National Guidelines for Tuberculosis Infection Control

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Country Office for Bangladesh

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National Guidelines for Tuberculosis Infection Control

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National Tuberculosis Control Programme
Directorate General of Health Services
Ministry of Health and Family Welfare
Dhaka, Bangladesh

Preface

The Government of Bangladesh has given high priority to TB control. TB control services are available throughout the country and the National TB Control Programme has achieved about 92% treatment success and 70.4% case notification through joint effort of GoB and development partners. Now the challenges are to sustain these achievements, maintain the quality of services and look into special areas like MDR-TB, TB-HIV co-infection, and Infection control.

While Bangladesh has a good DOTS program in place but there is no Infection control guideline for tuberculosis control in the country. Without guidance and policy maintaining control over the transmission of the disease is difficult. It is essential for countries to include TB-IC in their national infection control policies as part of health system strengthening.

Specific measures need to be taken within TB control programme to address the problem of infection control through developing appropriate guideline and by adopting the strategies to prevent the propagation and dissemination of the TB, including MDR-TB.

The development of the TB Infection Control Guideline is a timely and appreciable step taken by the National TB Control Program to address the issue of infection control for maintaining sustained success in TB control program in the country.

This guideline will provide information and guidance to health care professionals at different level of health care system, patients and general population and will act as an infection control framework from which other programs will also be benefitted.

I recommend this guideline for intensive use in implementation of core interventions in National TB Control Program. In conclusion, I congratulate all those who have contributed in preparing this guideline.

Md. Humayun Kabir
Secretary
Ministry of Health and Family Welfare
Bangladesh secretariat, Dhaka

Message

Tuberculosis is one of the major public health challenges in Bangladesh. Bangladesh has a good DOTS program in place and the coverage is GO-administratively hundred percent. The most cost effective public health measure for control of tuberculosis is effective identification and cure of infectious TB patients.

Transmission of TB is a recognized risk in health care facilities and communities, especially in resource limited settings where transmission is facilitated by inadequate infection control measures. For this, the World Health Organization (WHO) recommended TB Infection control as one of the important subcomponents of "Stop TB Strategy"

This TB Infection Control guideline describes important measures of preventing transmission of tuberculosis. Tuberculosis infection control interventions are though TB specific but eventually it helps strengthening health systems by controlling other infection diseases in health care settings.

I sincerely thank and appreciate the initiative of developing this TB infection control guideline and believe that National TB control program will be benefited by this initiative. I would also like to express my sincere thanks to WHO and URC for providing technical support to preparing this document.

10/08/11

Prof. Dr Khondhaker MD. Shefyet Ullah
Director-General
Directorate General of Health Services
Ministry of Health and Family Welfare

Acknowledgement

Tuberculosis remains a major public health problem in Bangladesh. Though the country has achieved commendable success in Tuberculosis control, yet this success may deem out unless effective TB control measures are taken based on strong general infection control for the diseases.

Early case detection remains one of the most important interventions for reducing the risk of TB transmission. TB Infection control measures describe the importance of early identification of TB cases and adherence to treatment to reduce the risk of emergence of multi drug resistant TB.

TB Infection control is a sub-component of the WHO's updated "Stop TB Strategy" that the Government of Bangladesh has adopted for the National TB Control Program. Infection prevention & control in general is multi-disciplinary. The interventions, even those that are TB specific eventually strengthen the health systems because they Dr.aw from different areas of expertise in design and implementation and improve collaboration between disciplines.

This TB Infection Control guideline emphasises the measures that reduce the risk of transmitting tuberculosis to managers, health care workers, patients, visitors and other persons in the health care facilities and households. It focuses on the safety of health care workers and reduction of patient-to-patient transmission. TB infection control interventions garners social support for decreasing TB transmission in the community. It helps to contribute sustainable changes towards healthy behaviour.

On behalf of MBDC Directorate, I express my sincere thanks to the working team of NTP, WHO, URC and other partners and stakeholders who contributed much for developing this Guidelines

Dr. Motiuddin Ahmed
Director MBDC and Line Director TB-Leprosy
DGHS, Mohakhali, Dhaka

Foreword

TB infection control is a combination of measures aimed at minimizing the risk of TB transmission within populations. It requires and complements the implementation of core interventions in TB and HIV control and strengthening of health systems.

TB infection control is a component of the WHO's revised Stop TB strategy, contributing to strengthening of health systems. It is one element of the 12 collaborative activities for control of TB and HIV recommended by WHO and also a component of the WHO's three I's for HIV/TB that includes isoniazid preventive therapy and intensified case finding to contribute to the universal access to HIV prevention, treatment and care.

Tuberculosis still poses an enormous public health problem in many parts of the world, particularly in low-income countries. In Bangladesh, the emergence of multidrug resistant TB (MDR-TB) and extremely drug resistant TB (XDR-TB) and association of HIV are considered to be an important threat for TB control, which increase the need to urgently give appropriate attention to implementation of TB infection control interventions and to prioritization of such interventions.

This guideline is a timely step for appropriate management of Tuberculosis Control and focuses on providing guidance on TB infection control in health-care settings of Bangladesh, because people working in such settings have a higher incidence of TB than does the general population.

I trust this guideline will strengthen the capacity of the national TB Control Program in implementation of adequate TB Infection Control measures.

Dr. Arun Bhadra Thapa
WHO Representative to Bangladesh, a.i.

Abbreviations

ACH	Air Changes per Hour
ACSM	Advocacy, Communication and Social Mobilization
AFB	Acid Fast Bacilli
ART	Anti Retroviral Therapy
BCG	Bacille Calmette Guerin
CDC	Chest Disease Clinic
CDH	Chest Disease Hospital
CPT	Co-trimoxazole Preventive Therapy
CS	Civil Surgeon
DGHS	Directorate General of Health Services
DOT	Directly Observed Therapy
DOTS	Directly Observed Treatment, Short course
DPM	Deputy Programme Manager
DST	Drug Susceptibility Testing
HCW	Health Care Worker
HEPA	High Efficiency Particulate Air
HIV	Human Immunodeficiency Virus
HRD	Human Resource Development
IC	Infection Control
ICF	Intensified Case Finding
IDU	Injecting Drug User
IEC	Information, Education and Communication
ILO	International Labour Organization
IPT	Isoniazid Preventive Therapy
LTBI	Latent Tuberculosis Infection
MDR-TB	Multi-Drug Resistant TB
MoH&FW	Ministry of Health and Family Welfare
NASP	National AIDS and STD Programme
NGO	Non Governmental Organisation
NIDCH	National Institute of Diseases of the Chest and Hospital
NTP	National Tuberculosis Control Programme
OPD	Outpatient department
PLHIV	People Living with HIV
SOP	Standard Operating Procedure
SS	Sputum Smear
TB	Tuberculosis
TB-IC	TB Infection Control
TLCA	TB & Leprosy Control Assistant
UH&FPO	Upazilla Health and Family Planning Officer
UV-C	Ultra Violet-C
UVGI	Ultra Violet Germicidal Irradiation
VCT	Voluntary Counselling and Testing
WHO	World Health Organization
XDR-TB	Extensively Drug Resistant TB

Contents

I. INTRODUCTION

TB Infection Control (TB-IC) is a combination of measures aimed at minimizing the risk of TB transmission within populations. It is a sub-component of the WHO's updated "Stop TB Strategy" and is one element of the WHO's 12 collaborative activities for TB/HIV. It is also part of the WHO's "Three I's for HIV/TB" that also includes Isoniazid Preventive Therapy (IPT) and Intensified Case Finding (ICF). TB-IC both requires and complements the implementation of core activities in TB, HIV and health systems. Thus, it is essential for countries to include TB-IC in their national infection control policies as part of health system strengthening.

TB-IC practices are not uniform nor stringently followed in hospitals, TB treatment centers, TB laboratories, and microscopy centers. Indeed, Guidelines to reduce TB transmission have been described in brief in the TB related National Guidelines and Operational Manuals, recently published by NTP, DGHS. However the Infection Prevention Practices: Standards and Guidelines (Third Edition, 2006), published by DGHS, MoH&FW, only covers Standard Precautions.

Airborne (droplet nuclei) precautions against transmission of TB infection among patients, health care workers and general population need to be scaled up. TB-IC measures should be addressed in more detail, guided by the latest international policy published by WHO in 2009, and accompanied by training of health care workers on TB-IC practices, standard operating procedures at facility level, and education of patients and communities. The National Tuberculosis Control Programme (NTP) has recognized this need and is developing TB-IC specific interventions for the next strategic planning period 2011 - 2015.

As Drug-resistant tuberculosis and TB/HIV are growing concerns, infection control has to be properly addressed. The TB prevalence rate is 426 per 100,000 (all cases), the TB incidence rate (all cases) is 225 per 100,000 (2009). Although the rates of MDR.-TB in Bangladesh do not appear high, the absolute number may be high considering the high TB burden in the general population. A MDR.-TB rate among new cases of 1% translates into approximately 3000 new MDR.-TB cases per year. The Global Tuberculosis Report (2010) estimated MDR.-TB rates of 2.2 % and 15% among new and previously treated TB cases, respectively in Bangladesh.

Bangladesh is a low HIV prevalence country. HIV prevalence amongst the most vulnerable populations is still below 1% (0.9). The first HIV patient in Bangladesh was diagnosed in 1989. Since then, about 2088 patients were detected. So far AIDS claimed about 241 lives in the country (NASP 2010). Due to several risk factors present in the country e.g., injecting Drug users, cross-border traffic, HIV may increase to epidemic levels in the coming years. Although the proportion of HIV positives among TB patients is found as low as 0.1% in three (limited) surveys, the high prevalence of TB infection (approximately 50% of the adult population) and the increasing HIV incidence among injecting Drug users (IDUs) to 7% ('concentrated epidemic') is crucial for strengthening TB/HIV collaboration and coordination

Health care workers are at increased risk of TB infection and disease compared to the general population. Currently, there are no national data or estimates of occupational TB risk for staff of

TB services and primary health care, but reviews in low and middle income countries mirror earlier studies in documenting an increased risk of TB. Non-medical staffs in health care settings are also at risk, where undiagnosed pulmonary TB patients with cough are presenting the risk of TB infection to close contacts and health care workers. Crowding and poorly ventilated enclosed environments increase this risk. Waiting rooms and corridors where patients wait to receive medical care are often areas of particular risk. Laboratories, particularly those carrying out *M. tuberculosis* culture procedures, are also high risk areas.

The importance of access to high quality, readily available TB diagnostic services when implementing TB-IC practices cannot be overstated. A fundamental paradigm of good TB-IC is to suspect and screen patients for TB, to separate potentially infectious patients, to diagnose TB rapidly, and thereby eliminating the source of infection. Strengthening TB diagnostic procedures: laboratory services and chest X-ray should be considered as key components in all TB-IC plans.

This guidelines describe the measures that reduce the risk of transmitting tuberculosis to managers, health care workers, patients, volunteers, visitors and other persons in the health care facilities, communities, prisons and households. It focuses on the safety of health care workers and reduction of patient-to-patient transmission. It also addresses concerns posed by the increasing drug resistant TB and immune-compromised patients. Infection prevention & control is multi-disciplinary. The interventions, even those that are TB specific eventually strengthen the health systems because they draw from different areas of expertise in design and implementation and improve collaboration between disciplines.

The interventions apply to health care facilities where TB patients, or their sputum or culture materials are handled or kept, for example DOT centers, Chest Disease Clinics (CDCs) and Chest Disease Hospitals (CDHs), MDR-TB management sites and TB culture and DST laboratories and smear microscopy centers. For the actual implementation from national level to smear microscopy center and community level, the MoH&FW, NTP and its implementing partners need to confirm if the combination of the recommended interventions described in *Annex-1* apply to these specified service delivery levels of the health system taking into consideration the structure of the health system, socio-economic circumstances, availability of resources, climate conditions, and opportunities for linkage with other programs and activities for each level. Ideally, actions and responsibilities of staff should be described in guidelines at facility level with TORs for different cares of staff to ensure and sustain the implementation process.

Definition of the service delivery level-specific interventions and actions as well as description of responsibilities and tasks for specified cares at these levels does not have to stand in the way of starting to implement interventions; in particular those that are key, simple, not costly and immediately doable after receiving training in TB-IC. However, prior to actual implementation, a risk assessment should be performed in each facility to develop the facility IC plan. Risk assessments have to be repeated to evaluate the impact of implementation and redefine priorities for a next planning period.

In October 2009 a core group and a review group were formed to developing a draft guidelines in TB-IC with technical assistance from Dr. Max Meis, International Consultant, TB CAP/KNCV. In July 2011, a new core and review group finalized the guidelines through a workshop.

II. GOAL AND OBJECTIVES OF TB INFECTION CONTROL

The goal of TB-IC measures, in conformity with the definition of TB-IC, is to reduce transmission of TB in health facilities, congregate settings and households (in particular of MDR-TB).

The objectives that have to be achieved are the following:

1. To strengthen coordination for implementing appropriate TB-IC.
2. To reduce the generation of aerosols and thereby the exposure to droplet nuclei.
3. To reduce concentrations of infectious particles
4. To reduce inhalation of infectious particles.

The set of interventions that will lead to achieving the objectives are categorized according to the objectives:
1. Managerial activities
2. Administrative controls
3. Environmental controls
4. Personal protective measures

There is no doubt that the implementation of a proper combination of control measures specified for each service delivery level and setting will lead to reaching the above objectives and goal. Moreover when recommended control measures and a risk assessment at each location together inform the development of location-specific TB-IC plans.

III. PATHOGENESIS AND TRANSMISSION OF TB

The following is a brief overview of important facts to understand the risk of (nosocomial) transmission of TB:

- Airborne particles, also called Droplet nuclei, carry *M. tuberculosis*. Droplet nuclei are generated when people suffering from pulmonary or laryngeal tuberculosis sneeze, cough, laugh or sing. TB spreads from Infectious Droplet nuclei are approximately 1-5 micrometers in diameter, and normal air currents can keep them suspended and airborne for hours (4 - 24 hours).
- Person-to-person.
- Infection, which is usually asymptomatic, occurs when a susceptible person inhales Droplet nuclei containing *M.tuberculosis* and the organisms reach the alveoli of the lungs.
- Once in the lungs, the organisms are taken up by the alveolar macrophages and may be contained or further spread throughout the body depending on the immune response.
- Disease, which is usually accompanied by focal and generalized symptoms, may develop soon after infection, but usually within 2-10 weeks after infection an immune response is generated that limits further multiplication and spread of the tubercle bacilli. However, when the initial defence mechanism fails, primary TB develops.
- Some of the bacilli may remain dormant and viable for many years: latent infection with *M.tuberculosis*.
- Persons with latent infection do not have symptoms of active TB and are not infectious.
- Infected people can develop active TB disease at any time. The risk of developing TB disease is high in the first few years following infection, and decreases over period of times. Infection may progress to TB disease due to various factors, the most important being the weakening of immune resistance, especially by HIV infection.

IV. TB INFECTION AND TB DISEASE

The following is a brief summary to understand the difference between TB infection and TB disease:

TB infection

- TB infection is the state of having a small number of *M.tuberculosis* bacteria in the body which are unable to grow due to control by the immune system. The bacteria are inactive, but remain alive in the body and can become active later. This condition is also referred to as latent TB infection (LTBI).

- TB infection does not cause a person to feel sick, and there are no symptoms or signs detected on medical evaluation.

- A tuberculin skin test is the main method used to diagnose TB infection. A positive result usually means that TB infection is present, but persons with HIV-associated immune suppression can have a false negative TB skin test even with TB infection. Also, persons who have received BCG vaccination may have a false positive skin test.

- Only one out of 10 people with TB infection and a normal immune system may develop TB disease in their lifetime. People with TB infection who become co-infected with HIV have approximately 5%-10% risk per year and 50% lifetime risk for developing active TB disease.

- Preventive treatment for TB infection with isoniazid can reduce the risk of developing TB disease, though the protective benefit only lasts about two years in persons with HIV infection.

TB disease

- Most TB disease occurs in the lungs. In persons with HIV infection, up to half of TB patients have disease in other parts of the body.

- A person with TB of the lungs usually has a productive cough which is sometimes blood stained.

- General symptoms of TB disease include fever, sweating at night, and loss of appetite, weight loss, and fatigue.

- With standard treatment TB disease can be cured, even in persons with HIV infection.

- Untreated TB is often fatal, especially in persons infected with HIV.

Factors which determine the likelihood of transmission

The probability that a person who is exposed to TB bacilli may become infected depends primarily on:

- The concentration of infectious droplet nuclei in the air, which is influenced by the number of organisms generated by the TB patient and the amount of ventilation in the area of exposure.
- The duration of exposure to the infectious droplet nuclei.
- The proximity to source of infectious droplet nuclei (also virulence of organism).
- The immune status of the exposed individual.

Host characteristics

The characteristics of people exposed to TB bacilli that may affect the risk for becoming infected are the following:

- Severe immune suppression due to HIV infection or intake of immunosuppressive drugs may increase the risk of TB infection and early TB disease following exposure.

- HIV is the strongest known risk factor for progression from TB infection to TB disease.
- Persons who use tobacco, alcohol may also be at increased risk of infection and disease.
- Persons with chronic diseases, for example malnutrition, diabetes and chronic diseases.

Features of TB patients that may enhance their ability to infect others

The probability that a TB patient is infectious depends on:

- Presence of the disease in the lungs (pulmonary TB), airways or larynx.
- Presence of cough or other forceful expiration.
- Presence of acid-fast bacilli (AFB) in the sputum.
- Failure of the patient to cover the mouth and nose when coughing or sneezing: poor cough etiquette.
- Patient who received inappropriate or short duration of chemotherapy not in line with the national guidelines .
- Undergoing procedures that can induce coughing or cause aerosolization of *M.tuberculosis* (e.g., sputum induction, bronchoscopy).

Environmental factors that enhance the likelihood of transmission

- Exposure in enclosed relatively small, poorly ventilated spaces.
- Inadequate ventilation to “clean” the environment through dilution or removal of infectious droplet nuclei .
- Re-circulation of air containing infectious droplet nuclei .

Risk factors for health care workers

- Work involves diagnosis and treatment of TB patients.
- Work involves cough-inducing procedures, for example sputum induction, intubation.
- Work in environments with limited or no infection control practices in place.
- Frequent and direct contact with (sputum or culture positive) TB patients.
- Duration of contact with (sputum or culture positive) TB patients.
- Frequent contact with (sputum or culture positive) TB patients who have not yet been started on treatment.
- HIV positive health care workers.

Infectiousness

In general, a person with TB of the lungs or larynx should be considered infectious until the patient: has had two consecutive negative sputum smears on two different days, with at least one morning specimen.

Patients with MDR-TB may respond to treatment more slowly and may remain smear - positive and culture-positive longer than new TB patients, thereby extending the period of time they may infect their contacts.

V. MEASURES TO REDUCE THE TRANSMISSION OF TB

Transmission of M. *tuberculosis* is a recognized risk in health facilities. The transmission could be to:

- Patients
- Visitors
- Health care workers

The magnitude of the risk varies considerably according to the following:

- The type of facility.
- The patient population served.
- The prevalence of TB in the community.
- The type of occupational health care .
- The department of the health facility where one works.
- The adherence to TB infection control measures.

The risk may be higher in areas where patients with TB are provided care before diagnosis and initiation of TB treatment (e.g., in clinic waiting areas, laboratories and OPD) or where diagnostic or treatment procedures that stimulate coughing are performed. The risk of TB transmission is also likely higher in the following settings:

- DOT centers.
- MDR-TB management locations.
- TB Culture and DST laboratories.
- Chest Disease Hospitals and Clinics.
- Smear microscopy centers.
- Congregate settings; for example prisons.
- VCT centers.
- Sites where TB and HIV services are co-located.

Personnel of the above listed facilities should be particularly alert to the need for preventing transmission of TB. The Ten Tips for Effective TB-IC without stigma' play a role in raising their awareness. See *Annex 2* .

Nosocomial transmission of *M. tuberculosis* has been associated with close contact with persons who have infectious TB and with the performance of certain aerosol generating procedures:

- Sputum induction
- Spirometry
- Bronchoscopy
- Endo-tracheal intubation and suctioning

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- Spirometry
- Bronchoscopy
- Endo-tracheal intubation and suctioning

- Surgical procedures on TB lesions.
- Pipetting and centrifuging TB culture specimens.
- Autopsy on corpses of TB patients.

Managerial activities

TB infection control requires action at national and subnational level to provide managerial direction, and at health facility level to implement TB infection control measures. The recommended set of activities for national and subnational TB infection control is necessary to facilitate implementation of TB infection control in health-care facilities, congregate settings and households**.**

1. Identify and strengthen a coordinating body for infection control

- At all levels of the health service there shall be a coordinating body or infection control team consisting of three to five members with a focal person responsible for overseeing TB infection control.
- The responsibilities must be formally assigned in the terms of reference of the body or in the job description of the focal person.

2. Adopt a national strategy and Guidelines including HR development

- Develop a comprehensive national infection control strategy, guidelines and policies.
- Disseminate the approved strategy to all concerned sites, institutions and personnel.
- Incorporate key points from the new strategy, guidelines and policies in relation to national guidelines and operational manuals, when due for revision.
- Develop standardized training curricula for in-service and refresher training on infection control.
- Establish a core group of staff from NTP and chest disease clinics as master trainers.
- Revise pre-service curricula in conformity with the standardized training curricula.
- Supervise staff regarding basic TB-IC practices.
- Include core indicators regarding TB-IC practices in the TB supervision checklist.

3. Conduct assessments at all levels of health care and congregate settings

- Conduct a situational analysis of the current risk level and implementation of TB-IC in order to contribute to the development of the national infection control strategy.
- Use a standardized assessment tool to conduct facility level assessments. See *Annex 3*.
- Conduct facility level assessments in order to develop specific infection plans and guidelines relevant to the facility. See *Annex 4.*
- Analyze the findings and recommendations of the facility assessments and translate these into interventions of the facility work plans

4. Conduct comprehensive planning and budgeting

- Develop a country TB-IC action plan with activities that should be undertaken to implement the control measures.
- Cost activities, identify funds and communicate funding gaps with international partners to mobilize additional resources.
- Set timelines for the activities and monitor with simple indicators and realistic targets.
- Procure necessary equipment and supplies for TB infection control including UVGI fixtures, UV-C meters, vaneometers, smoke tubes, anemometers, respirators, fit test kits, and face masks for MDR -TB patients.

5. Ensure appropriate design, construction, renovation, use and maintenance

- Assemble a multidisciplinary team including an architect and civil engineer before the design phase of every construction / renovation project.
- Determine the use and utilisation of facilities and designated spaces, and assess the risk for nosocomial transmission of the facility and designated spaces; design and reorganize accordingly.
- If possible, allocate 8 square meters of space for each smear positive patient bed.
- If possible, construct buildings at least 4 meters apart to allow for adequate ventilation.
- Construct rooms with high ceilings (2.5 meters minimum). Spaces with upper room UVGI require ceilings of 3 meters high.
- Design buildings, spaces with openings in opposite walls transverse to the prevailing wind direction; place new building or select existing building for converting into TB ward/clinic in area where there is good cross breeze.
- Design sloping ceilings/roofs with open gaps at the highest points that allow for “stack” effect and will create a natural air flow as hot air rise. Use of wind driven turbines on the roofs are another way of increasing the ventilation.
- Construct open-air sheltered or half-open spaces with a roof to protect patients from sun and rain at waiting areas, sputum collection points, and day-time recreational areas.
- Separate staff areas from patient areas with additional doors in halls as needed and reallocate the different sections within the building.
- Consider large functional windows, large air vents and open fanlights, openings in doors; open high level air vents just under the ceiling can improve ventilation during the night without the effect of a cold breeze directly over the patients.
- Create multiple separate waiting areas for infectious patients; big waiting areas can be sub-divided for different groups of patients.
- Create ante rooms before entering high risk areas, i.e. isolation wards, laboratories.

- Construct showers and toilets that are well ventilated, especially as they are confined spaces used by many patients. Bricks with angulated holes will allow ventilation and privacy and a row of these in the wall at face level is recommended. Windows should be as large as possible. Opaque glass in louvers / shutters is another suggestion for the windows.
- (Re-) position furniture and seating within patient areas so as to allow for free airflow over desks and tables without affecting other patients and health workers.
- The above suggestions are more compelling for MDR-TB management centers.

6. Conduct surveillance of TB disease among health workers

- Adopt the indicator (nominator and denominator). See *Annex 5*.
- Develop a disease notification system.
- Educate staff on the importance of disease notification and reduce stigma.
- Evaluate the impact of control measures and if needed re-adjust interventions.

7. Address TB-IC issues for ACSM including engagement of the civil society

- Develop TB/airborne IC advocacy within the national TB-ACSM strategic framework and planning cycle.
- Engage decision makers and key stakeholders in TB-IC ACSM.
- Ensure adequate financial support for implementation of effective TB-IC measures.
- Develop different set of messages for different target audiences.
- Utilise existing communication channels to deliver messages.
- Identify TB-IC contacts to act as conduits for information and questions within relevant entities.
- Add TB/airborne IC on relevant meeting agendas.
- Include TB/airborne IC in the formulation of policies and work plans.

8. Monitor and evaluate the set of TB infection control measures

- Provide policy and decision makers with relevant information for the purposes of policy formulation, advocacy and program design.
- Define a set of core indicators for TB-IC that includes the TB global report indicators. See *Annex 6.*
- Revise the current monitoring forms to include data on TB-IC.
- Determine how data will be collected, compiled, reported and analyzed at national and sub-national levels.

9. Enable and conduct research

- Provide an evidence-base for effective TB-IC measures, particularly for recommended interventions where there is a knowledge gap of evidence.
- Identify collaborative research partnerships (national and international).
- Identify priority research.
- Obtain ethical clearance.
- Conduct research and disseminate results of research to key stakeholders.
- Utilize research results to guide policy development

Administrative controls

Administrative controls should be implemented as a first priority because that have been shown to reduce transmission of TB in health-care facilities. Such controls are a vital part of sound infection control practices, which require people with TB symptoms to be promptly identified, separated and treated. The physical separation of TB patients or people suspected of having TB requires rational design, construction or renovation, use and maintenance of buildings.

10. Promptly identify people with TB symptoms

- Develop and validate a triage checklist.
- Assign responsible persons for triaging.
- Develop a reporting form.
- Monitor the percentage of suspects against total outpatients and diagnosed sputum positive TB patients.

11. Separate infectious patients

- Identify or re-allocate space for separating (SS+) or isolating (X/MDR-TB) patients.
- Provide information to patients and visitors explaining the rationale for separation / isolation.
- Place clear signs e.g. restricted area, directional signage, where needed to inform patients and visitors.
- Provide hospital guide to assist the people: to give them directions and to keep people away from restricted areas.

12. Control the spread of pathogens

- Develop messages and IEC materials on cough etiquette. See *Annex 7.*
- Provide face masks for MDR -TB patients and educate how to use these.
- Remind and convince non-adhering patients to comply with the respiratory hygiene policy of the facility.
- Mitigate the negative consequences of stigma wearing face masks.

13. Minimize time spent in health facilities

- Further improve diagnostic services.
- Fast-track outpatients.
- Develop or review the standard and criteria for admission and waiting time.
- Further reduce turn-around-time and time until treatment was started.
- Introduce rapid diagnostics.
- Carry out investigations in parallel rather than in sequence.
- Use smear-negative algorithms.
- Manage waiting and consultation time to keep it as short as possible.
- Develop nuanced messages and IEC materials for communities and patients on the infection risks of (prolonged) stay in health facilities.

14. Provide TB/HIV prevention and care package for health care workers

- Develop a workplace policy regarding TB (and HIV) prevention and care for staff. See *Annex 8.*
- Educate staff on signs and symptoms of TB and encourage early care seeking.
- Provide periodic screening for staff at risk.
- Keep a screening register.
- Develop a notification system.

Environmental controls

Environmental control measures maximize dilution and air exchange and decontaminate air when adequate ventilation cannot be reached in high risk areas. In choosing a ventilation system (i.e. natural, mechanical, or mixed-mode), it is important to consider local conditions, such as building structure, climate, regulations, culture, cost and outdoor air quality. Any ventilation system must be monitored and maintained on a regular schedule. Maintenance facilities should be kept in hand. Adequate resources (budget and staffing) for maintenance are critical.

UVGI devices do not replace ventilation systems; rather, they should be considered as a complementary intervention. Several studies have shown that a well designed UVGI upper room system can disinfect mycobacteria or surrogate test organisms in a test room that is equal to 10–20 equivalent air changes. Upper UVGI devices are potentially hazardous if improperly designed or installed.

The use of room-air cleaners is not recommended in health facilities.

15. Use ventilation systems

- Procure equipment i.e. vaneometer, ventilation smoke tube kit, measure tape, anemometer (if applicable) to measure ACH. See *Annex 9 and 10*.
- Conduct (periodic) air exchange measurements and identify the areas in the facility with insufficient air exchange.
- Select areas in the facility where ventilation can be enhanced (mixed-mode). See *Annex 11*.
- Design the location and install mounted-fans, supply and exhaust grilles in identified high risk areas with insufficient air changes per hour. See *Annex 12*.
- Consider closed mechanical recirculation filtration systems only in well established settings with a constant power supply, where availability of trained maintenance staff is guaranteed and there is easy access to parts.
- Commission environmental engineers to design, select, install and maintain (mixed-mode) mechanical ventilation systems.
- Designate responsible staff to check ventilation equipment and moving parts of window frames according to a location specified rotating time schedule and repair deficiencies immediately.
- Develop a preventive maintenance and repairs program for ventilation devices and moving parts of windows.
- Designate responsible staff to check ventilation equipment and moving parts of window frames according to a specified time schedule.
- Keep repair and maintenance logs.

16. Use of upper room or shielded ultraviolet germicidal irradiation fixtures

- Require an uninterrupted power supply (or backup generator) and key switches to control the UVGI units separate from the general lighting systems.
- Commission the design and process inspected installation of the upper-room UVGI fixture. See *Annex 1 3.*
- Establish realistic performance and maintenance objectives during the design phase of the UVGI installation with regard to acceptable decline in emission, cleaning schedule, lamp replacement schedule, measuring lamp performance, maximum exposure.
- Develop a budgeted, location specific maintenance, cleaning and replacement program.
- Identify individuals who will maintain the system and obligate occupants/staff to communicate deficiencies.

- Replace lamps on a rotating schedule and focus cleaning efforts at intervals specific to location.
- Assess performance conducting regular UVC measurements.
- Keep cleaning, replacement and maintenance and performance assessment logs.

17. Establish appropriate laboratory biosafety measures

- Raise biosafety levels of reference laboratories performing (liquid) culture and drug - susceptibility testing.
- Commission the design and process inspected construction / renovation of negative pressure containment laboratories by international laboratory experts.
- Train laboratory staff on infection control measures through international training courses and regional exchange programs.
- Implement infection control measures at TB culture and DST laboratories and sputum microscopy centers.
- Procure laminar flow cabinets and biological safety cabinet Class II. See *Annex 14.*
- Commission the installation, servicing and replacement of HEPA filters by a certified agency.
- Keep service and replacement logs.
- Develop standard operating procedures to assure proper infection control measures including performance measurements of ventilated cabinets (with smoke tubes and air velocity meter), spillage, laboratory waste management, safe sputum collection and specimen transportation.
- Keep daily performance measurements logs.

Personal protective equipment

In addition to implementation of administrative and environmental controls, use of particulate respirators is recommended for health care workers when caring for patients or those suspected of having (infectious) drug-resistant tuberculosis. In particular, health care workers should use particulate respirators during high-risk aerosol-generating procedures associated with high risk of TB transmission (e.g. bronchoscopy, intubation, sputum induction procedures, aspiration of respiratory secretions, and autopsy or TB lung surgery. Visitors should also wear particulate respirators when in enclosed space with infectious cases.

Particulate respirators must meet or exceed the N-95 standards set by the United States Centers for Disease Control and Prevention/National Institute for Occupational Safety and Health (CDC/NIOSH) or the FFP2 standards that are CE certified.

Consider the risk of stigma that the use of particulate respirators may generate.

18. Use of particulate respirators

- Select and procure different makes, models and sizes of respirators, as well as respirator fit test kits.

- Determine eligible staff working in high risk facilities / areas i.e. MDR-TB rooms and homes, and TB culture and DST laboratories.
- Conduct (annual) respirator fit testing and medical evaluation. See *Annex 15, 16 and 17*
- Assign and train staff to conduct the fit tests.
- Keep personnel register on fit test results.
- Put up signs where high risk areas are entered, reminding staff to wear respirator when entering.
- Provide information to patients and staff why staff is wearing respirators and patients wear face masks.
- Keep respirators in safe clean and dry place for re-use purpose (1-2 weeks).

In *Annex 18* several examples of good and bad practice are depicted.

VI. CONGREGATE SETTINGS

TB is spread even more readily in these settings than in health care settings because of the longer duration of potential exposure, crowded environment, poor ventilation, and limited access to health care services. In Dhaka prison the case notification of smear-positive TB is almost five times the notification for the general population[1]. Statistics on tuberculosis among prison staff is not available, but the theoretical risk to acquire TB working in the prison cannot be denied..

Any health care facility (e.g. medical or infirmary) within a prison, offering services under NTP, should be considered as a TB care facility; therefore, the set of TB infection control measures should be implemented, as in any health care facility**.** In general, the objective should also be to apply managerial activities, administrative controls, environmental controls and personal protective equipment depending on the findings of a risk assessment of the entire setting. The urgency to implement TB-IC measures in congregate settings will have to be decided by the responsible authorities.

As a first step, involvement of policy makers responsible for congregate settings in the coordinating system for planning and implementing TB-IC interventions is recommended.

19. Intensify control measures in prisons and refugee camps

- All congregate settings in country surveillance activities and in facility assessments.
- Sensitize policy makers responsible for prisons and refugee camps and train their staff on TB-IC.
- Include a specific focus on all congregate settings regarding advocacy and IEC messages and materials, monitoring and evaluation activities and operational research.
- Strengthen interventions that secure early identification and cough etiquette through the services offered under NTP.
- Intensify TB screening of all new and transferred congregate dwellers.
- Diagnose people suspected of having TB as quickly as possible.

[1] Page 13 in Tuberculosis Control in Bangladesh, Annual Report 2008

- Separate people suspected of having TB and infectious patients always and, if possible, isolate them in an adequately ventilated area, until sputum conversion.
- Separate persons having or suspected of having drug resistant TB, from other inmates (including other TB patients), and refer for rapid diagnosis and proper treatment.
- Offer a TB screening and care package to congregate staff.

VII. HOUSEHOLDS

Various actions to reduce transmission at community level are necessary because household members and other close contacts of persons with infectious TB, in particular MDR-TB, are at risk of becoming infected with TB and consequently developing the disease. Whether a patient is treated on an ambulatory basis or admitted to a health facility appears to have little impact on household transmission, provided the patient is treated effectively.

Patients with drug resistant TB remain infectious for much longer, even if treatment is initiated. This may prolong the risk of transmission in the household**.**

MDR-TB increases the risk of morbidity and mortality, particularly in the presence of HIV co-infection. As in congregate settings, the objective should again be to apply managerial activities, administrative controls, environmental controls and personal protective equipment with an emphasis on early identification and initiation of treatment. Additional control measures should be implemented for the management of MDR-TB and HIV/MDR-TB patients at home**.**

20. Promote proper TB-IC in the household, before and after diagnosis

- Train community health care workers and community volunteers on TB-IC.
- Include basic infection control behaviour-change in any community information and education messages and IEC materials in particular on cough etiquette.
- Provide TB screening of all household members
- Conduct home visits of culture-positive MDR-TB patients and HIV/MDR-TB patients to assess homes on TB-IC (ventilation, cough etiquette, close contacts) and educate household members on TB-IC.
- Offer HIV screening to all household members of MDR-TB and HIV/MDR-TB patients.
- Reduce exposure in households of MDR-TB and HIV/MDR-TB patients. See *Annex 19.*

Glossary of Terms

The terms listed below have been defined or adapted for the purpose of this document.	
Air Changes per Hour	Under ideal conditions – in which droplet nuclei are evenly distributed and room air is uniformly mixed – the proportion of infectious particles eliminated with each air change or one "equivalent air change" is 63%. A second air change removes 63% of what remains, and so on. One air change has occurred when the volume of air entering or exiting a room is equal to the volume of the room. Subsequent increases in air changes leads to an exponential reduction in droplet nuclei.
Advocacy Communication and Social Mobilization	In this context, the aim of advocacy is to secure financial resources and change policies, Guidelines or procedures by influencing groups such as politicians, decision makers and journalists. The aim of communication is increase awareness, influence social norms, change behaviour (in individuals or subpopulations) and improve communication and counselling between people with TB, their families and providers. The aim of social mobilization is to change norms, improve services, expand community support and solve social problems, often by bringing groups together to act at the community level.
Adequately ventilated room	A room with at least 12 air changes per hour (ACH).
Aerosol	Liquid or solid particles dispersed in air, that are of fine enough particle size (0.01 to 100 micrometers) to remain airborne for a period of time
Airborne precautions	Precautions that apply to patients or suspects with airborne infections and are used in addition to Standard Precautions (see below); these include use of respirators by health workers, patient placement in a separated well-ventilated area and use of medical mask on patient for transportation outside patient's isolation area. These precautions are generic for all airborne infections but they also contribute to reduce the spread of TB.
Anemometer	A hot wire device that measures the air velocity commonly used in laboratories when testing the performance of a biological safety cabinet.
Biological Safety Cabinet Class I (BSC I)	Cabinet that protects the worker and the environment from exposure to an aerosol by drawing air into the cabinet, but provides no product (specimen/culture) protection. It is similar in air movement to a chemical fume hood or ventilated cabinet, but has a HEPA filter in the exhaust system to protect the environment. The exhaust air is either exhausted outside or re-circulated into the room. Also see Laboratory Fume Hood.
Biological Safety Cabinets Class II (BSC II, Types A, B1, B2, and B3)	Cabinet that protects the worker, the environment, and the product (specimen/culture) from exposure to an aerosol. Air flow is Dr.awn around the worker into the front grille of the cabinet, which provides worker protection. In addition, the downward laminar flow of HEPA-filtered air provides product (specimen/culture) protection by minimizing the chance of cross-contamination along the work surface of the cabinet. Because cabinet air exhaust is passed through a certified exhaust HEPA filter, it should be contaminant-free (environmental protection), and may be re-circulated back into the laboratory (Type A BSC) or exhausted out of the building (Type B BSC).
Community involvement	Community involvement in TB means the involvement of people with TB and their communities in the design, implementation, monitoring and evaluation of health promotion, TB preventive and curative services. Home-based care and community-based approaches for management of TB are part of community involvement in TB control.
Congregate settings	A mix of institutional settings where people live in close proximity to each other such as correctional facilities e.g. prisons, jails, homeless shelters, refugee camps, military barracks, dormitories and nursing homes. For the purpose of this document, health-care facilities are considered separately, even though these are settings where people congregate.
Control	Measures used to minimize the risk of spreading TB within populations.

Droplet nuclei	Airborne particles that carry Mycobacterium *tuberculosis*; droplet nuclei are generated after people who have pulmonary or laryngeal TB disease cough, sneeze, shout, or sing. The particles are approximately 1–5 m; n ormal a ir currents can keep them airborne for prolonged periods and spread them throughout a room or building. droplets are generally >5 m i n d iameter. droplets settle faster than a droplet nucleus and will not reach the alveoli.
Extensively Drug Resistant TB (XDR-TB)	XDR- TB is defined as resistance to at least rifampicin and isoniazid from among the first-line anti-TB Drugs (which is the definition of MDR- TB) in addition to resistance to any fluoroquinolones, and to at least one of three injectable second-line anti-TB Drugs used in TB treatment (capreomycin, kanamycin, and amikacin).
Fit testing	The use of a protocol to select the best fit of a respirator on a person
Health care facility	Any establishment that is engaged in direct patient care on site
Health care settings	Clinical context where health care is provided (e.g. hospital, outpatient clinic, home).
Health care workers	Health care workers are all people, in public and in private services, in the health sector and other sectors, whose main activities are aimed at enhancing health. They include the health service providers – for example doctors, nurses, pharmacists, laboratory technicians – and the health management and support workers for example financial officers, cooks, drivers and cleaners.
HEPA filter	Filter that provides a minimum removal efficiency of 99.97% of particles 0.3 micrometers in diameter.
Infection control assessment	An assessment of the implementation of managerial activities (including risk assessment), administrative controls, environmental controls, and respiratory protective equipment in a setting, in the context of local epidemiological, climatic and socioeconomic conditions .
Infectious case	Smear-positive cases are the most infectious and most likely to transmit TB. Smear-negative but culture- positive cases can also transmit TB.
Isolation room	Patient room (ideally single) where infectious TB patients should be isolated from other patients.
HIV prevalent settings	HIV-prevalent settings are defined as countries, sub-national administration units (e.g. districts, counties) or selected facilities (e.g. referral hospitals, Drug rehabilitation centres) where the adult HIV prevalence rate among pregnant women is more than or equal to 1% or HIV prevalence among tuberculosis patients is more than or equal to 5%.
Laboratory Fume Hood	A type of engineering control designed for purposes of worker protection (but not protection of the environment or the product [specimen/culture]. These devices are exhausted directly out-of-doors and are designed to minimize worker exposures. They may be used for sputa smears and other aerosol-generating procedures where product protection is not critical.
Measures	These include the set of managerial activities, administrative controls, environmental controls and personal protective equipment for TB infection control.
Mechanical ventilation	Mechanical ventilation is created by using a supply and/or an exhaust fan to force air exchange and to Dr.ive airflow. It works by generating negative or positive pressure in the room to Dr.ive air changes. To be effective, all doors and windows must be kept closed with controlled air leakage into or out of the room.
Mixed-mode ventilation	A ventilation system that combines the use of both mechanical and natural ventilation. It provides the opportunity to choose the most appropriate ventilation mode based on the circumstances.
Multi drug resistant TB	TB caused by strains of *M.tuberculosis*, which are resistant to both isoniazid and rifampicin with or without resistance to other drugs.
Natural Ventilation	Ventilation created by the use of external natural forces such as wind and temperature. Control of airflow direction cannot be achieved by simple natural ventilation and is dependent upon sufficient wind speed or direction, or temperature differential.

Negative pressure	Permits the control of the air-flow direction so the room with negative pressure has a lower pressure than adjacent areas, which keeps air from flowing out of the room and into adjacent rooms or areas. It is the relative air pressure difference between two areas in a health care facility.
Nosocomial transmission	An infection occurring in a patient in a hospital or other health facility in whom the infection was not present or incubating at the time of admission. This includes infections acquired in the hospital but appearing after discharge, and also occupational infections acquired by staff working at the facility.
Particulate respirators	Special type of closely-fitted mask with the capacity to filter particles to protect from inhaling infectious droplet nuclei. The N-95 respirator has filter efficiency level of 95% or greater against particulate aerosols free of oil when tested against 0.3 μm particles. The "N" denotes that the mask is not resistant to oil; the "95" refers to 95% filter efficiency. The FFP2 respirator has a filter efficiency level of 94% or greater against 0.4 ¼m particles and is tested against both an oil and a non-oil aerosol.
People suspected of having TB or people with TB symptoms	Any person who presents with symptoms or signs suggestive of TB.
Personal protective equipment	Personal protective equipment for eyes, face, head, and extremities, protective clothing, respiratory devices, and protective shields and barriers, which should be provided, used, and maintained in a sanitary and reliable condition wherever it is necessary by reason of hazards of processes or environment, biological hazards, chemical hazards, radiological hazards, or mechanical irritants encountered in a manner capable of causing injury or impairment in the function of any part of the body through absorption, inhalation or physical contact.
Public health principles	In this context and for the purpose of this policy, these are principles upon which a public health programme is based; they form the basis for the managerial activities that represent the core activities for the operationalisation of TB infection control measures.
Public health surveillance	The ongoing, systematic collection, analysis, interpretation and dissemination of data regarding a health-related event, for use in public health action to reduce morbidity and mortality, and to improve health. Data disseminated by a public health surveillance system can be used for taking immediate public health action, planning and evaluating programmes, and formulating research hypotheses.
Risk assessment	The risk assessment includes analysis, collection and review of surveillance data and in-depth facility description.
Separation	Placing patients infected or colonized with the same known pathogen in a designated unit (one that has the same space and staff), to which patients without the pathogens are not admitted.
Smoke tube	Device used to generate visible, non-hazardous smoke which can be used to monitor proper airflow direction and assist in assessing the proper function of ventilation systems.
Standard Precautions	The basic infection control precautions in health care that are intended to minimize spread of infection associated with patient's blood, body fluids, secretions and non-intact skin. Examples of such precautions include hand hygiene (possibly by hand rubbing with alcohol based formulations or hand washing using soaps and clean water), respiratory hygiene, cleaning and disinfection, waste management and – based on infection control assessment – use of personal protective equipment (e.g. gloves, facial protection, gowns).
Surgical or face mask	Cloth or paper mask that prevents the spread of micro-organisms from the wearer to others by capturing the large wet particles near the source (mouth); it may not provide protection from inhaling infectious droplet nuclei, such as *M. tuberculosis*
Triage (in relation to TB)	A system for identifying TB suspects based on cough, used in fast-tracked TB diagnosis and further separation when necessary.
UVGI	Radiation at 254 nm, produced within the UV-C region of the electromagnetic spectrum. UVGI prevents microbial replication by inactivating both bacterial and viral DNA. The most practical and effective application uses wall or ceiling-mounted UVGI fixtures to create a upper room air disinfection zone. Good mixing of air between the upper and lower room is required to allow effective disinfection of air in the lower part of the room where people breathe (the breathing zone).
Vaneometer	A device that measures the velocity of air with a moving replaceable vane inside. Commonly used during facility assessments to calculate the ACH.

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Annex 1. Recommended combination of interventions for specified situations (*to be confirmed by situational analysis*)

Service level	Managerial	Administrative	Environmental	Personal Protection
Chest Disease Hospital	TB-IC focal person[1]	Triage	Natural ventilation	N-95 or FFP2
	TB-IC risk (re-)assessment	Separate waiting areas	Mixed mode ventilation	Fit testing staff
	(Integrated)TB-IC plan incl. training	Separation rooms	UVGI if ACH < 12	
	ACSM plan incl. TB-IC	Cough etiquette Face masks		
	Monitoring and evaluation	Minimize time spent	Safe waste disposal	
		Periodic TB screening - staff		
Select recommended actions per location from guidelines based on risk assessment				

Service level	Managerial	Administrative	Environmental	Personal Protection
MDR-TB ward	TB-IC focal person	Separation and isolation rooms	Natural ventilation	N-95 or FFP2 staff
	TB-IC risk (re-)assessment	Visitors restrictions	Mixed mode ventilation	N-95 or FFP2 visitors when in indoors
	Monitoring and evaluation	Cough etiquette Face masks	UVGI if ACH < 12	Fit testing staff
	TB-IC plan including training	Minimize time spent	Safe waste disposal	
		Periodic TB screening - staff		
Select recommended actions per location from guidelines based on risk assessment				

Service level	Managerial	Administrative	Environmental	Personal Protection
Chest Disease Clinic (CDC)	Clinic In-charge	Separate (open space) sputum collection area	Natural ventilation	N-95 respirator for HCWs and Face mask for patient
	TB-IC risk (re-)assessment	Separate waiting area	Mixed mode ventilation	
	(Integrated)TB-IC plan incl. training	Cough etiquette Face masks	Safe waste disposal	
	ACSM plan incl. TB-IC	Minimize time spent		
	Monitoring and evaluation	Periodic TB screening - staff		
Select recommended actions per location from guidelines based on risk assessment				

[1] Selected by local authority

Service level	Managerial	Administrative	Environmental	Personal Protection
DOT center	UHFPO/ MO DC/ NGO representative	Separate (open space) sputum collection area	Natural ventilation	N-95 or FFP2 if ACH < 12
		Separate waiting area	Mixed mode ventilation	
		Cough etiquette Face masks		
		Minimize time spent	Safe waste disposal	
		Periodic TB screening - staff		
Select recommended actions per location from guidelines based on risk assessment				

Service level	Managerial	Administrative	Environmental	Personal Protection
VCT center	Center In-charge responsible	Triage	Natural ventilation	N-95 or FFP2 if ACH < 12
	TB-IC risk (re-)assessment	Fast tracking	Mixed mode ventilation	Fit testing staff
	(Integrated)TB-IC plan incl. training	Separate counselling hrs		
	ACSM plan incl. TB-IC	Cough etiquette Face masks		
	Monitoring and evaluation	Minimize time spent		
		Periodic TB screening - staff		
Select recommended actions per location from guidelines based on risk assessment				

Service level	Managerial	Administrative	Environmental	Personal Protection
Culture & DST Laboratory	Laboratory Coordinator	Separate (open space) sputum collection area	Mixed mode ventilation	N-95 or FFP2 when performing C/DST
	Bio risk (re-)assessment	Separate containments	Mechanical ventilation at least C/DST space	Fit testing staff
	(Integrated) Biosafety plan incl. training	Minimize time diagnosis	Biosafety cabinet Class II (certified[1])	
	Monitoring and evaluation	Periodic TB screening - staff	Laminar flow hood (certified)	
			Safe waste disposal	
Select recommended actions per location from guidelines based on risk assessment				

[1] Includes decontamination, HEPA filter performance testing and replacement, calibration and maintenance => certification by certified agent.

Service level	Managerial	Administrative	Environmental	Personal Protection
Sputum Microscopy laboratory	Medical technologist (lab) responsible	Separate (open space) sputum collection area	Natural ventilation	
	Bio-risk (re-)assessment	Minimize time diagnosis	Mixed mode ventilation (extractor fan)	
	(Integrated) Biosafety plan incl. training	Periodic TB screening - staff	Safe waste disposal	
	Monitoring and evaluation			
Select recommended actions per location from guidelines based on risk assessment				

Service level	Managerial	Administrative	Environmental	Personal Protection
Sputum Collection and Smearing center	TB-IC risk (re-)assessment	Well ventilated waiting area	Natural ventilation	
	(Integrated)TB-IC plan incl. training	Cough etiquette Face masks		
	ACSM plan incl. TB-IC	Minimize time diagnosis	Safe waste disposal	
	Monitoring and evaluation	Periodic TB screening - staff		
Select recommended actions per location from guidelines based on risk assessment				

Service level	Managerial	Administrative	Environmental	Personal Protection
District Hospital	TB-IC focal person[1]	Triage	Natural ventilation	
	TB-IC risk (re-)assessment	Fast tracking	Mixed mode ventilation	
	(Integrated)TB-IC plan incl. training	Separation rooms		
	ACSM plan incl. TB-IC	Minimize time spent	Safe waste disposal	
	Monitoring and evaluation	Symptomatic TB screening		
Select recommended actions per location from guidelines based on risk assessment				

[1] Superintendent/ Consultant/Medical officer

Service level	Managerial	Administrative	Environmental	Personal Protection
Upazilla Health Complex	UH&FPO responsible	Triage	Natural ventilation	
	TB-IC risk (re-)assessment	Separate (open space) sputum collection are	Mixed mode ventilation and Safe waste disposal	
	(Integrated)TB-IC plan incl. training	Separate waiting area (if possible)		
	ACSM plan incl. TB-IC	Cough etiquette Face masks		
	Monitoring and evaluation	Minimize time spent		
		Symptomatic TB screening		
Select recommended actions per location from guidelines based on risk assessment				

Service level	Managerial	Administrative	Environmental	Personal Protection
Prisons	In-charge medical services	TB screening new arrivals	Natural ventilation	
	TB-IC risk (re-)assessment	Separation TB patients	Mixed mode ventilation	
	TB-IC plan incl. training - staff	Cough etiquette Face masks		
	ACSM plan incl. TB-IC	Symptomatic TB screening - prisoners	Safe waste disposal	
	Surveillance	Symptomatic TB screening - staff		
Select recommended actions per location from guidelines based on risk assessment				

Service level	Managerial	Administrative	Environmental	Personal Protection
Households of MDR-TB patients	TLCA/CHCP/HA/FWA/ NGO worker	Separate beDr.oom if possible	Natural ventilation	N-95 or FFP2 when indoors for care giver and community health worker
	TB-IC risk assessments-homes	Restrict visiting crowded public events		
	(Integrated)TB-IC plan incl. training	Restrict visitors in the house		
		Cough etiquette Face masks	Safe waste disposal	
	ACSM plan incl. TB-IC	Periodic TB screening - staff		
		TB screening household		
Select recommended actions per location from guidelines based on risk assessment				

Annex 2. Ten Tips for Effective TB IC without Stigma

1. Include patients and community in advocacy campaigns;
2. Know your facility infection control plan;
3. Educate people about cough etiquette when coughing;
4. Screen patients to identify persons suspected of having TB for “fast track” or separation;
5. Provide prompt TB diagnosis and treatment;
6. Monitor infection control practices;
7. Wear a respirator when attending X/MDR -TB patients in enclosed spaces;
8. Educate staff and visitors about TB signs and symptoms and about good infection control practices;
9. Make sure that some windows at all times remain open, preferably high level air vents;
10. Separate TB suspects and TB patients, in particular sputum smear positive patients, from other patients, in particular HIV positive patients.

Annex 3. Facility assessment tool

a) Services visited

Chest disease hospital ward___ Chest disease clinic___ DOTS center___ VCT center___

Outpatient department___ Laboratory___ Other (specify) ___

Are the visited services available for both people with TB and people living with HIV? yes ___ no___

Comments (progress after previous assessment?)

_____

b) TB Infection Control measures implemented

TB Infection Control measures	Yes	No	Comments
Managerial			To be asked during the assessment
Coordinating body or responsible person in place			
Health facility design, and use			
Surveillance and assessment of TB among HCWs			:
TB infection control plan in place			:
Staff trained in TB IC			:
ACSM			
Monitoring and evaluation conducted			
Operational research			
Administrative			To be asked and observed during the visit
Triage			
Separation / cohorting			
Cough etiquette			
Expedient service delivery			
Prevention and care package for HCWs			
Environmental			To be asked and observed during the visit
Natural and/or mechanical ventilation			Provide sketch. Check air flow (with smoke tube, vaneometer). Calculate ACH (see below)
Fans			
UVGI			Sketch if available. Functioning? Last maintenance check?
Personal protective equipment			To be asked and observed during the visit
Respirators available for staff			When recommended, average usage? Storage? Signage? Comments:
Fit testing and/or fit check			

1) Function, use and utilisation of room assessed for ACH

_____

_____

2) Sketch room. Include main room, anteroom, hallway, UV lights, fans, windows, doors, furniture:

3) Make a flowchart of the patient flow through the facility

_____

_____

d) Summary of the facility assessment

Strengths	**Weaknesses**
Problems identified	
Suggested Solutions and recommendations	
Next assessment:	**Name, date and signature:**

Annex 4. Example : Assessment report of NIDCH-OPD

Managerial:

TB infection control plan in place: No
Staff trained in TB IC : No
ACSM: No comprehensive ACSM plan in place.
Monitoring and evaluation conducted: Monitoring in place but not structured /planned.

Administrative

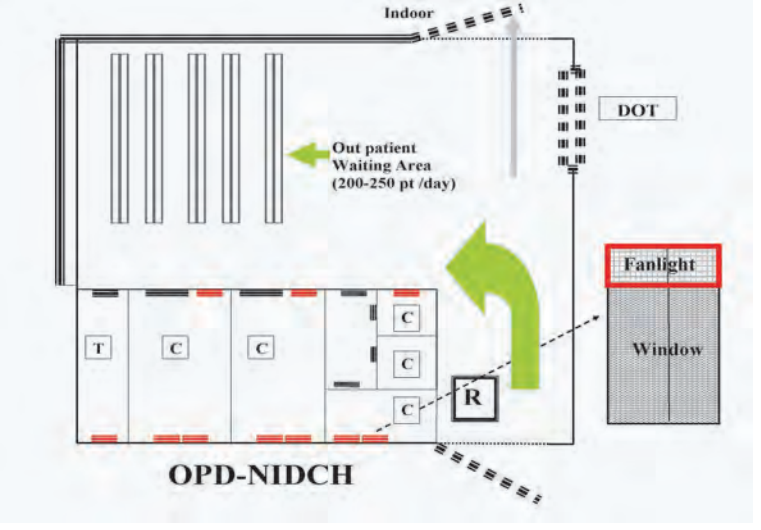
Triage: Through the verbal questionnaire Separation / cohorting: No partition in waiting area Cough etiquette: No poster on cough etiquette. No counselling. Few patients wear face masks Expedient service delivery : 2-5 hours. Some TB patients need to wait 72 hours for admission. Prevention and care package for HCWs : No Periodic TB screening.
Symptomatic HCWs are brought under TB screening

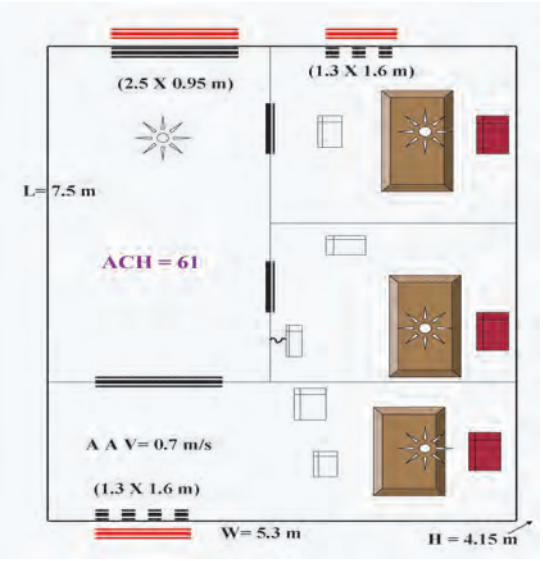
Environmental

Natural and/or mechanical ventilation: Natural and mixed mode mechanical ventilation: open waiting area, all windows and doors open except for fanlights above doors and windows Fans : In place and working (high speed ceiling fans) Personal protective equipment:

Respirators available for staff : Not for all. Few are available

Fit testing and/or fit check: No.





Summary of the facility assessment

Strengths :

- Well ventilated, good light and space, high ceiling waiting room
- Long corridor along with transverse wings
- Well ventilated, illuminated high ceiling consultation room
- Fixed patient chair to maintain optimum doctor patient distance
- Direction and flow of air is good (smoke tube test)

Summary of the facility assessment

Weaknesses:

- No ACSM material in OPD
- Waiting time-long

Problems identified:

- No screening system in place
- Suspect of MDR patient, general patient and their attendances are in same one waiting area in close proximity.

Summary of the facility assessment

Suggested Solutions and recommendations:

- OPD should have cough etiquette posters, information and masks specially in reception and waiting area
- OPD area should have a partition (half) for separation of suspected MDR-TB patients
- Educate and correct patients on cough etiquette
- Provision of staff (may be cured TB Patient) for primary screening of coughing patients in the waiting area
- All fanlights should be open/functional, repair and maintain, Wall-mounted directional fan could be considered to fit behind doctor
- Decrease waiting time and make proper mechanism for fast tracking of suspected MDR-TB patients.

Annex 5. TB disease incidence (rate) among health care workers: Indicator Reference Sheet

Overall outcome indicator **TB disease incidence (rate) among different cadres of health workers**	
Definition	Number of health workers, who develop TB in one year expressed as a proportion of the total number of health workers during that same year
Numerator	Number of health workers employed in health facilities who develop TB in one year
Denominator	Total number of health workers employed in health facilities during that same year
Purpose	To measure the incidence of tuberculosis in health workers over time as a measure of impact of infection control measures on health workers.
Methodology	The definition of health worker is context specific. As well as medical & nursing staff this may include those who have patient contact, and/or whose work is within the facility walls e.g. domestic staff (but unlikely to include gardeners, security staff, maintenance staff who are likely to have little "prolonged exposure" to TB). The issue here is risk of exposure to tuberculosis. The number of health workers starting tuberculosis treatment during the reporting period will be used as the numerator. Facility-level employment records and staff health records with age and sex details should be available for all workers working in health facilities and the relevant summary data from each clinic/ UHC/ district should be aggregated to national level where this indicator should be compared to TB rates in the general population (after direct age and sex standardization has been carried out).
Periodicity	Collected annually from each facility
Strengths and Limitations	This indicator can be used to monitor changes in tuberculosis rates in health workers to monitor impact on this by policy and highlights a very important issue that is a potential Dr.ain on scarce human resources for health thus can provide good information to be used to advocate for better working conditions of health staff and better infection control. The number of TB cases reported by each facility are likely to be low even if incidence rates are very high, thus "small number" problems may arise making meaningful comparisons at sub national/local level problematic, This indicator needs to be sex and age standardized against population to be meaningful. In addition the HIV status rates among health workers compared to the general population may also be a factor in differential TB rates. It may be useful to assess TB rates by different cares of staff. Concerns are likely to be raised about confidentiality and special efforts need to be made to ensure staff confidentiality.
Importance	Desirable, core for evaluation
Responsibility	TB IC Committee, NTP
Measurement tools	Facility health workers staffing and occupational health records

Annex 6. TB Global Report Indicators (2010)

3.41 Number of health care workers working in the country in the public and private sector diagnosed TB in 2008 (regardless of job position)?

3.42 Number of health care workers working in the country in the public and private sector in 2008?

3.43 Have health care workers been trained in TB infection control in 2008?
Y / N

3.44 Number of tertiary (referral) hospitals with the following?
Person in charge of TB infection control

TB infection control assessment done since 2008

Training on TB infection control conducted since 2008

3.45 Total number of tertiary (referral) hospitals?

Annex 7. Cough etiquette

Messages and IEC materials for example leaflets, stickers, posters on cough etiquette shall contain the following information.

- Cover nose and mouth with hands, arm (sleeve), tissue, cloth, saree, orna or face mask when coughing and sneezing;
- When coughing and sneezing, turn head away from others;
- Use in the nearest waste bin to dispose of the tissue, cloth etc. after use;
- Spit in a cloth or container with lid;
- Perform hand hygiene (e.g., hand washing with soap and water, antiseptic hand wash) after having contact with respiratory secretions.

Annex 8. The basic principles of workplace policy (ILO-WHO)

Recognition of TB as a workplace issue

TB is a workplace issue because it affects the health of workers and the productivity of enterprises. The workplace has a role to play in broader global efforts to limit the spread and effects of TB. Workplace programs should be gender-sensitive, taking into account women's greater vulnerability to TB and its impact as a result of higher levels of poverty, the burden of care, and the increasing incidence of HIV among women.

Non-discrimination

No one should experience discrimination on the basis of their TB status, whether in terms of continuing employment relationships or access to health insurance, occupational safety, and health care schemes. Employees with TB should be entitled to work for as long as they are medically fit and appropriate work is available.

Confidentiality

Neither job applicants nor employees should be asked to disclose information on the basis of their perceived TB or HIV/AIDS status. Access to personal data should be bound by the rules of confidentiality and be in accordance with the ILO code of conduct on the protection of worker's personal data.

Healthy work environment

The work environment should be healthy and safe, as far as practicable, in order to prevent the transmission of TB. This includes the responsibility for employers to provide information and education on TB transmission, appropriate environmental measures, and protective clothing where relevant.

Care and support

Workplaces should provide access to health services that fulfill the needs of male and female employees with TB and related illnesses, or should refer workers to treatment and care services in the community. The DOTS approach is preferred. Measures to accommodate and support workers with TB should be made through flexible leave arrangements, rescheduling of working times, and arrangements for return to work.

Social dialogue

Control and management of TB in the workplace is more effective when planned and implemented on the basis of collaboration between managers and the workforce. A workplace health and safety committee with broad representation should be responsible for overseeing implementation.

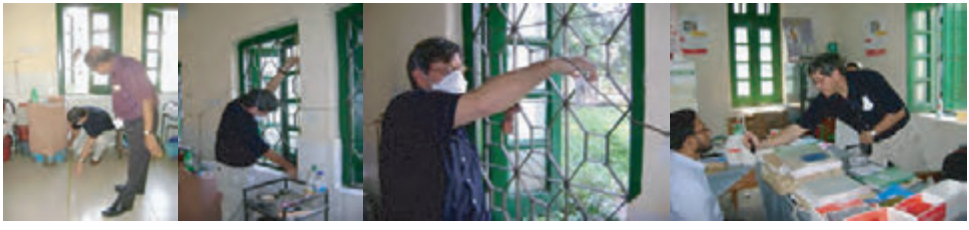
Annex 9. What do you need to measure ACH?

Tape measure

Calculator

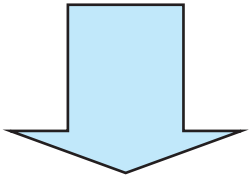
Vaneometer

Ventilation smoke tube kit



Annex 10. Formula for calculation of ACH

Average Flow Rate=
Average air velocity x
Area of window x
3600 sec



Calculation of air changes per hour (ACH)

ACH= Average flow rate / room volume

Average flow rate= __m^3 / hour

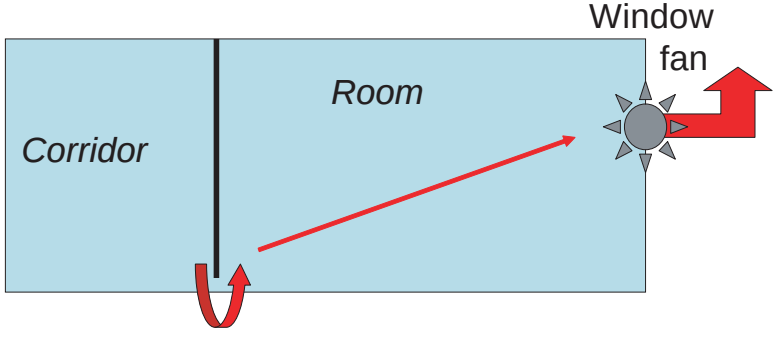
Room volume= __ m^3

Annex 11. How to ensure and enhance ventilation?

- If possible, position windows and doors in opposite walls of wards and rooms to assure cross ventilation.
- Keep opposite windows and doors open as much as possible to maximize cross ventilation; consider high level air vents under the ceiling.
- Make ventilation openings in or above the entrance doors as cross ventilation can occur in enclosed rooms where door cannot be left open for confidentiality purpose.
- Place fans to obtain adequate dilution when natural ventilation alone cannot provide sufficient ventilation rates.
- Consider installation of turbine driven extraction fans: “Whirly Birds”.
- Control the direction of air flow from clean to less clean to the outside (across the health care worker first and thereafter across the patient) with wall-mounted electrical fans or extractor window-fans.
- Monitor natural and or mechanical air flow by designated staff daily.
- Incorporate preventive maintenance procedures into existing facility maintenance programs.

Annex 12. Example of mixed-mode ventilation

Airflow with window exhaust fan: negative pressure



Annex 13. Upper-room shielded UVGI fixtures

Ceiling mounted UVGI fixture

Corner wall and ceiling mounted UVGI fixtures

Annex 15. Respirator medical evaluation

Respirator Medical Evaluation

This questionnaire is used in determining whether or not you have a medical condition that may affect your ability to wear a respirator. Fit testing is also required. All medical information is considered confidential.

All information must be completed for respirator approval.

Name: _____ Date: _____ Employee Number# : _____

Job Title _____ Unit/Department_____ Manager _____

Work phone: _____ Home Phone_____

Work Location:

	Yes	No
Have you ever used a respirator mask before?		
Have you ever had problems wearing a respirator?		
Do you have medical problems that may interfere with respirator use?		
Are you short of breath at rest?		
Do you get short of breath when walking?		
Do you get chest pain with certain activities?		
Do you have claustrophobia?		

Has a doctor ever told you that you had any of the following?

	Yes	No		Yes	No
Angina			Diabetes		
Heart Attack			Lung Disease		
Heart Disease			Asthma		
Epilepsy or Seizure			High Blood Pressure		

Smoking History: _____Smoker _____ Ex-Smoker _____ Never Smoker

Are you currently taking any medications?
If yes please list: _____

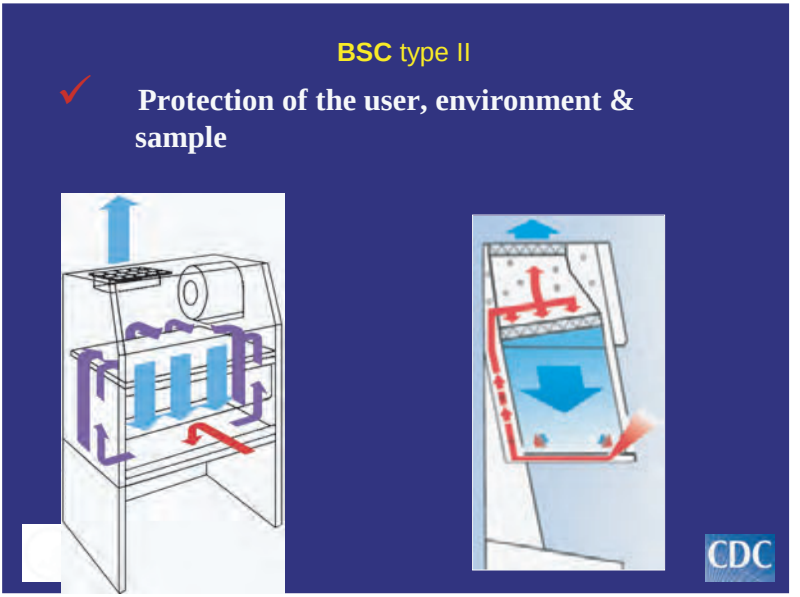
Since facial hair may interfere with the respirator face piece seal, gentlemen need to be clean shaven while wearing any tight-fitting respirator. This includes disposable filtering face piece respirators such as N-95s. OSHA does allow facial hair while wearing a powered air-purifying respirator (PAPR) with a loose-fitting hood. Fit testing should be repeated if you have a weight change of 20 pounds or more, significant facial scarring in the area of the face piece seal, significant dental changes (i.e. multiple extractions without prosthesis, or acquiring dentures), reconstructive or cosmetic surgery, or any other condition that may interfere with face piece sealing. I understand the above, and will schedule a new fit test with Employee Health if indicated.

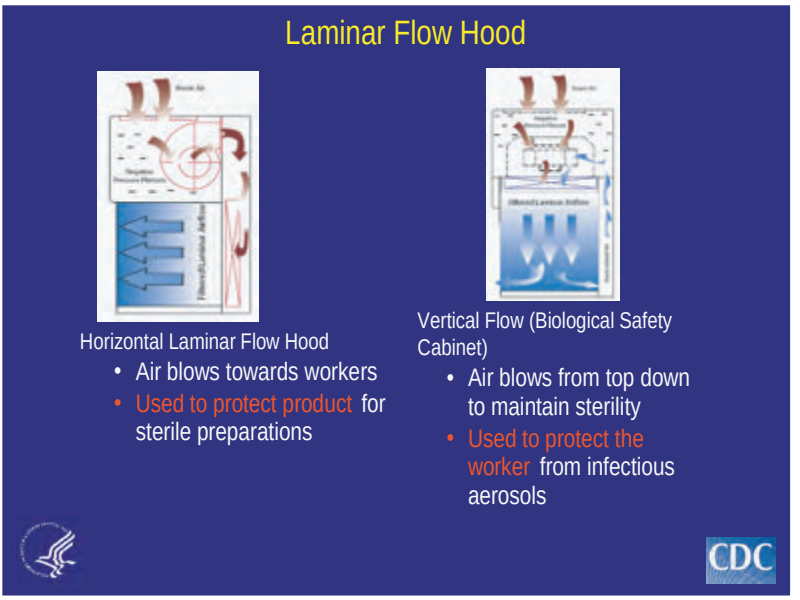
Employee Signature_____ Date: _____

Approved_____ Denied _____

Restrictions/Remarks_____

Annex 14. Biosafety cabinet Class II and laminar flow hoods





Annex 16. Respirator fit test procedure (form)

Respirator Fit Test Procedure Form			
Employees should pass an appropriate qualitative fit test or quantitative fit test: • Prior to initial use, • Whenever a different respirator (size, type, model or make) is used, • Periodically thereafter, • Additional fit test whenever changes in physical condition or job description that could affect respirator fit are noticed or reported.			
Steps	Activity	Y	N
Step 1	Respirator Medical Evaluation		
Sensitivity test			
Step 2	Use sensitivity solution to establish if health worker tastes test agent		
Apply respirator			
Step 3	Find centre of nose piece and bend		
Step 5	Open respirator		
Step 5	Place straps on back of hand		
Step 6	Place respirator on face		
Step 7	Pull top strap over head		
Step 8	Place top strap on crown of head		
Step 9	Pull lower strap over head		
Step 10	Pinch metal clip or foam cuff around nose		
Step 11	Pull respirator over chin		
Step 12	Check for major leaks		
Fit testing			
Step 13	Cover head with hood with opening in front		
Step 14	Squirt 5-10 times with fit test solution before each following step		
Step 15	Normal breathing 1 minute		
Step 16	Deep breathing 1 minute		
Step 17	Move head side-to-side 1 minute		
Step 18	Move head up-and-down 1 minute		
Step 19	Talk non-stop 1 minute		
Step 20	Jogging or walking in place 1 minute		
Step 21	Normal breathing 1 minute		
Administration			

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Step 11	Pull respirator over chin		
Step 12	Check for major leaks		
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Step 13	Cover head with hood with opening in front		
Step 14	Squirt 5-10 times with fit test solution before each following step		
Step 15	Normal breathing 1 minute		
Step 16	Deep breathing 1 minute		
Step 17	Move head side-to-side 1 minute		
Step 18	Move head up-and-down 1 minute		
Step 19	Talk non-stop 1 minute		
Step 20	Jogging or walking in place 1 minute		
Step 21	Normal breathing 1 minute		
Administration			

Annex 17. Directions for use of N-95 or FFP2 respirator

1- Find centre of nose piece and bend

2- Open respirator

3- Place straps on back of hand

4- Place respirator on face

5- Pull top strap over head

6- Place top strap on crown of head

Annex 17. Directions for use of N-95 or FFP2 respirator

7- Pull lower strap over head

8 - Place strap at base of head

9 - Pinch metal clip around nose

10 - Pull respirator over chin

11- Check for major leaks

12 - Breath in-and-out quickly

Annex 18. Examples of good and bad practice

Good!

Naturally ventilated stair way “Brise-soleil”

Bad!

Windows sealed with renovation

Good!

High ceiling (4.15 m), open partitions, ceiling fans for dilution of room-air, fanlights above window and door for cross ventilation

Bad!

Air conditioner in front of Biosafety cabinet

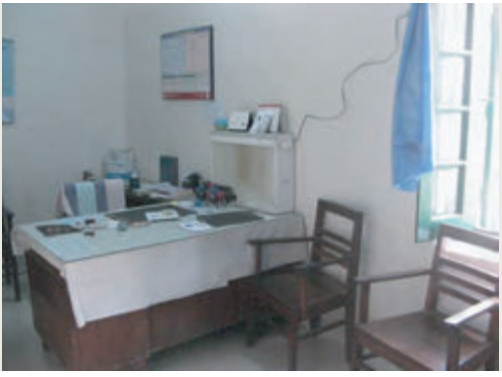
Good!

Open waiting area

Bad!

No maintenance of moving parts of window

Good!



Patient seat closest to open window

Bad!

Fanlights cannot be opened on a cold day

Bad!

Non-functioning, not cleaned UVGI fixture

Good!

MDR -TB patient wearing face mask

Good!

Well-ventilated spacious ward

ANNEX 19. Measures for (HIV-) MDR-TB household members and care providers:

- Houses should be adequately ventilated, particularly rooms where people with MDR-TB spend considerable time. Natural ventilation may be sufficient to provide adequate ventilation, but this needs to be assessed and objectively demonstrated.
- MDR-TB patients should be encouraged to spend as much time as possible outdoors, if possible sleep alone in a separate, adequately ventilated room, and spend as little time as possible in public places or in public transport.
- While culture positive, MDR-TB patients who cough should at all times wear face masks when visited by household members.
- Community health care workers and community volunteers should wear respirators when attending MDR-TB patients or suspected MDR-TB patients in their homes.
- Ideally, household members living with HIV, or family members with strong clinical evidence of HIV infection, should not provide care for MDR-TB patients. If there is no alternative, HIV positive family members should wear respirators.
- Children below five years of age should spend as little time as possible in the same living spaces as MDR-TB patients. Such children should be followed up regularly and screened for TB.
- HIV positive household members and children should be prohibited from visiting a culture positive XDR-TB patient.
- Adaptations of the patient's home may be considered, if the patient has the resources. For example building of a separate bedroom or outdoor shelter, enlargement of a window or construction of a window in an opposite wall, construction of air vents under the roof, use of an electrical fan (if there is electricity).

List of members of committee developing the guidelines for TB Infection Control

Dr. Max Meis, International Consultant, TB CAP/KNCV has provided support in developing the TB-IC guidelines for Bangladesh. Mr. Tristan Bailey, Knowledge Exchange Officer of TB CAP/KNCV contributed editing of manuscript.

A core group provided guidance and background information to develop the draft Guidelines on TB Infection Control.

A review group consisting of participants and resource persons of the TB Infection Control workshop held on 25 – 29 October, 2009, made vital contributions for developing the draft Guidelines.

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The Infection Control Guidelines was finalized through a workshop held on 13-14 July 2011, with participation of the following members of the core and review group.

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