthcare measures focused on administrative, environmental and respiratory protection in the health facilities [9-11]. To reduce transmission, the WHO has developed a TB-Infection Control (TB-IC) policy in 2009 that includes managerial, administrative, environmental and personal protective measures and equipment [11]. The government of Bangladesh also adopted the TB-IC guidelines 2011-2015 as a part of health system strengthening [12].

According to national TB-IC guidelines, before actual implementation, a risk assessment should be performed in each facility to develop the facility infection control plan. The national TB-IC guideline consists of four themes for facility assessment:

- (i) managerial activities-to strengthen coordination for implementing appropriate TB-IC,
- (ii) administrative controls-to reduce the generation of aerosols and thereby the exposure to droplet nuclei,
- (iii) environmental controls-to reduce concentrations of infectious particles, and
- (iv) personal protective measures-to reduce inhalation of infectious particles.

This study aimed to assess the status of TB infection control measures and status of implementation of national TB infection control guideline in public and private tertiary care hospitals and specialized chest diseases hospitals in Bangladesh.

Objective of the study

To assess the current practices of tuberculosis infection control at selected public and private tertiary care hospitals and specialized chest diseases hospitals.

2. Methodology

This is a descriptive study using both qualitative and quantitative methods. The study team employed the following methodologies for data collection –

- Key informant interviews (KII) and
- Facility assessment tool

2.1 Study team

The team consisted of one medical doctor, two sociologists, one anthropologist, one medical technologist, and one physicist with several years of experience in public health research.

2.2 Study Sites

The team conducted this study in 11 health facilities, eight chest disease hospitals (seven government chest diseases hospitals, one non-government chest disease hospital (Specialized TB hospital) and three tertiary care hospitals (two government tertiary care teaching hospitals and one private tertiary care teaching hospital) of Bangladesh.

The hospitals are:

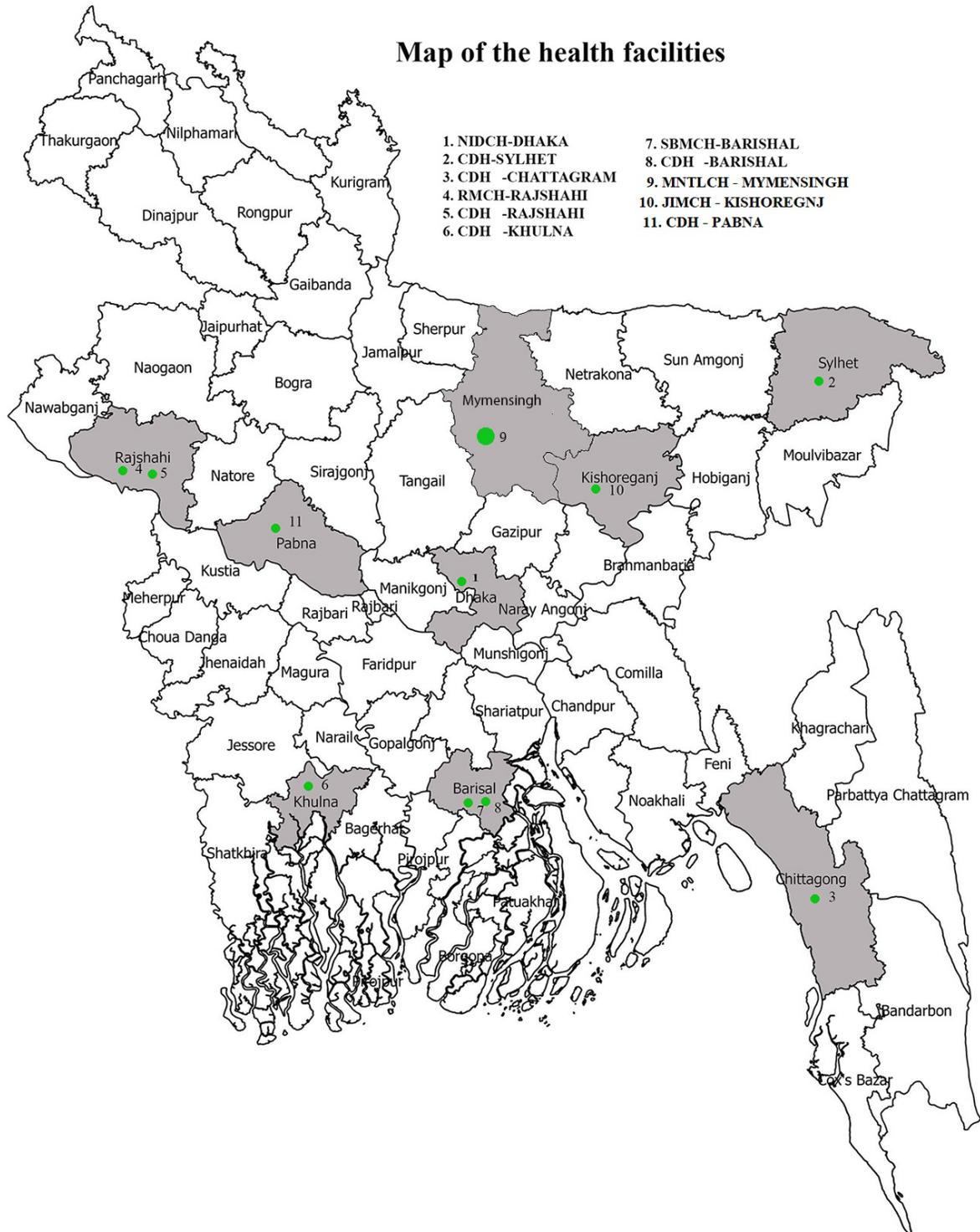
1. National Institute of Diseases of the Chest and Hospital (NIDCH), Dhaka
2. Chest Disease Hospital, Sylhet (CDH-Sylhet)
3. Chest Disease Hospital, Chattogram (CDH- Chattogram)
4. Rajshahi Medical College Hospital (RMCH), Rajshahi
5. Chest Disease Hospital, Rajshahi (CDH- Rajshahi)
6. Chest Disease Hospital, Khulna (CDH- Khulna)
7. Sher-E-Bangla Medical College Hospital (SBMCH), Barishal

8. Chest Disease Hospital, Barishal (CDH- Barishal)
9. Mymensingh TB & Leprosy Control Hospital (MTLCH), Mymensingh
10. Jahurul Islam Medical College Hospital (JIMCH), Kishoreganj
11. Chest Disease Hospital, Pabna (CDH- Pabna)

The tertiary care hospitals are the highest level in the division-level government hospitals, situated in the divisions. The tertiary care level private hospital was situated in the Upazila level. The chest diseases hospitals are situated both in division and district level, providing medical services mainly to patients who are critically ill with TB or with MDR-TB.

The map shows the 11 hospitals in Bangladesh, where we conducted the study.

Fig 1: Map of Study Hospitals



2.3 Study Design

This is a mixed method study. Data were collected from February 2018 to June 2018.

2.3.1 Study Population

We conducted a total of 59 key informant interviews (KII) with hospital management and health care providers. The preferable respondents were director of the hospitals, head of medicine departments, senior physicians, laboratory personnel and nursing supervisor (matron). Most of our selected respondents were from general TB ward, MDR TB ward, medicine wards, radiology department, pathology department, emergency ward and out-patient department. Numbers of interviews at each site were based on our data saturation. In addition to KII, each interviewer wrote down an impression note after each interview to document the observations. We observed the 11 facilities and documented data by using a facility assessment tool.

2.4 Data collection and analysis

To complete the structured facility assessment tool at the hospital facilities, we did informal observations at:

- General TB wards
- MDR TB wards
- Adult medicine wards
- Emergency wards
- Waiting-areas outside the X-ray rooms
- Outpatient department and
- DOTS corner.

We observed and recorded the infection control practices, protective measures, ventilation, and availability of resources to reduce nosocomial transmission in the wards. We also explored about different infection control measures from various types of hospital staff through KIIs. Data on infection control practices as part of facility assessment form of the selected health facilities were grouped under the four themes of TB-IC guideline (managerial, administrative, environmental and personal protective measures).

We transcribed the recorded KIIs in verbatim and reviewed impression notes prepared by the interviewers. The data analysis was conducted in two phases: interim analysis and after completion of all interviews.

- During interim analysis, the study investigator and one qualitative team member reviewed five KIIs. They discussed to identify the themes that were evolved from the data set and categorized those themes under the four broad sections of national TB-IC guideline. Then they prepared a draft code list. They coded the available interviews and prepared the summary of each code. Data were analyzed thematically, and any possible changes identified were incorporated into the interview guidelines. The revised guidelines were used to conduct the rest of the interviews.
- During the final analysis, the team followed the same methodology and process, and come up with a final code list. They coded all the interviews using the final code list.

Data collected in the facility assessment tool were organized based on the presence or absence of the mentioned protective measures. The facility data analyzed and summarized all together under the above mentioned broad four sections or themes.

2.5 Ethical issues

We sought informed written consent from all participants and interviews were conducted upon consent. For observation, we took verbal consent from the hospital authority.

3. Findings

A. Findings from Key Informant Interviews

Among the total 59 KIIs; 28 were with physicians, 11 were with nurses and 19 were with lab personnel and one with a project director. The KII participants' age ranges from 27 to 60 years, and 34 were male. The findings from analysis of KIIs are described below under four sections.

3.1 Implementation of the managerial activities

In all the study hospitals, we did not find any infection control coordinating body or responsible person in place. There was no facility-based surveillance system in place to detect TB among the concerned healthcare workers. Only one staff from National Tuberculosis Reference Laboratory (NTRL) received training on biosafety and biosecurity. But no interviewed staff reported receiving training focusing on TB infection control measures. Only, limited laboratory equipment monitoring activities were in place; however, none of the study hospitals did conduct any operational research on TB. There was no advocacy, communication and social mobilization available for healthcare workers in the participating hospitals.

3.1.1 Coordinating body in place

The national TB-IC guideline suggests a coordinating body or infection control team responsible for overseeing TB-IC activities at all levels of the health services [12]. Physicians of few hospitals (both tertiary care hospitals and chest disease hospitals) mentioned that they never received any verbal or written instruction to form a committee for TB infection control in the hospital. When asked about challenges to form an infection control committee, the respondents mentioned that they did not get a detailed plan, instructions, and budget from the respective authority of TB-IC.

One respondent (director of a hospital) stated,

“How would we do that? Doesn't it require money? Who will give me the money? (Indicating a tube light, he said) this light is fused as well as the switchboard is not working, it needs a socket and a switch to repair, where would I get the money to buy these?”

Respondents stated not having any clear instruction from the higher authority on how the TB infection control committee will work.

One respondent (consultant physician) mentioned,

“Instruction should come from higher authority, if ministry provides any instruction, the hospital authorities will work on it. The ministers, secretaries, directors should persuade on infection control, they are the main managers.”

3.1.2 Surveillance and assessment of TB among health care workers

According to national TB-IC guideline, there should be a disease notification system and surveillance system to report the number of healthcare workers in the facilities developed TB annually [12]. From the interviews, we found that none of the hospitals, whether the chest disease or tertiary care, had surveillance and assessment system for their HCWs. Only the non-government chest disease hospital mentioned they had conducted a sort of surveillance for HCWs three years ago. The physicians mentioned, lack of assigned persons and lack in proper guidelines were the barriers to run the surveillance and assessment. According to the respondents, staffs never received any information on the importance of disease notification system. One respondent reported, they had no surveillance system, no routine TB screening, if anyone complains, and then s/he could do the TB tests.

HCWs of chest disease hospitals required to perform their chest x-ray and sputum tests to submit their annual confidential reports (ACR). However, they usually fill-out the forms without performing the tests. One respondent (consultant physician) said,

“We do not go under any surveillance, even we do not perform any tests, we supposed to submit chest x-ray or sputum for our annual confidential reports, and still we do not go for those tests.”

3.1.3 TB infection control plan in place

None of the study respondents knew about any written plan on TB infection controls having in the facilities. We had not found any plan for infection control in any of the facilities. One respondent (senior physician) said,

“Each hospital should hold a TB program, and on that program, the hospital should instantly form an infection control committee. Who will be responsible for surveillance implementation and periodically inform the director about the activities? Director will send it to the central authority. If the chain could be established, every work will be done smoothly. But we haven't received any papers from the government yet.”

3.1.4 Staff trained in TB-IC

None of the staffs of study hospitals had any training on TB infection control. The HCW's mentioned they received training on MDR-TB treatment regimens. However, they never received any TB infection control training. One respondent (laboratory-in-charge) informed receiving training on biosafety and biosecurity and said,

“I haven't received any training by the name of infection control, but I received training on biosafety and biosecurity, where I learned how to deal with samples safely, and how to work in the biosafety cabinet safely.”

Another respondent (nurse-in-charge) said,

“I had never received any training on infection control, I never heard about this type of training. My colleagues working here for many years also never received any training on any infection control.”

3.1.5 Advocacy, communication and social mobilization (ACSM)

We did not find any advocacy, communication, and social mobilization taking place in the facilities assessed, which was recommended in the TB-IC guideline. The guideline requires developing TB-IC advocacy within national TB ACSM strategic framework, planning and engaging decision makers, developing the different sets of messages for target audiences, and adding TB-IC meeting agendas. Additionally, the guideline includes TB-IC in the formulation of policies and work plan. None of the facilities performed advocacy due to lack of assigned personnel as well as proper instructions.

3.1.6 Monitoring and evaluation conducted

As the responses from KIIs, neither the tertiary care hospitals nor the chest disease hospitals had any initiative in place to monitor and evaluate the infection control measures. The respondents also stated that they have never received any instructions to conduct monitoring and evaluation for TB infection control.

One respondent (senior physician) said,

“Our hospital only can do the most essential things. It is not possible to do all the things, the doctors remain busy with documentation, writing history, treatment, and finally discharge the patients. So, it is not possible for us to do more activities.”

He also recommended that the NTP should take the lead to initiate a TB infection control committee in each hospital. The committee will be responsible for surveillance, monitoring and reporting to the hospital director periodically. The director will send a letter to the central authority. If the chain could be established, then everything will work properly.

3.1.7 Operational Research

Research requires a budget, planning, and manpower. Only one of the facilities conducted any operation research on TB infection control. The non-government chest disease hospital mentioned about some research on TB treatment regimens. Almost all the respondents mentioned, they did not receive any budget or instructions to conduct operational research. One respondent (senior consultant) stated,

“It should be started by implementing NTP guideline, there should be an individual chapter or ministry could send letters to hospital directors to initiate this research activity.”

3.2 Implementation of the administrative controls

All the doctors said that they always try to maintain a triage; cohorting or isolation; they also mentioned that the nurses try to provide counseling on cough etiquette. According to the respondents' statement, none of the facilities could provide expedient service delivery. The HCWs received a minimum amount of risk allowances but no prevention and care package.

3.2.1 Triage:

In relation to TB, triage can be defined as a system for identifying TB suspects based on cough, used in fast-tracked TB diagnosis and further separation when necessary [12]. We found from the interviews, there was no triage checklist in any facilities; and no personnel was assigned for this. No reporting format was developed; there was no monitoring of suspects against outpatients and diagnosed sputum positive patients. The doctors from all facilities mentioned that they always try to maintain triage while attending the patients. This was a regular practice among them.

One respondent (tertiary care hospital's director) said,

“This is our routine practice and as a doctor, we judge, which patient will receive the treatment earlier, how intense the treatment should be and where the patient should go for.”

Another respondent (a physician from a CDH) said,

“Yes, we see the patients on a priority basis; we treat the serious patients first.”

3.2.2 Separation/ Isolation

Among the seven chest disease hospitals, four had dedicated TB out-patient waiting areas. The hospitals that lacked dedicated waiting areas for TB patients, infectious and non-infectious patients shared the common waiting area. We found the hospitals keeping sputum positive patients and MDR patients separately. All the hospitals lacked signs such as; ‘restricted areas’; any directional sign; or provide any hospital guide to assist people, and keep people away from restricted areas.

One respondent (senior consultant physician) said,

"Is it possible to separate patients? For example, we have accommodation for 120 patients in the hospital, 60 are sputum positive and 60 are sputum negative. Now if 10 patients become sputum negative from the positive patients, where I will accommodate them? I am bound to keep them with the positive patients."

In some interviews, we found few doctors perceiving that the positive room does not mean full of germs. As the room is well ventilated with lights and fans, germs may not stay in the room and nothing to fear of TB germs for a short duration stay.

One respondent (hospital director) said,

“Initially we send all admitted patients to the smear-positive room regardless of positive or negative for pulmonary TB. Then we do the tests of sputum AFB, and GeneXpert. If the patients were diagnosed as negative, we transferred them to the negative room.”

3.2.3 Cough etiquette

The TB-IC guideline recommends the facilities should develop messages on cough etiquette and provide face masks to MDR patients and provide information on how to use the face mask. The guideline also recommends providing a reminder to wear the mask and lowering the stigma of wearing masks among the patients.

Study participants, especially doctors from both tertiary care hospitals and chest disease hospitals mentioned, whenever they found any patient with cough, they suggested the patients to cover their mouth with a handkerchief or a napkin or a tissue. However, there was no supply of masks for patients in the study hospitals, but the non-government chest disease hospital provided face mask to their patients. Besides, the doctors added that the nurses usually provide instruction on cough etiquette to the patients.

One respondent (a physician from a tertiary care hospital) said,

“We usually do not provide any instruction on cough etiquette (to patients), if they cough in front of us, we instruct them to cover their mouth with a handkerchief or cloth.”

3.2.4 Expedient service delivery

None of the hospitals could provide expedient or proper service delivery. The specialized TB hospitals and tertiary level hospitals both lack resources or logistics and manpower for the expedient service delivery. The most frequently reported challenge was the high patient load that made it difficult to implement the recommended activities.

One respondent (a physician from a chest disease hospital) said,

“We cannot provide services beyond our capacities, we have some limitations, we have sufficient amount of medicines, but we lack oxygen, which is vital for TB patients.”

3.2.5 Prevention and care package for health care workers

None of the facilities developed a workplace policy regarding TB-IC. Almost all participating hospitals reported having no TB screening for healthcare workers. No health education on the sign and symptoms of TB was found to be conducted and there was no case notification system for TB among HCWs. The healthcare workers mentioned, they received an amount of BDT 250-450 as a risk allowance and all participants believed the amount was insufficient. One respondent (a physician from a chest disease hospital) said, risk allowance was 5% of their salary; BDT 315 per month meant nothing. The 5% was entitled in 1971 when the salary was BDT 750, now it should be raised to 30% of the salary. The physicians mentioned that they raised a demand to the government to increase the risk allowance; they did not receive any formal announcement yet. We came to know that, the staff worked in the TB sectors especially for MDR, applied to the Ministry of Finance to increase the risk allowances.

On the other hand, the doctors informed us that apart from the risk allowances they did not have any health care package. They also said that the HCWs could avail free check-up if anyone develops a symptom. He or she could do the free check-up, but it was not done regularly.

One respondent (physician) said,

“No, we did not receive any specific instructions for a regular health checkup, like in every six months or yearly.”

On the contrary, the doctors and nurses from tertiary care level hospitals informed that there was no allocation of risk allowance or any type of health care packages for them.

One respondent (nurse) said,

“We do not receive any package, any money; we have to pay our own money for treatment purpose.”

In Table-1, we showed the summary information on managerial and administrative control measures we found from the interviews with key informants.

Table 1: Distribution of managerial and administrative measures for Tuberculosis Infection Control (TB-IC) at 11 study hospitals in Bangladesh, February 2018 – June 2018

TB-IC measures	Measures reported	Reason for non-adherence
Managerial activities		
Coordinating body or responsible person in place	0	a. Need instructions from the ministry b. Lack of budget c. Need a comprehensive plan
TB infection control plan (written)	0	a. An infection control body required to formulate the plan b. Need instructions from the ministry c. Need a comprehensive plan
Surveillance among HCWs /Conduct of risk assessment in the facility	0	a. Lack of assigned manpower b. Need proper guidelines c. Need awareness
Training on infection control	0	a. Need instructions from higher authority of national level
Advocacy, communication and social mobilization	0	a. Lack of assigned manpower b. Need proper guidelines
Monitoring and evaluation	0	a. A chain of activity from a civil surgeon or director to central authority required to formulate monitoring and evaluation b. The workload of the HCWs-giving less emphasis on infection control
Operational research	0	a. Need instructions from the ministry b. Lack of budget c. Need a comprehensive plan
Administrative controls		
Triage	11	a. The physicians try to maintain triage but do not have triage checklist
Separation	8	a. Lack of dedicated waiting areas b. Patients overload
Cough etiquette-education	11	a. Nurses provide instructions
Expedient service delivery	0	a. Lack of resources and assigned manpower
Prevention care/ risk allowance for HCWs	7	a. The staff of chest disease hospitals received an amount as a risk allowance

3.3. Implementation of the environmental controls

The physicians from chest disease hospitalv said they had a very well natural ventilated in-patient ward in their hospitals. However, while we observed, we found mechanical ventilation only in few of these facilities. We also found that some of the facilities had functioning exhaust fans. On

the other hand, only half of the chest disease hospitals had functioning ultra-violet-germicidal irradiation (UVGI) lights and the tertiary care hospitals did not have any UVGI lights.

3.3.1 Natural and mechanical ventilation

All the doctors from the chest diseases hospitals said that they had very well natural ventilation system. The respondents explained that the chest disease hospitals should be made as a sanatorium. The place would be filled with fresh air, bigger room with adequate doors and windows for very good ventilation ensuring a healthy environment. All the chest disease hospitals were found as more or less well ventilated. The tertiary care level hospitals also took initiatives to ensure better ventilation.

One respondent (senior physician) said,

“Recently hospital authority is trying to replace the glass windows to tempered glass (Thai glass) windows. If so, then one part will remain closed another part will open, fresh air and lights may enter, cross ventilation will be improved.”

On the other hand, almost half of the chest disease hospitals had functioning exhaust fans. In one chest disease hospital, exhaust fans were never installed; rests of the three hospitals had exhaust fans but were non-functioning.

3.3.2 Fans

The study hospitals had adequate ceiling fans. However, the building and electric lines were old, and often lights and fans get fused. Repairing and replacement were reported as challenging and time-consuming.

One respondent (consultant physician) said,

“The Government public works department (PWD) is responsible for providing fans. We lack some fans, last year we raised a requisition for seven fans. The executive engineer said he would send the fans, we did not receive the fans yet, I do not know whether we will get it or not”.

3.3.3 Ultraviolet germicidal irradiation

The tertiary care hospitals did not have any UVGI lights, while all the chest disease hospitals had, in the MDR wards. However, our respondents reported that the hospitals’ authorities never

received any verbal or written instructions on UVGI use. One respondent (nurse) from a chest disease hospital said they preferred to put the light on for an hour every night. The nurses from another chest disease hospital mentioned putting on the UVGI light twice a day: in the morning and the evening for an hour each time.

One respondent (one physician of CDH) mentioned regarding the misuse of the UVGI that,

“No need to use the UVGI in the day time can be used at night. But in the MDR wards this light remains on for 24 hours, if the lights become out of order, there is no allocation of money to repair or purchase them”.

One respondent mentioned that they had UVGI became non-functioning almost a decade ago, another respondent (nurse of a CDH) said,

“Who will replace this? There is no such system.”

Half of the selected chest disease hospitals did not have any UVGI lights; two hospitals had non-functioning UVGIs. On the other hand, we did not find any UVGI lights in the tertiary care hospitals.

3.4. Personal protective measures

Participants from the chest disease hospitals reported that they had a supply of N95 respirators for healthcare workers but the supply should be increased. However, the tertiary care hospitals had no supply of N95 respirators available for the staff.

3.4.1 Respirators availability for staff

The tertiary care hospital’s HCWs did not use N95 respirators to attend patients as they had no supply. The CDHs had N95 respirator supply, but not always adequate for the requirements of the patient’s wards, the laboratory personnel had adequate supply of N95 respirator.

One respondent (director of one chest disease hospital) said,

“We have to indent for respirators, for example, if we place requirements for 1200 respirators, we receive 800.”

Moreover, the doctors from non-government chest disease hospital said that they tried to follow NTP's TB-IC (2011) in their hospital. TB-IC, 2011 edition stated that the laboratory personnel must wear N95 respirators before sputum processing and staining. But the doctors were not adherent to the respirators use.

Few respondents from tertiary care hospitals mentioned, they did not hear about the N95 respirators. Moreover, study team have not seen signs put up where high-risk areas are entered or any sign reminding staff to wear respirators when entering.

3.4.2 Fit testing and/or fit check

In the study facilities, we did not find any fit testing training on N95 respirator conducted. The HCWs said they never received any instruction on how to use N95 respirators. Among the interviewed physicians (28 physicians), five said that they did not even hear anything about N95 fit testing.

One respondent (senior physician) said,

“What is it? What does it mean? I have no idea about this”.

He also said, they used this N95 barely for handling respiratory cases, but never gone through fit test.

One respondent from the non-government chest disease hospital (management personnel) was aware that his staff wearing N95 respirator may not be well fitted. There is a chance of a hollow between respirators and nose, so it should be checked, and to him, fit test is a must. But they never received any training on the fit test and they had no facilities in their hospital to conduct the fit test.

Another respondent (senior consultant physician of a CDH) said that he knew about fit testing, but never did it, as it creates additional trouble. He mentioned,

“For fit testing, a glass jar is needed, and you must put your head inside the jar; if the glass vapors, then it did not work properly; is it possible to check like this? Who will obey this? Everyone will say, this is enough if we can wear this, but why fit testing is needed? In our country we have fit test theoretically, but not in reality.”

B. Findings from Facility Assessment:

Through the facility assessment, we measured the status of TB-IC practice and level of implementation of the national TB-IC guideline. We did the facility assessments under the four sections mentioned in the guideline.

The assessments were done at male medicine ward, female medicine ward, waiting-areas (radiology, out-patient department) and DOTS corners, in the selected 11 facilities. We did some structured observations; informal discussions and measured areas, free spaces, and ventilation. In area measurements; we measured the length, width, and height of the place and calculated the total volume of the area. We checked for the presence of fans (functioning /not- functioning), UVGI lights (functioning /not- functioning), number of doors and windows (including how many of them were open), number of ventilator in walls, number of exhaust fans (functioning /not-functioning), presence of air condition, open ventilation, etc. We observed for use of N95 respirator, surgical/cloth mask, use of gloves, cough etiquette etc.

The findings from the facility assessment are described below by four sections as per national TB-IC guideline:

3.5.1 Assessment of managerial activities

The result from our facility assessment tool shows that, there was no tuberculosis infection control committee or body in place and TB infection control plan was also not available. There was no TB screening for health care workers existed in the facilities while we examined. Administrative personnel monitors these facilities gave more emphasis to improve the treatment system rather than TB infection control.

3.5.2 Assessment of administrative controls: observation and informal discussions with facility staff

The triage system was not well maintained within these facilities during our observation. Pathologist and radiologist said that they maintained the patient's priority according to the severity of illness. Only CDHs have separate wards for TB cases and non-TB cases. In tertiary care teaching hospitals, there was no separation or isolation setting for presumptive pulmonary TB cases. The pathologists ensured that they maintain the practice of cough etiquette during

sputum induction, collection, processing, and examination, and did proper disposal of cup and sticks. CDHs burned the waste with kerosene oil by their staff. We came to know that one tertiary care teaching hospital dumped waste under the soil. We didn't find any expedient service delivery within the facilities. Only Government staffs of CDHs get risk allowance in between BDT 200-450 only. The staff of CDHs addressed that this allowance as nominal against the risk they possess.

3.5.3 Assessment of environmental controls: Observation and measurements

We found waiting areas were well ventilated (i.e. windows and doors opened when feasible) within all 11 facilities. In CDHs, sputum samples were collected in a well-ventilated clearly designated area-away from other people, preferably in outdoors. But sometimes we found presumptive TB cases produce sputum specimen in front of others. Rooms were naturally ventilated at all chest diseases hospitals. The public tertiary care hospitals had only natural ventilation system. The non-government tertiary hospital had few exhaust fans, four CDHs had exhaust fans and most of those were non-functioning. Most of the facilities had adequate ceiling fans in each department and four- fifth of the fans were functioning. Among eight CDHs, seven had presence of UVGI lights, only three CDHs had functioning UVGIs. Volume of the spaces and opening areas were combined with the air velocity to get the air changes per hour (ACH) in all measured areas (General TB wards, MDR TB wards, Adult medicine wards,- Emergency wards, Waiting-areas outside the X-ray rooms, Outpatient department, and DOTS corner). The ACH depends on the seasonality as air velocity changes and also it depends on the openings of the rooms. We examined the facilities in summer season.

For ventilation, the NTP guideline recommends a room with at least 12 ACH. We found most of the measured areas of the health care facilities were well ventilated. Ventilation in chest disease hospitals was a bit better than the tertiary care hospitals.

3.5.4 Assessment of personal protective measures: Observation

Only MDR-TB ward, GeneXpert Laboratory, TB reference laboratories - Regional Tuberculosis Reference Laboratory (RTRL) and National Tuberculosis Reference Laboratory (NTRL) and DOTs staffs used N-95 respirators. Nursing In-charge of above-mentioned departments stated that they had available N95 respirators in their facility provided by NTP. We found no staff got

training on proper fit testing on N95 respirator use among these selected 11 healthcare facilities in Bangladesh.

We demonstrated the facility assessment data in Table 2.

Table 2: Distribution of facility assessment of 11 study hospitals in Bangladesh based on observation, February 2018 – June 2018

Serial no. of facilities	Posters	Triage-observed	Triage-checklist	Cough etiquette	Segregation	Natural ventilation	Mechanical ventilation	N95 respirator		Patient with a surgical mask		Exhaust fan		UVGI	
								Availability of N95	HCWs with N95 use	Self-provided	Hospital provided	Functioning	Non-functioning	Functioning	Non-functioning
1	✓	✓	X	✓	✓	✓	✓	✓	✓	✓	X	6	0	9	3
2	X	X	X	✓	✓	✓	✓	✓	✓	X	X	0	8	3	4
3	X	X	X	✓	✓	✓	✓	✓	✓	✓	X	1	3	0	1
4	X	✓	X	✓	X	✓	X	X	X	X	X	0	0	0	0
5	X	X	X	✓	✓	✓	X	✓	✓	X	X	0	0	0	10
6	X	X	X	✓	✓	✓	✓	✓	✓	✓	X	3	1	8	0
7	✓	X	X	✓	X	✓	X	X	X	X	X	0	0	0	0
8	X	X	X	✓	✓	✓	X	✓	X	X	X	0	0	0	2
9	X	X	X	✓	✓	✓	✓	✓	✓	X	X	3	0	0	0
10	X	X	X	✓	X	✓	✓	✓	✓	X	X	0	3	0	0
11	✓	X	X	✓	✓	✓	✓	✓	✓	X	✓	10	0	2	3

4. Challenges reported

Most of the participants were not aware of the national TB-IC guidelines and therefore it was difficult to assess the status of its implementation.

5. Recommendations

Based on the findings of this explorative study, we are suggesting the following recommendations to enable the health system for better implementation of TB-IC guideline.

- The national TB-IC guidelines should be introduced in all health facilities who deal with TB cases through participatory approaches. The hierarchy of TB-IC measures should be discussed, and suggestion can be sought to implement the guidelines using the available resources in the hospitals. In tertiary care general hospitals, the PTB patients can be cohorted or isolated in a corner of the ward where higher dilution of air can be achieved with cross ventilation.
- Facilities should seek clear instructions on TB-IC guidelines.
- Clinical prediction rule (CPR) for presumptive TB cases can be developed and followed for the identification of TB cases, which can be used by installing the software in a tab. The tab-based CPR will help in rapid identification of TB.
- Regular intense monitoring at facilities by the infection control co-coordinating bodies can be maintained for triage and segregation of TB patients.
- Annual screening of healthcare workers for TB should be initiated.
- Fit testing for N95 respirator can be done annually.
- A diseases surveillance system in the facilities can be initiated.
- Patient's awareness building can be initiated at the facilities.
- TB awareness program can be performed in the communities, schools and at all level of health care facilities.
- Facilities can maintain the tuberculosis infection control training database and arrange regular refresher training for the health care workers.

6. Conclusion

There was a little initiative to introduce the national TB-IC guidelines among the hospitals and healthcare workers. There is willingness but lack of funding, workforce, supervision and strong legislation. The health facilities are giving more emphasis to improve the TB patient management system rather than the prevention through infection control. The Ministry of Health and Family Welfare (MOHFW) through NTP may improve the TB-IC practices by addressing the scope of improvements.

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