

Guidelines on Airborne Infection Control in Healthcare and Other Settings

In the context of tuberculosis and other airborne infections

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Table of Contents

Table of Contents	2
Tables and Figures	3
Glossary	4
Foreword	7
Preface.....	8
Acknowledgements.....	9
Background.....	10
<i>Importance of infection control for respiratory infections</i>	10
<i>Purpose and scope of these guidelines</i>	10
<i>Overview of transmission and pathogenesis of TB</i>	11
<i>Standard Precautions</i>	11
Hierarchy of controls to reduce risk of transmission of respiratory pathogens	12
Managerial activities for National, State, Hospital administration, and Local health officials	13
<i>National Airborne Infection Control Committee</i>	13
<i>State Airborne Infection Control Committee</i>	13
<i>District Airborne Infection Control Activities</i>	13
<i>Role of Architects / Engineers in Health Infrastructure Design</i>	14
<i>Role of Health Care Facility Administration</i>	14
<i>Facility infection control plans</i>	16
Administrative control strategies for health-care facilities.....	18
<i>Administrative controls for outpatient areas</i>	18
<i>Administrative interventions in the inpatient areas</i>	20
Environmental controls.....	22
<i>Ventilation</i>	23
<i>Natural ventilation</i>	23
<i>Considerations for hot climates</i>	27
<i>Considerations for cold climates</i>	28
<i>UVGI</i>	30
<i>Filtration (HEPA Filters)</i>	33
High-risk settings.....	34
<i>Airborne Precaution Rooms</i>	34
<i>MDR-TB Wards</i>	36
<i>ART centres</i>	38
<i>Bronchoscopy/procedure rooms</i>	40
<i>Intensive Care Units</i>	42
<i>Radiology Areas</i>	44
<i>Autopsy Suites</i>	44
TB laboratories.....	46
<i>Designated Microscopy Centers</i>	46
<i>TB Bacteriology Laboratories</i>	46
<i>Administrative Controls for TB bacteriology laboratories</i>	47
<i>Environmental controls required for TB bacteriology laboratories</i>	48
<i>Personal Protection measures for TB bacteriology laboratory staff</i>	48
<i>Accidents and Spillages</i>	49

<i>Waste disposal and handling</i>	51
Health worker safety and Capacity development	52
<i>Health care worker safety</i>	52
<i>Personal respiratory protection</i>	52
<i>Surveillance for TB disease among health care workers</i>	53
<i>Capacity development</i>	54
<i>Trainings on Airborne Infection Control</i>	54
Patient Counseling and Household Precautions	56
<i>Counseling</i>	56
<i>Household Precautions for TB patients</i>	56
<i>MDR-TB</i>	56
Monitoring and Evaluation	58
<i>Baseline Facility Risk assessment</i>	58
<i>Reporting formats on Airborne Infection Control Activities</i>	59
<i>Monitoring Indicators</i>	59
Appendices	61
Appendix 1: Composition and Terms of Reference for the National Airborne Infection Control Committee (NAICC)	61
Appendix 2: Composition and Terms of Reference for the State Airborne Infection Control Committee (SAICC)	62
Appendix 3: Role of the Sub-Committee on Biomedical Waste Management / Infection Control (SC-BMW/IC) under the District Health Society in Airborne Infection Control Activities:	64
Appendix 4: Generic facility infection control plan	66
Appendix 5: Considerations for planning UVGI installations	70
Appendix 6: Specifications for an indoor sputum collection booth	72
Appendix 7: Health Care Facility Airborne Infection Risk Assessment Tool	73
Appendix 8: Detailed Infection Control indicators	81
Appendix 9: Infection control reporting formats for Facility, District, and State	85
References	96

Tables and Figures

Table 1: Elements of Standard Precautions	11
Table 2: Summary of key recommendations on administrative controls	18
Table 3: Summary of key recommendations on environmental controls	22
Table 4: Minimum air-changes per hour required for various health care settings	26
Table 5: Summary of key recommendations on UVGI	30
Table 6: Recommended specifications and procedures for airborne precaution rooms	34
Table 7: Summary of recommendations for MDR-TB Wards	36
Table 8: Summary of recommendations for ART Centres	38
Table 9: TB Bacteriology laboratory activities that may generate aerosols	46
Table 10: Summary of recommended administrative and bio-safe practices for TB bacteriology laboratories	47
Table 11: Summary of environmental controls recommended for TB bacteriology laboratories	48
Table 12: Procedures for spills inside and outside biological safety cabinet	50

Table 13: Recommended training for State and District Officials, and Health-care facility administrators on airborne infection control..... 54
Table14: Monitoring indicators for infection control activities..... 59

Figure 1: Schematic of a room with natural ventilation. Fixed unrestricted openings on both sides allow for adequate air exchange. 24
Figure 2: Examples of poorly-installed exhaust fan in an open window space, with “short-circuiting” of air-flow. In this installation, the fan adds little to ventilation; removal of the fan was recommended, as natural ventilation was adequate..... 25
Figure 3: Schematic showing how adequate air exchange might be achieved in a room with air-conditioning/heating. The air conditioner is located away from the exhaust, near the door, so that cooled air sweeps across the room. An exhaust fan, adequate to achieve the required air exchange, is installed on the other side. Adequate air intake has been enabled by having enough space under the door (a few inches clearance) for air to freely enter the room. 26
Figure 4: Example of roof mounted turbine ventilation, or “whirlybird”, highly appropriate for improving ventilation in warm climates. 28
Figure 5: Schematic showing seating arrangement for patient and health care worker (red cross). In (A), natural ventilation would allow potentially infected air to cross health care worker. In (B), with this seating arrangement the chance of such exposure is lessened somewhat..... 29
Figure 6: Schematic diagrams of mechanical ventilation, with optimal directional control or airflow in the room. In (A), supply is on one side, exhaust from the other, so aerosols are not dispersed to other patients or staff. In (B), supply is from the top, and again exhaust near the patient’s head, for optimal directional control..... 29
Figure 7: Vertical irradiance profile of a 30W UVGI horizontal beam fixture, showing 10 µW/cm2 “kill zone”. From First et al., ASHRAE Transactions 1999:105..... 31

Glossary

The terms listed below have been defined or adapted for the purpose of this document[1, 2].	
Air Changes per Hour	One air change has occurred when the volume of air entering or exiting a room is equal to the volume of the room. The proportion of airborne particles eliminated with each air change is 63%, under ideal conditions of mixing. A second air change removes 63% of what remains, and so on. Subsequent increases in air changes leads to an exponential reduction in droplet nuclei.
Airborne precautions	A series of interventions to reduce spread of airborne infections, including patient placement in a separated well-ventilated area, the use of source control (like a medical mask) for patient for transportation outside patients isolation area, and the use of particulate respirators (like N95) by health workers. These precautions are generic for all airborne infections but they also contribute to reduce the spread of TB.
Airborne isolation room	A room with ≥ 12 air changes per hour (ACH) and controlled direction of air flow, which can be used to contain airborne infections. It can be naturally or mechanically ventilated.
Cough hygiene	The patient practice of covering the mouth and nose during

	coughing with a tissue, cloth, or by wearing a medical mask. This practice reduces the dispersion of respiratory aerosols.
Droplet nuclei	<i>Mycobacterium tuberculosis</i> is carried in airborne particles called droplet nuclei that can be generated after persons who have pulmonary or laryngeal TB disease cough, sneeze, shout, or sing. The particles are approximately 1–5 µm; normal air currents can keep them airborne for prolonged periods and spread them throughout a room or building. Droplets are generally >5 µm in diameter. Droplets settle faster than droplet nuclei and will not reach the alveoli.
Health-care facility	Any establishment that is engaged in direct patient care on site.
Health-care workers	All people, in public and in private services, in the health sector and other sectors, whose main activities are patient-care oriented. This includes providers -- such as doctors, nurses, pharmacists, laboratory technicians -- and also support workers in health care facilities such as cleaners.
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.
Infectious case	Smear-positive TB cases are the most infectious and most likely to transmit TB, and are taken as ‘infectious cases’ for infection control purposes. Smear-negative but culture- positive cases can also transmit TB, but with much lower efficiency.
HEPA filtration	“High Efficiency Particulate Air” filtration that removes at least 99.97% of particulates that are 0.3 microns or larger, such as respiratory aerosols, from the air and thus improving air quality. This represents the minimum acceptable performance standard.
HIV care settings	HIV-care settings are those facilities involved in health care of primarily HIV-infected persons. These include anti-retroviral treatment centers and community-care centers.
Mechanical ventilation	Mechanical ventilation is created by using a supply (HVAC) and/or an exhaust fan to force air exchange and to drive airflow. It works by generating negative or positive pressure in the room to drive 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 mixed-mode ventilation system combines the use of both mechanical and natural ventilation. It provides the opportunity to choose the most appropriate ventilation mode based on the circumstances.
Natural Ventilation	Natural ventilation is 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.
Nosocomial transmission	An infection occurring in a patient in a hospital or other health care facility in whom the infection was not present or incubating at time

	of admission. This includes infections acquired in the hospital but appearing after discharge, and also occupational infections among staff of the facility.
Particulate respirators	A special type of closely-fitted mask with the capacity to filter particles to protect from inhaling infectious droplet nuclei. The N95 respirator has filter efficiency level of 95% or greater against particulate aerosols free of oil when tested against a 0.3 µm particles. The "N" means "Not resistant to oil". The "95" refers to 95% filter efficiency. The FFP2 respirator has filter efficiency level of 94% or greater against a 0.4 µm particles and is tested against both oil and a non-oil aerosol.
Risk assessment	An in-depth facility description of risk of nosocomial transmission, including assessment of patient population, work practices and ventilation.
Separation	Placing patients infected or colonized with the same known pathogen in a designated unit (i.e. with the same space and staff), to which patients without the pathogens are not admitted.
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 (hand washing using soaps or possibly by hand rubbing with alcohol based formulations), cough hygiene, cleaning and disinfection, waste management and – based on infection control assessment – use of personal protective equipment (e.g. gloves, facial protection, gowns). Details on Standard Precautions are available at: http://www.who.int/csr/resources/publications/EPR_AM2_E7.pdf
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 (Ultraviolet Germicidal Irradiation)	UVGI (254 nm), which is produced within the UV-C region of the electromagnetic spectrum, eliminates the ability of microbes to replicate by inactivating both bacterial and viral DNA. The most practical and effective application uses wall or ceiling-mounted UVGI fixtures to create an upper room air disinfection zone. Good room air mixing between the upper and lower room is required to allow effective disinfection of air in the lower breathing zone.

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Background

Importance of infection control for respiratory infections

TB is endemic in India, and diagnosis is frequently delayed. Unsuspected TB cases contribute to TB transmission because they are not being treated and may go unsuspected for days or weeks, and may visit multiple health-care facilities or be admitted indoors to wards. Unless TB is considered, available diagnostic tests may not be used, proper treatment might not be initiated, and proper TB infection control measures might not be in place.

The global spread of Influenza A H1N1 has highlighted the need for health care facilities to implement standard infection control precautions and to improve preparedness for pandemic respiratory infections. Preparedness for pandemics means having infection control activities already in place; many of the same infection control activities will help contain TB as well.

Purpose and scope of these guidelines

These guidelines are designed to provide up-to-date information about methods of reducing the risk of airborne infections in health care facilities. These guidelines provide technical and operational guidance on recommended precautions to reduce the risk of transmission of airborne pathogens. They also detail and prioritize the necessary managerial activities for all levels – national, state, and local/health care facility levels included.

While much of the guidelines focus on TB as the prototypic disease of airborne transmission, they apply to other respiratory infections as well. Additional specific measures may be required for influenza A H1N1 and H5N1; detailed guidelines are available with NCDC and MoHFW websites.¹ Effective implementation of these recommended measures will greatly improve preparedness for future respiratory virus pandemics.

The document is intended for health system officials from programmes covering hospital services, TB, HIV/AIDS control, health officials dealing with epidemic respiratory diseases like influenza A H1N1 and H5N1, and health care facilities in the public and private sectors.

The guidelines will apply to all health-care facilities from sub-centres to medical colleges, and to high-risk areas within these facilities. These high-risk areas include TB & Chest OPD, Medicine OPD, Indoor wards, DOTS-Plus sites for MDR-TB treatment, ART Centres, bronchoscopy suites, TB bacteriology culture laboratories, intensive care unit (ICU), and operating theatres (OT). Beyond health-care facilities, these guidelines offer some limited but practical suggestions on how to minimize the risk of TB transmission in households and other congregate settings.

¹

Overview of transmission and pathogenesis of TB

TB is caused by bacteria (a type of germ) called *Mycobacterium tuberculosis* (*M. tuberculosis*). With rare exceptions, TB is infectious only when it occurs in the lungs or larynx. TB that occurs elsewhere in the body is usually not infectious, unless the person also has TB in the lungs or larynx at the same time. A person who has TB disease in his or her lungs or larynx can release many tiny particles called droplet nuclei into the air by coughing or sneezing; smaller numbers of droplet nuclei are released during normal activities like talking or spontaneously during breathing. These droplet nuclei particles are invisible to the naked eye and are approximately 1 to 5 microns in size. (A micron is approximately one-hundredth the width of a human hair.) Droplet nuclei can remain airborne in room air for a long period of time, until they are removed by natural or mechanical ventilation.

In order for TB to spread, there must be a source patient who has infectious TB disease and a susceptible host (a person to inhale droplet nuclei containing *M. tuberculosis*). Anyone who shares air with a person with infectious TB disease of the lungs or larynx is at risk, although TB is not usually spread by brief contact. TB is spread when another person inhales one or more of these particles and becomes infected with TB.

Standard Precautions

Standard Precautions is the term used for the group of infection control practices to reduce the risk of transmission of pathogens. These are based on the principle that all blood, body fluids, secretions, excretions except sweat, non-intact skin, and mucous membranes may contain transmissible infectious agents. Standard precautions are applicable to all patients in all health care settings. **Standard precautions combine the major features of *Universal Precautions*, *Body Substance Isolation*, and *Airborne Precautions*.** Implementation of these precautions requires *risk assessment* in all health-care activities.

Table 1: Elements of Standard Precautions

• Hand hygiene
• Selection of personal protective equipment based on assessment of risk
• Respiratory hygiene and cough etiquette
• Prevention of injury from needles and other sharp objects
• Cleaning of the patient care environment
• Linen and waste management
• Cleaning and disinfection of patient-care equipment

Hierarchy of controls to reduce risk of transmission of respiratory pathogens

The selection of the combination of controls will be based on the infection control assessment and informed by local epidemiological, climatic and socioeconomic conditions.

Administrative controls: Administrative controls are to identify persons with respiratory symptoms, separate them into appropriate environment, fast-track them through the health care facility to reduce exposure time to others, and diagnose/treat them with minimal delay. Hospitalization should be reduced or avoided to the greatest extent possible. At facility level, administrative controls play a major role in reducing the risk of TB transmission and are essential for the implementation of other controls (i.e. environmental controls and personal protective equipment).

Environmental Controls: The choice of environmental controls is largely determined local factors and resources. Ventilation should be prioritized to reduce the number of infectious particles in the air. Effective ventilation may be achieved by natural ventilation where possible. In high-risk settings where optimal ventilation cannot be achieved through natural or mechanically-aided means, properly designed, placed and maintained shielded ultraviolet germicidal irradiation devices should be considered as a complementary control.

Personal protective equipment: Personal protective equipment (e.g. particulate respirators certified as N95 or FFP2) should be available as required in high-risk situation, especially drug-resistant tuberculosis, and during high-risk aerosol-generating procedures such as bronchoscopy or sputum induction.

Managerial activities for National, State, Hospital administration, and Local health officials

Managerial activities should ensure political commitment and leadership at all levels (national, state district and facility level). The managerial activities are based on public health principles and represent the foundation of any public health programme. Facility level managerial activities should be in line with and complement the national, state and district level managerial activities and are to support and facilitate the implementation of the controls described later at facility level.

National Airborne Infection Control Committee

A National Airborne Infection Control Committee (NAICC) has been constituted to provide for a multi-lateral national level coordinating body, to develop these national guidelines, and provide technical guidance for their implementation, evaluation, and revisions. This committee would be providing guidance to all partners during regular meetings and would review and monitor the activities periodically. Members of the NAICC and the terms of reference can be found in

Appendix 1. Key National level activities include:

- Developing and strengthening coordination bodies
- Promote the incorporation of infection control considerations into health facility design, construction, renovation, and use
- Conduct surveillance and assessment at all levels of the health system
- Conduct monitoring and evaluation
- Facilitate operational research to

State Airborne Infection Control Committee

A State Airborne Infection Control Committee (SAICC) should be established as the first priority in implementation of the guidelines to function as a coordinating body. Separate coordinating body is justified by the multiple lines of authority involved in implementing recommended infection control activities at variety of health care facilities in the states. The establishment of these bodies will be particularly important during the initial years of infection control activity implementation, as they will serve to help sensitize stakeholders on the importance of airborne infection control. Structure and terms of reference of the SAICC can be found in **Appendix 2.**

District Airborne Infection Control Activities

The airborne infection control activities at the district level should be coordinated and undertaken by the Sub-Committee on Biomedical Waste Management / Infection Control (SC-BMW/IC) under the District Health Society (DHS). They should function under guidance and close coordination with the SAICC, State Health Society and with the TB Sub-Committee under DHS (NRHM). Separate coordinating body is not justified as the multiple lines of authority involved in implementing recommended infection control activities at variety of health care facilities in the districts are also under administrative arena of the DHS. The role of the SC-BMW/IC will be particularly important during the initial years of infection control activity implementation, as they will serve to help sensitize stakeholders on the importance of airborne infection control. The key functions to be taken up by this district level SC-BMW/IC are detailed in **Appendix 3.**

Role of Architects / Engineers in Health Infrastructure Design

Professionals responsible for the design, building refurbishment and organization (physical layout) of health care facilities need to consider patient flow patterns so that nosocomial transmission is minimized. These professionals need to be engaged in finding affordable solutions to improve the organization of existing and new facilities. To do so, they should also be included in training opportunities that underscore principles of Airborne IC and the role they play to ensure that the elements of Airborne IC are considered. Particular attention is required for facilities that are designed or reorganized to provide integrated or co-located TB and HIV diagnostic and treatment services, and those facilities that deal with drug-resistant TB.

Role of Health Care Facility Administration

Hospital administration plays a key role in creating the necessary conditions at the institutional level to prevent spread of health care associated pathogens. The physical separation of TB patients or people suspected of having TB requires rational design, construction or renovation, and use of buildings. Controls aimed at reducing TB transmission in health-care settings include triage, physical separation of TB patients or people suspected of having TB, cough etiquette and respiratory hygiene and minimize time spent in health care facilities. Facility Infection Control Committee should have a facility infection control / bio-medical waste management plan in place. The airborne infection control plan should be an integral part of this facility plan.

Following are the specific activities for health care facility administration:

a) Conduct a facility-risk assessment and develop a facility plan for airborne infection control:

- Risk assessments help identify strengths, weaknesses, and opportunities for improvement.
- Health care administration should strengthen facility infection control committees to incorporate airborne and TB infection control as a core responsibility.
- The committees should develop a facility plan for implementation of airborne (including TB) infection control.
- The facility plan may be based on the generic version annexed, or it may be specific for the facility.
- Regardless, the facility infection control plan should ensure proper implementation of all recommended controls, and should be aligned with and complement the national guidelines.

b) Rethink the use of available spaces and consider renovation and/or construction to optimize implementation of controls:

- Consider renovation and/or new construction of physical infrastructure to optimize the implementation of infection control measures.
- Space for screening of patients should be adequate.
- Waiting areas should be decompressed and moved out of poorly ventilated corridors.
- Separate, well-ventilated waiting area for respiratory symptomatic should be made available wherever possible.

- Consider developing outdoors waiting areas for high-risk settings like chest OPD, ART centers, microscopy, DOTS centers and MDR TB management sites.
- Ventilation in all areas, especially registration, waiting areas, OPD should meet standards for health care settings (Table 4).
- As far as possible, re-circulating air conditioners should be used with great caution, due to the harmful effect on air exchange in most installations.
- In the event that re-circulating air conditioners have to be used, then it would be desirable to have an exhaust fan installed in the reverse direction forcing fresh air in the room and giving directional control. This would compromise with the comfort to some extent but add value to the safety of the room.
- Great care should be taken to ensuring adequate air exchange regardless of the climate control solution.

c) Designate focal points for the facility-level activities, and support training of frontline health care workers:

- Facilities should have focal points designated to ensure activities are properly implemented.
- These focal points should play a key role in sensitization of the front-line health care staff in all aspects of infection control, including standard precautions, patient risk assessments, and airborne infection control considerations.
- Workers should be released to participate in trainings.
- Regular sensitization and reinforcement of policies and practices should be conducted by infection control focal points.

d) Ensure proper implementation of the administrative controls (listed below):

- At facility level, administrative controls play a major role in reducing the risk of TB transmission and are essential for the implementation of other controls (i.e. environmental controls and personal protective equipment).
- Evidence shows that implementation of administrative controls reduces transmission of TB in health care facilities. For this reason, administrative controls should be implemented as first priority.
- These, however, should be complemented by the environmental controls and personal protective equipment described later.

e) Budget for maintenance:

- At facility level, a realistic budget should be available for comprehensive maintenance of all controls incorporated in the facility infection control plan.
- Integrating with other programmes and the general health system at large would be essential to mobilize the requisite funding support to carry out these activities especially for engineering / environmental rectifications recommended in the risk assessment report.
- Ensure that adequate infection control supplies are provided, i.e. hand hygiene facilities (soap and clean running water, alcohol-based hand rub), PPE – gowns, gloves, eye protection, medical masks and particulate respirators; additional PPE items for housekeeping purposes

should also be made available, e.g. protective footwear, waterproof aprons, rubber gloves, and adequate supply of appropriate cleaning and disinfection materials.

f) Supervise and monitor infection control activities:

- Facility-level infection control activities frequently involve changes in work practices that tend to weaken over time, hence ongoing supervision and monitoring is essential.
- Facility administrators are responsible for ensuring that administrative and environmental controls outlined in the facility plan are successfully and consistently implemented.
- Periodic supervisory visits apart from the pre-assessment visits to predetermined number of health care facilities from the SC-BMW/IC and SAICC members should be an integral part of the SAICC implementation action plan.
- Facility administrators should ensure compliance to the corrective actions as suggested in the recommendations of the pre-assessment and periodic follow up visits to be monitored rigorously facility wise at the SC-BMW/IC and SAICC meetings.
- Facility administrators should ensure regular submission of the quarterly reports on progress made on implementation of the interventions and maintenance of minimum standards to the SC-BMW/IC and SAICC.

g) Address training and communication needs of health workers, patients and visitors:

- Human Resource Development (HRD) for infection control requires specific planning at all levels.
- Such planning should ensure that health workers at the different levels of the health system are available and have the professional competence necessary to successfully implement infection control measures.
- Administrators and supervisors should be sensitized in the administrative and environmental controls in greater details while health care workers training should focus more on administrative controls and the appropriate use of personal protective equipments for optimizing patient care.
- Advocacy, communication and social mobilization have to be an essential component of the infection control plan. These activities should include civil society and community involvement, behavioral change campaigns and reinforcement of positive message for health workers, patients and visitors. Some examples of communication material on cough hygiene, segregation policies for ward posting can be availed from the IEC resource center (<http://www.tbcindia.org/IECRC>).

Facility infection control plans

Each healthcare facility caring for patients with respiratory infections should develop and implement an appropriate infection control plan, including the airborne infection control component. A generic facility plan outline, including detail for the airborne infection control component, is provided in **Appendix 4**.

Infection control plans serve to establish visible commitment of facility and facility administration to infection control, articulates clear policies and procedures to ensure proper implementation, and makes staff roles and responsibilities clear.

The facility infection control plan should describe specific measures to be taken, and staff roles and responsibilities on ensuring implementation. The plan should also identify the resources in terms of human, material and funding for executing the infection control plan.

Broad Areas of Infection Control suggested to be covered in facility infection control plan:

1. Facility procedures for Standard precautions
 - a. Hand hygiene
 - b. Personal protection (gloves, gowns, masks, shields)
 - c. Respiratory hygiene and cough etiquette
 - d. Prevention of injury from needles or other sharp objects
 - e. Cleaning and disinfecting medical equipments
 - f. Cleaning the patient care environments
 - g. Linen and waste management
2. Facility bio-medical waste management protocol
- 3. Procedures for de-compression of crowded areas**
- 4. Airborne infection control protocol**
5. Regular assessment of TB in all facility staff
6. Infection control training of HCWs

The airborne component of the plan should include the following elements, and answer in simple terms “Where”, “Who”, and “How”:

- Screening patients for acute febrile respiratory illness, or cough >2 weeks
- Cough etiquette: Providing face masks/tissues or educating persons respiratory symptoms, IEC, and providing dustbins
- Segregation: Placing respiratory suspects (including TB suspects) and cases in a separate waiting area, if possible.
- Fast tracking respiratory symptomatics to expedite their receipt of services in the facility.
- Respirators (for those high-risk settings where recommended)
- Procedures for using and maintaining environmental control measures (like regular opening of windows).
- Surveillance for TB in HCW, including procedures for recording and reporting these instances in Facility IC report
- Educating staff on the facility infection control plan and standard procedures.
- Monitoring the plan’s implementation

Administrative control strategies for health-care facilities

Administrative control measures (policies and work practices) have the greatest impact on preventing TB transmission. They serve as the first line of defense for preventing the spread of TB in health care settings.

Table 2: Summary of key recommendations on administrative controls

Outpatient Settings <ul style="list-style-type: none">• Screen for respiratory symptoms as early as possible upon patient's arrival at the health care facility• Provide patient education on cough hygiene and sputum disposal• Segregate patients with respiratory symptoms• Fast-track patients with respiratory symptoms
Inpatient settings <ul style="list-style-type: none">• Minimize hospitalization of TB patients• Establish separate rooms, wards, or areas within wards for patients with infectious respiratory diseases• Educate inpatients on cough hygiene and provide adequate sputum disposal• Establish safe radiology procedures for patients with infectious respiratory disease, including smear-positive TB cases or TB suspects

Administrative controls for outpatient areas

The aim of administrative interventions in the outpatient area of any healthcare facility that manages patients with suspected tuberculosis is two-fold: (a) reduce the total time period that such a patient stays in the healthcare facility, and (b) reduce airborne transmission to other patients and healthcare workers in this limited time period.

Given the heavy patient load at most health care institutions, it is but natural that patients of tuberculosis, like any other patient, have to sometimes wait long periods before they are actually examined by the physician. During this period, these patients are a constant source for airborne spread of disease to others. Reducing the overall stay of such patients in the healthcare facility is likely to prove the single-most effective measure of reducing airborne disease transmission in these areas. This can be achieved by fast tracking these patients, which itself can be accomplished by several measures that are not mutually exclusive. Fast-tracking will also depend upon the type of healthcare facility. At a chest centre/hospital, most patients are chest symptomatics where fast-tracking has no real application. But the process will be more useful for general hospitals and OPDs.

The implementation of the key administrative interventions (screening, education, segregation, and fast tracking) would vary from facility to facility.

Screening: Screening for respiratory symptoms should occur as early as possible upon patient's arrival at the health care facility. Patients can be effectively screened at the

registration counter itself by asking simple questions related to chronic respiratory symptoms, and those suspected to have tuberculosis can be given special cards or priority slips. The services of existing staff at the registration counter can be used for this purpose, or a special screening counter can be established prior to the registration process. This screening can be performed by physicians, nurses, paramedical staff and/or volunteers specially deputed for this purpose. If a separate screening counter is used, patients can be encouraged to first visit this counter if they have suggestive symptoms, by appropriate advertisements, posters or announcements in the registration area. Even if screening at registration is not possible, screening can occur when patients register at specific clinics or when in waiting areas.

Education on cough etiquette and respiratory hygiene: Another physical method that can prove useful for reducing airborne transmission is the provision patient education on cough hygiene and sputum disposal. This education can easily be imparted to patients through posters and other means in the waiting area, as well as by actual discussion by a paramedical staff or volunteers while the patient is waiting for his turn. Where possible, disposable medical masks can be provided to patients by health care workers or volunteers. These workers should also explain to patients how and when to use masks. Cough etiquette should be reinforced by all staff members when poor cough etiquette is observed.

Disposal of sputum at health settings need to be considered. Outpatient settings should make available tissue papers, and make bins with disinfectants accessible to patients for disposal of sputum. Wall posters with instructions on cough etiquette and sputum disposal should be provided; these handouts should be available at the RNTCP IEC resource centre.

Patient segregation: Segregation of patients with respiratory symptoms can be achieved by having a separate waiting area for chest symptomatics, within the overall outpatient area. This is particularly important in larger institutions with heavy OPD loads. If feasible, a separate doctor can be deputed to assess these patients in the segregated waiting areas, so that these patients do not mix with other patients waiting in the outpatient area. Another alternative is to implement a patient flow control mechanism at the entry point of the waiting area, so that chest symptomatics (who have been screened earlier and are carrying priority slips or other similar identification) are diverted to this special area rather than the common waiting area. The outpatient area, more so this segregated area, should be well ventilated to reduce overall risk of airborne transmission.

Fast tracking of patients with respiratory symptoms: Those identified as patients with respiratory symptoms can be further fast-tracked in both their clinical and laboratory evaluation. One option could be to directly send these patients for sputum smear examination before they see a doctor. The other options are to allow these patients to jump the routine queue and be seen earlier than other patients, or to have totally segregated physician areas for these patients. The other important area where these patients can be given priority is while performing chest radiography.

It is acknowledged that limited evidence is available to support the feasibility and effectiveness of these administrative interventions. In a setting of high patient load, it may prove difficult to screen and fast-track some patients at the expense of others, although with proper counseling and explanation, this may still be feasible. Patient misgivings, for instance in visiting the laboratory before the doctor, also need to be factored in. The site(s) of screening and the personnel involved need to be identified and/or created, and this may mean more administrative approvals. With all the ethnic, linguistic, social, economic and educational diversity existing in Indian patients, it is unlikely that a single measure will work well for all groups of patients. This field is an important area of operational research, and pilot projects need to be undertaken to identify what sets of administrative measures are likely to yield good results in a particular setting.

Administrative interventions in the inpatient areas

Minimize hospitalization of TB patients: One of the most effective means to reduce the risk of transmission of airborne pathogens such as *M. tuberculosis* in hospital settings is to manage such patients in the outpatient setting whenever possible. Many patients can be managed entirely as outpatients, thereby avoiding hospitalization and the risk of exposing other patients and staff. If hospitalized, patients should be re-evaluated frequently for possible discharge with continuation of therapy as outpatients.

Establish separate rooms, wards, or areas within wards for patients with infectious respiratory diseases: When hospitalization is required, patients with infectious respiratory diseases should be physically separated from other patients so that others are not exposed to the infectious droplet nuclei that they generate. Policies on patient separation inevitably generate concern about stigma, but with appropriate measures – such as training and public posting of separation rules – stigma can be minimized. Administrative procedures should ensure that separation happens promptly and automatically, similar to the automatic separation of men and women during inpatient admission. If sputum-smear microscopy or other relevant diagnostic tests are performed for patients with respiratory symptoms at the time of admission, then those who are most infectious can be quickly identified for separation from other patients.

Suggested priorities for separation of patients are as follows:

1. Separation of patients with confirmed or suspected diseases of public health concern, such as epidemic influenza, from all other patients.
2. Separation of sputum-smear positive TB patients from immune-compromised patients.
3. Separation of patients with known or suspected drug-resistant TB from immune-compromised patients.
4. Separation of patients with known or suspected TB from all other patients.

The best choice for infectious or potentially-infectious patients is to house and manage them in airborne precaution rooms. Where such airborne precaution rooms are not feasible, other options for physical separation include:

- Having a few small ‘airborne precautions rooms’ for patients with infectious respiratory disease patients.
- Having a separate ward designated for patients with infectious respiratory disease.
- Keep a designated area with better ventilation available for the placement of potentially-infectious patients.
- Where it is not possible to have a designated airborne precaution room, ward, or area of a ward, there can at least be an area designated as a “No Immune-Compromised Patient Area”, where TB inpatients would be preferentially placed. This approach avoids specifically labeling patients as immune-compromised, HIV+, or having infectious TB. If properly implemented, this approach would keep vulnerable immune-compromised patients safely away from areas where infectious TB patients (if any) might be housed.

Educate inpatients on cough hygiene and provide adequate sputum disposal: Wards housing infectious patients should display sign boards in the ward demonstrating cough hygiene. All patients admitted in the ward/area should be issued surgical masks and counseled on their proper use. Adequate measures for safe collection and disposal of sputum

Establish safe radiology procedures for patients with infectious respiratory disease, including smear-positive TB cases or TB suspects: When caring for an infectious TB case / suspect, the radiology departments should attempt to:

- Schedule inpatient chest radiographs on infectious and suspect TB patients for non-busy times, such as the end of the afternoon.
- Provide coughing patients with a surgical mask to wear, or tissues or cloth to cover their mouths.
- Provide priority service to potentially infectious TB patients to minimize the length of time spent in the department.
- Restrict access to the radiology suite to patients and essential personnel only.
- Use the room with the best ventilation for taking images of potentially infectious TB patients.

Environmental controls

Environmental control measures are the second line of defense for preventing the spread of TB in health care settings. Environmental controls include ventilation (natural and mechanical), ultraviolet germicidal irradiation, filtration and other methods of air cleaning. It is important to recognize that if administrative controls (policies and work practices) are inadequate, environmental controls may not eliminate all the risk. Some environmental control measures are simple and inexpensive while many others are technically complex and expensive

Environmental controls work on the same basic principle – dilution of infectious particles through real or ‘effective’ *air exchange*. In the case of ventilation, that dilution occurs through the introduction of fresh, uninfected air and the removal of infected air. In the case of UVGI or filtration, dilution is ‘effective’ through the creation and re-circulation of ‘cleaned’ air, in which infectious particles have been removed by irradiation or physical extraction.

Certain circumstances may require *directional control of airflow*, so that air containing infectious particles is not introduced into clean air where staff or other patients are located.

Table 3: Summary of key recommendations on environmental controls

- Health-care facilities should seek to achieve minimum standards for air exchange. High-risk settings should be prioritized for immediate assessment and implementation of improved ventilation.
- In most settings, natural ventilation is the preferred method for ensuring adequate air exchange. Specific guidance on design and implementation of natural ventilation in health care facilities is available from WHO.²
- In existing health-care facilities relying on natural ventilation, ensure effective ventilation at all times and in all climatic conditions through proper operation and maintenance, and by regular checks to ensure fixed, unrestricted openings. If mechanical ventilation is used, the system should be well designed, maintained and operated, to achieve adequate airflow rates and air exchange.
- In high-risk settings where it is not possible to achieve adequate air exchange using natural ventilation, a complementary option is to use upper room or shielded ultraviolet germicidal irradiation (UVGI) devices.
- Optimal arrangement of patients and staff should be implemented in all outpatient departments, DOT centers, microscopy centers, and radiology
- Directional control of air flow is recommended in specific high-risk settings where infectious patients with drug-resistant TB or other acute respiratory diseases of potential concern are likely to be managed – i.e. airborne precaution rooms, MDR-TB wards and clinics, and bronchoscopy suites

² World Health Organization. *Natural Ventilation for Infection Control in Health Care Settings*. Available at http://www.who.int/water_sanitation_health/publications/natural_ventilation/en/index.html

Ventilation

Ventilation can reduce the risk of infection through dilution and removal. When clean or fresh air enters a room, by either natural or mechanical ventilation, it dilutes the concentration of airborne particles, such as droplet nuclei, in room air. This is similar to opening of windows and doors to remove foul odors. Dilution reduces the likelihood that a person in the room will breathe air that may contain infectious droplet nuclei. As room air exchange doubles, the concentration of airborne particles in the room falls by half.

Improved ventilation in health-care facilities is essential in preventing transmission of airborne infections and is strongly recommended. Better ventilation lowers the risk of transmission of TB and other airborne infections.

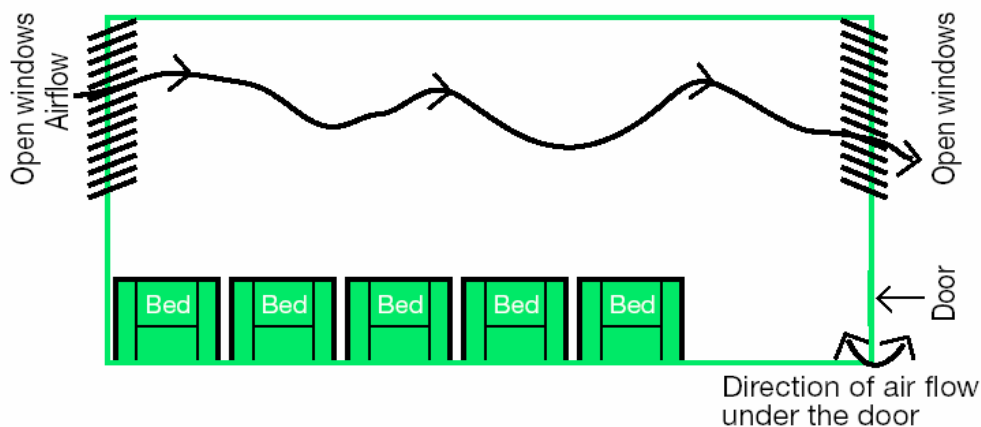
Table 4: Summary of advantages and disadvantages of different types of ventilation systems for health care settings

	Mechanical Ventilation	Natural Ventilation	Hybrid (mixed-mode) ventilation
Advantages	Suitable for all climates and weather	Suitable for warm and temperate climates	Suitable for most climates and weather
	More controlled and comfortable environment	Lower capital, operational, maintenance costs for simple implementations	Energy saving, relative to mechanical ventilation
	Occupants have limited control to affect ventilation	Capable of achieving very high ventilation rates	More flexible
Disadvantages	Expensive to install and maintain	Easily affected by outdoor climate and occupants behavior	May be more costly or difficult to design
	Can fail to deliver required ventilation rates, through faulty design, maintenance, or operation	May be difficult to plan, design, and predict performance	
	Noise from equipment	Reduced comfort level of occupants in extreme weather	
		Cannot achieve directional control of airflow, if required	

Natural ventilation refers to fresh dilution air that enters and leaves a room or other area through openings such as windows or doors. Natural ventilation is "controlled" when openings are fixed

and unrestricted to maintain air flow at all times. Unrestricted openings (i.e. those that cannot be closed) on opposite sides of a room provide the most effective natural ventilation (**Figure 1**). In existing health-care facilities that have natural ventilation, when possible, effective ventilation should be achieved by proper operation and maintenance of openings, and by regular checks to see that openings remain free of obstruction at all times.

Figure 1: Schematic of a room with natural ventilation. Fixed unrestricted openings on both sides allow for adequate air exchange.



Simple natural ventilation may be optimized by maximizing the size of the windows, opening up fixed window panes, by locating windows on opposing walls, and by the use of propeller "mixing fans". Types of mixing fans include ceiling fans, stand/desk mounted fans, or window/exhaust fans located in open windows. Mixing of air can disperse pockets of high concentrations, such as in the vicinity of patients. The total number of infectious particles in the room will not change with mixing; the concentration of particles near the source may be reduced, and the concentration in other parts of the room may increase. In other words, unless adequate ventilation is present the mixing fan will not be useful in reducing infectious particles and the risk of transmission.

A common problem with reliance on natural ventilation is that patients or staffs close windows during cold weather or at night. Further, there is likely to be variability of airflow patterns due to varying weather. In colder climates where rooms are closed to keep temperature adequately high even in winter, natural ventilation can be implemented by airing via windows at frequent intervals. *If natural ventilation is inadequate, additional mechanical ventilation or other measures may be needed, especially in areas where risk of *M. tuberculosis* transmission is high.*

Mechanical ventilation uses fans to drive the air flow through a building. Mechanical ventilation can be fully-controlled and combined with air conditioning and filtration systems as is normally done in some office buildings. Mechanical ventilation also includes "*Mixed Mode ventilation*", in which exhaust and/or supply fans are used in combination with natural ventilation to obtain adequate dilution when sufficient ventilation rate cannot be achieved by natural ventilation alone.

Mechanical ventilation with or without climate control may be appropriate where natural ventilation cannot be implemented effectively, or where such systems are inadequate given local conditions (e.g. building structure, climate, regulations, culture, cost and outdoor air quality). If mechanical ventilation is used, the system should be well designed, maintained and operated, to achieve adequate airflow rates and air exchange.

The simplest form of mechanical ventilation is the use of *exhaust fans*, placed for instance in windows and move air from inside a room to the outdoors. Exhaust fans also may be more acceptable to staff and patients than keeping windows consistently open. If exhaust fans are used, it is important to ensure that airflow is adequate, that air flows across the room (not in and out the same window or vent), and that exhaust fans and air intake (windows or vents) are not located so that short-circuiting will occur (**Figure 2**).

An under-utilized form of mechanical ventilation is the use of *air supply fans*, which move air from outside to inside a room. This is usually the same device as a typical exhaust fan, but mounted in reverse. Air supply fans often have particular value when attempting to ventilate a clinical exam room, to see that the air flows out of the exam room into the waiting area outside.

Figure 2: Examples of poorly-installed exhaust fan in an open window space, with “short-circuiting” of air-flow. In this installation, the fan adds little to ventilation; removal of the fan was recommended, as natural ventilation was adequate.



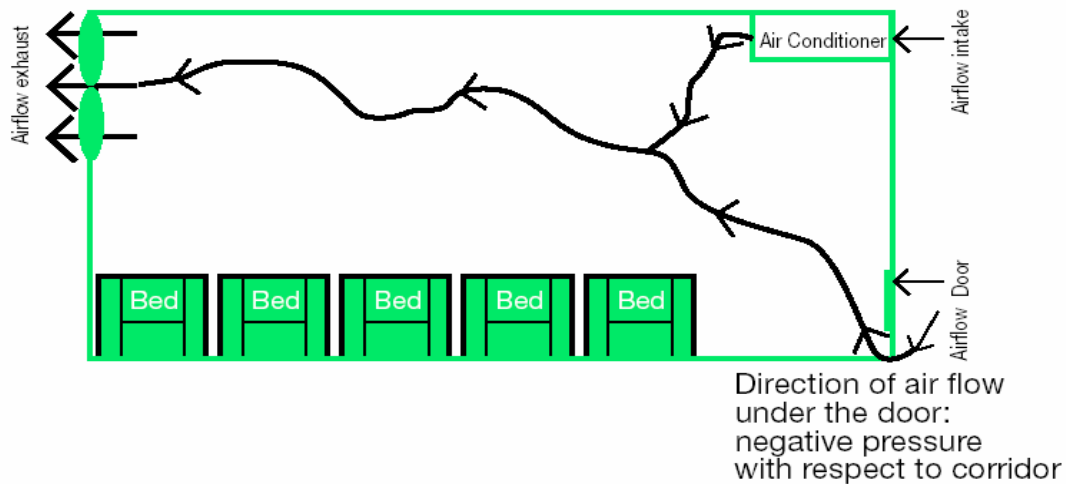
Challenges of achieving adequate ventilation and climate control

Effective ventilation is often at odds with efforts to make indoor climate more comfortable. In practice, air cooling or heating is more energy efficient with re-circulation of air. The implication of installing a split A/C and closing the doors and windows is, however, complete lack of air exchange. Careful attention must be given to ensuring adequate ventilation when installing climate control.

It is possible for rooms with air conditioning or heaters to have adequate ventilation. In the example in **Figure 3**, a well-installed exhaust fan has been installed on the other side of the room to achieve adequate air exchange, and air is allowed to enter the room by keeping a larger gap

under the door. It is acknowledged that this arrangement leads to less effective cooling than a sealed room, but safety with adequate comfort trumps maximal comfort without safety.

Figure 3: Schematic showing how adequate air exchange might be achieved in a room with air-conditioning/heating. The air conditioner is located away from the exhaust, near the door, so that cooled air sweeps across the room. An exhaust fan, adequate to achieve the required air exchange, is installed on the other side. Adequate air intake has been enabled by having enough space under the door (a few inches clearance) for air to freely enter the room.



National standards for minimum ventilation in health-care settings

Health-care facilities should maintain a minimum amount of ventilation during all climatic conditions (**Table 4**). These recommendations are based on the minimum ventilation rate estimated to reduce the probability of infection in an enclosed room to less than 5% with an hour of exposure to an infectious source case. In settings relying on mechanical ventilation (either fan-assisted or closed systems) ventilation rates can be calculated with the assistance of local engineers.

Table 4: Minimum air-changes per hour required for various health care settings

Type of Health-Care Setting	Minimum Air-Changes per Hour (ACH)	Minimum hourly averaged ventilation rates (liters/second/patient)
Registration areas	>6 ACH ³	>40 l/s/patient
Outpatient departments and their waiting areas	>6 ACH	>40 l/s/patient
Inpatients departments	>6 ACH	>40 l/s/patient
High-risk settings and their waiting areas ART centres	>12 ACH ⁴	80–160 l/s/patient

³ Equivalent to >40 liters/second (l/s) for a 4×2×3m (24 m³) room.

⁴ Equivalent to >80 l/s for a 4×2×3m (24 m³) room.

TB / Chest departments (outpatient and inpatient) Bronchoscopy procedure rooms MDR-TB wards and clinics Airborne precaution rooms	
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Where ACH is not able to be measured, as is usually the case in rooms with natural ventilation, the following standards for ventilation should be followed to ensure that air exchange is safely >12 ACH under all climactic conditions.

- Natural ventilation should be "controlled", with fixed, unrestricted openings that are insensitive to climactic conditions
- Openings should constitute >20% of floor area
- Openings should be on 2 sides, preferably opposite sides. For example, a 100 ft² room should have >10 ft² fixed, unrestricted openings on two sites, for a total of 20 ft²

Where these natural ventilation standards cannot be met, the addition of other measures should be considered. Improvements in ventilations should be based on the assessment of the facility and informed by local climactic conditions, building structure, regulations, and cost. If mixed-mode mechanical ventilation is used, the installation should be designed to achieve the minimum ACH standards. Calculation of exhaust fan requirements to achieve a minimum air exchange can be based on the rating of the fan in terms of cubic feet per minute (CFM).⁵ Of note, the fan rating should be adjusted downwards depending on estimates of the efficiency of installation, particularly air leakage and resistance from any covering mesh or screen. A typical adjustment to the fan rating would be to assume the fan operates at 75% of rated efficiency.

Considerations for hot climates

Climactic extremes may require some adjustments to ensure that minimum ventilation standards are achieved. In the case of hot climactic conditions, the following design considerations should be made.

- Air conditioners are to be avoided, or very cautiously used in patient care areas. If air conditioners are used, it must be acknowledged that the need to maintain adequate ventilation for airborne infection control may to some degree necessarily compromise the comfort of room occupants and the efficiency of the air conditioner.
- Minimize solar heat gain through proper use of sunshades or external shading.
- Use outdoor shaded waiting areas to the greatest extent possible.
- Where augmentation of ventilation is required, use air supply fans may help improve thermal comfort, compared to exhaust fans.
- The use of evaporative coolers ("desert coolers") may be an effective solution to achieve both comfort and adequate ventilation, as these tend to have powerful fans. Proper maintenance, however, is essential.

⁵ An online tool for estimating the total fan rating for a given room can be found at <http://www.csgnetwork.com/airexchangecalc.html>. This reference is provided for convenience, and is not an endorsement of the site.

- The installation of “whirlybirds” (also known as whirligigs or wind turbines) that do not use electricity and provide a roof exhaust system can greatly increase both ventilation and comfort.

Figure 4: Example of roof mounted turbine ventilation, or “whirlybird”, highly appropriate for improving ventilation in warm climates.



Considerations for cold climates

In cold climates, high ventilations rates may adversely affect thermal comfort, and are difficult to achieve as windows may be closed to keep the building warm. Even if normal heating is introduced, high ventilation rates usually mean energy efficiency will be low. Therefore, ventilation and heating strategies must be planned carefully.

- Building design should seek to capture the solar heat and minimize conduction loss through the wall. Proper insulation of walls and the use of double glazing on windows are desirable.
- Where augmentation of ventilation is required, use air exhaust fans may help maintain adequate ventilation, even where windows or doors are closed.
- Targeted radiant or direct near-body heating methods are more effective than common convective radiators. This includes modern electric coil heaters and heated blankets/mattresses.

Optimal arrangement of patient and staff should be implemented in all settings. Health care staff should be mindful of the direction of airflow to ensure they are closest to the clean air source, and that patients are closest to the exhaust. This involves arranging patients and staff so that contaminated air is not likely to cross directly into staff/patient spaces. The natural direction of air flow should be between patients and staff, and not across patients and staff (**Figure 4**). This is especially important for settings such as DOT centres, OPD exam rooms, and smear microscopy laboratories.

Directional control of air flow is recommended in specific high-risk settings where infectious patients with drug-resistant TB or other acute respiratory diseases of potential concern are likely to be managed – i.e. airborne precaution rooms, MDR-TB wards and clinics, and bronchoscopy suites. This simply means having in place a system to minimize the chance that airflow goes

from. In a room relying on natural ventilation that is situated away from other patient care areas, no additional changes would be required as there would be no area of concern for contaminated air to flow. It is important to keep the doors to corridor or other rooms closed, to prevent escape of infectious aerosols to other parts of the facility. The direction of air movement can be easily assessed using smoke tubes, strips of ribbon, or simply by observing the directionality of dense smoke from “Dhoop” or incense. Directional control of airflow can be achieved in mixed mode ventilation by proper attention to adequate exhaust and supply ventilation (as in Figure 3 above).

Figure 5: Schematic showing seating arrangement for patient and health care worker (red cross). In (A), natural ventilation would allow potentially infected air to cross health care worker. In (B), with this seating arrangement the chance of such exposure is lessened somewhat.

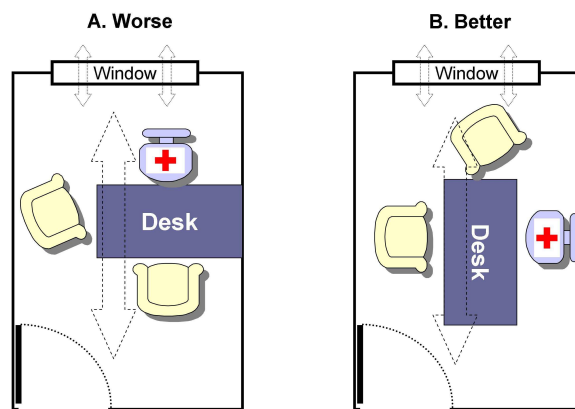
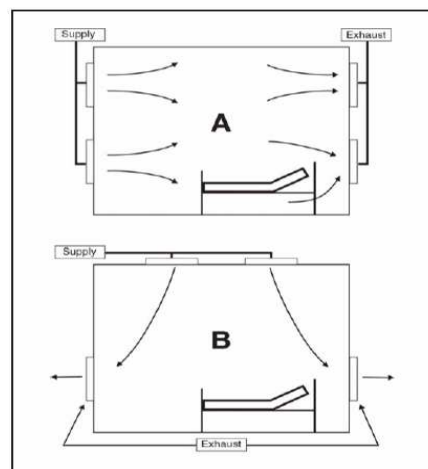


Figure 6: Schematic diagrams of mechanical ventilation, with optimal directional control or airflow in the room. In (A), supply is on one side, exhaust from the other, so aerosols are not dispersed to other patients or staff. In (B), supply is from the top, and again exhaust near the patient’s head, for optimal directional control.



UVGI

Priority should be given to achieving adequate air exchange using ventilation (natural or mechanical). However, in some settings it is not possible to achieve adequate ventilation; for example, because of climatic changes (e.g. in winter or during the night), or building structure. In addition, in settings such as MDR-TB wards and ART centres, transmission of TB poses a high risk of morbidity and mortality. In high-risk settings where adequate ventilation is not possible, a complementary option is to use upper room or shielded ultraviolet germicidal irradiation devices.

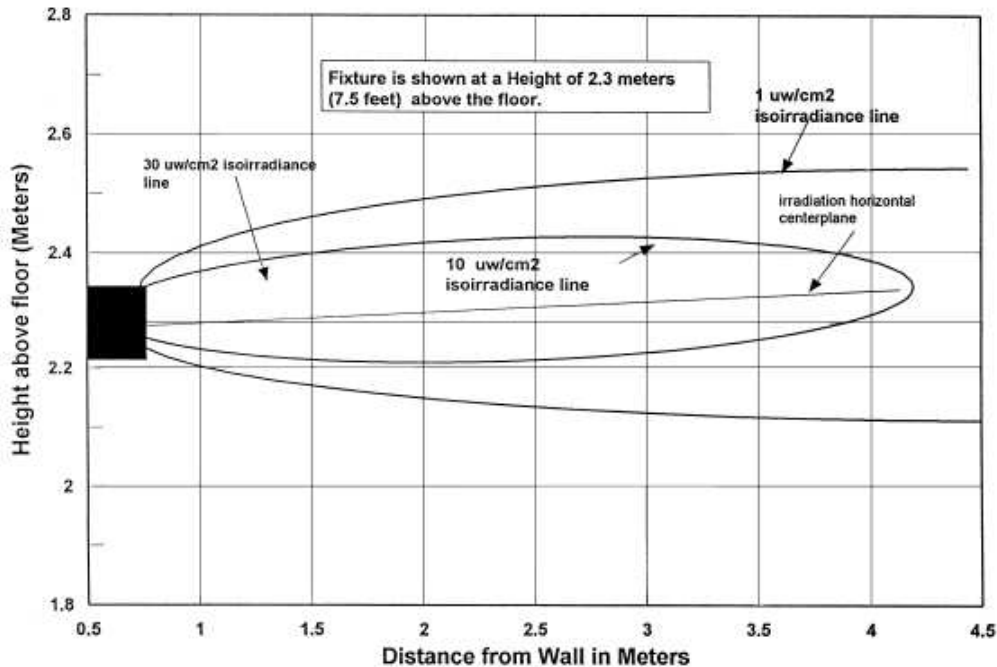
Table 5: Summary of key recommendations on UVGI

- UVGI should only be considered in high-risk areas (defined in Table 4) where adequate ventilation is not achievable.
- Installation is critical. If the UVGI is not appropriately installed, it may be ineffective or dangerous to staff/patients.
- Measurement of UV intensity is crucial and required for proper installation.
- Maintenance is critical, and should include cleaning with spirit at least twice-monthly (or more frequently in dusty environments) and periodic bulb replacements. If the UVGI is not maintained, it may become ineffective, providing a false sense of security to staff and patients. If maintenance and prompt bulb replacement with the correct product cannot be guaranteed, than UVGI should not be used.
- Installations should seek to irradiate the maximal air volume with the highest intensity UV, while keeping staff and patient exposure to less than 6.0 mg/cm² over an 8-hour period.
- Avoid installations that directly irradiate patients or have bulbs routinely visible.
- No obstruction should be placed between the UV bulb and the air that it is supposed to irradiate; e.g. transparent plastic bulb covers will absorb all UV radiation at germicidal wavelengths.

Ultraviolet germicidal irradiation (UVGI) uses a type of radiation that has been shown to kill or inactivate *M. tuberculosis* in air. UVGI is maximally germicidal at a wavelength of 254nm (UV-C, or short-wavelength UV). This sort of UV radiation differs from the longer wavelength UV in sunlight (UV-A and UV-B), in that UV-C penetrates poorly.

UV-C UVGI devices may be sometimes less expensive than structural alteration of the facility for ventilation purposes. Several studies have shown that a well-designed and maintained UVGI upper room system can disinfect *Mycobacterium* (or surrogate test organisms), with an efficiency of 10–20 equivalent air changes per hour. It has been estimated that when an average UVGI intensity of 10 µW/cm² is present, 63% of airborne tuberculosis germs that arrive in that “kill zone” will be killed in 24 seconds, and 99% will be killed in 2 minutes.

Figure 7: Vertical irradiance profile of a 30W UVGI horizontal beam fixture, showing 10 $\mu\text{W}/\text{cm}^2$ “kill zone”. From First et al., ASHRAE Transactions 1999:105.



UVGI effectiveness is affected by:

- Intensity of the radiation—depends on the wattage, condition, and age of the lamp. The intensity of radiation fades over time as the filament ages, and drops sharply as dust accumulates on the lamp.
- Length of exposure time—depends on how quickly air containing infectious particles moves past the lamp
- Proximity of infectious particles to the UVGI lamp—the placement and number of lamps used should be sufficient to bring radiation of adequate intensity to enough air volume.
- Mixing of air - inadequate air mixture has been shown to dramatically reduce the effectiveness of UVGI. Without air mixture, in effect UVGI will sterilize the same volume of air repeatedly, and not dilute contaminated air with the sterilized air.
- Relative humidity—UVGI effectiveness decreases with increasing humidity, as water vapor absorbs UVGI at the germicidal wavelength of 254nm. UVGI is not recommended for rooms in which the relative humidity of the air is greater than 70%.

There are a number of limitations to UVGI.

- UVGI only provides an equivalent to air exchange, and does not provide fresh air or directional airflow.
- If the UVGI is not installed and maintained properly, it may be ineffective at inactivating *M. tuberculosis* and provide a false sense of security.
- Poorly designed or installed UVGI may cause overexposure injuries to HCWs and patients.

Types of UVGI installations

UVGI may be installed in several forms:

- Continuous upper air irradiation, in which shielding placed below the UVGI sources prevents injury to occupants;
- Portable UVGI floor units;
- High-intensity UVGI in the ducts of a mechanical ventilation system (in-duct UVGI); and
- Bare bulbs can be used to irradiate areas when not occupied, for example in biosafety cabinets. Bare bulbs should be avoided in patient care areas, as these are most likely to cause injury.

The actual radiation levels of an upper-air UVGI installation are difficult to predict. For a given fixture, final radiation levels will vary for every room and for different parts of the same room.

Physical factors that affect each installation include:

- Type of lamps used;
- Age of lamps;
- Effectiveness of the fixture baffles at preventing radiation from reaching occupied areas;
- Locations of the fixtures; and
- Reflectivity of the walls and ceilings.

UVGI Safety Considerations

Overexposure to UVGI can cause painful but transient dermatitis or keratoconjunctivitis, similar to that caused by sun overexposure. The 8-hour exposure dose limit (threshold limit value) for germicidal UV is 6.0 mJ/cm^2 . This translates to 0.2 uW/cm^2 of measured UV intensity at eye level for areas where exposure will be constant everyday, such as the head of the patient's bed. In other areas where persons would be present only transiently, such as hallways, the intensity could be up to 2.0 uW/cm^2 .

The only way to tell if an installation is safe is to measure radiation levels in the occupied part of the room. Measurements should be made at numerous locations and elevations where people may be exposed for long time periods. For example, in an inpatient ward, readings should be taken at the heads of beds as well as the center and corners of the room.

Planning a UVGI installation

Specific suggestions for planning UVGI installations are given in **Appendix 5**. In general, one rule of thumb is to install the required number of fixtures necessary to achieve continuous, uniform upper-air exposure. Some sources have suggested approximately 30 W UV lamp power for every 200 ft^2 (19 m^3) of floor area, though this rule of thumb would be adjusted based on local building features. UVGI fixtures should usually not be open, directed at the ceiling, unless the area is one where persons will not be continuously exposed, like a corridor. Open upper air bulb installations frequently create high reflectivity, and tend to accumulate dust easily on the bulb, requiring frequent cleaning and maintenance.

Filtration (HEPA Filters)

Filtration is another option to remove infectious particles from the air. It may be considered where sustainable resources for membrane replacement and maintenance are assured, where natural ventilation is not possible, and where the risk of TB transmission and morbidity are high. Filtration devices perform poorly in high-dust conditions, as the effectiveness in terms of equivalent air exchange can rapidly diminish. Situations where it might be considered include small room volume settings like bronchoscopy suites, Laboratories, or individual TB patient rooms. Careful attention should be given to the equivalent air exchanges per hour the filter requires; most filters clean very little air per hour, and only add marginally to dilution of potentially infectious air with cleaned air.

If filters are chosen, then only true-HEPA membrane filters (rated to remove 99.97% of 1 micron particles) should be entertained. Other filtration mechanisms, such as ionizers, have not been adequately studied.

High-risk settings

Airborne Precaution Rooms

In some hospitals airborne precaution rooms are available for patient segregation. Airborne precaution rooms can be naturally ventilated or mechanically ventilated. It is acknowledged that mechanical ventilation is expensive to install and maintain in precaution rooms, often does not deliver the recommended ventilation rate, and may fail to maintain negative pressure.

Specifications for these rooms are suggested below.

Table 6: Recommended specifications and procedures for airborne precaution rooms

Room layout

- Post signage on the door.
- Ensure appropriate hand-washing facilities.
- Ensure appropriate room ventilation (> 12 ACH, or >80 l/s/patient average ventilation rate).
- Ensure directional control of airflow, with air flow only entering the room when the door is open, and exhausted outside safely.
- Naturally ventilated airborne precaution rooms: the air flow should be directed to areas free of transit, or safely outside where it may be diluted.
- Mechanically ventilated airborne precaution room: to control the direction of air flow the pressure of the room should be maintained slightly less than then pressure of the entry area (i.e. “negative pressure”), so that air flows into the room when doors are open.
 - Clean-to-dirty airflow;
 - A negative pressure differential of >2.5 Pa (0.01-inch water gauge);
 - An airflow differential >125-cfm (56 l/s) exhaust relative to supply;
 - Sealing of the room, allowing approximately 0.5 square feet (0.046 m²) leakage;
 - An exhaust to the outside, or a HEPA-filter if room air is re-circulated.

Room Setup

- Remove all non-essential furniture; the remaining furniture should be easy to clean, and should not conceal or retain dirt or moisture within or around it.
- Set up a trolley outside the door to hold PPE. A checklist may be useful to ensure that all equipment is available (see sample checklist).
- Stock PPE supply and linen outside the precaution room/area (e.g. in the change room).
- Stock the sink area with suitable supplies for hand washing, and with alcohol-based hand rub near the point-of-care and room door.
- Place appropriate waste bags in a bin. If possible, use a touch-free bin. Dirty bins should remain inside the precaution rooms.
- Place a puncture-proof container for sharps disposal inside the precaution room/area.
- Place an appropriate container with a lid outside the door for equipment that requires disinfection or sterilization.

Procedures

- Before being allowed into the airborne precaution areas, visitors should consult the nurse in charge, who is also responsible for keeping a visitor record. A roster of all staff working in the airborne precaution areas should also be kept for possible outbreak investigation and contact tracing.
- Patient-care equipment that is required for use by other patients should be thoroughly cleaned and disinfected before use.
- Ensure scrupulous daily cleaning of the airborne precaution room/area.

MDR-TB Wards

Table 7: Summary of recommendations for MDR-TB Wards

<ul style="list-style-type: none">• Located away from the other wards, with adequate facilities for hand washing and good maintenance and cleaning.• Adequate ventilation (natural and/or assisted ventilated) to ensure >12 ACH at all times.• adequate space between 2 adjacent beds , at least 6 feet• Cough hygiene should be promoted through signage and practice ensured through patients and staff training, ongoing reinforcement by staff• Adequate sputum disposal, with individual container with lid, containing 5% phenol, for collection of sputum• All staff should be trained on standard precautions, airborne infection control precautions, and the proper use of personal respiratory protection. A selection of different sizes of re-usable N95 particulate respirators should be made available for optional use by staff.
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MDR TB wards are inpatient facilities for admitting the MDR patients for initiation of treatment and managing clinical complications during treatment. This includes but is not limited to all RNTCP DOTS-Plus sites.

- Location and Design:
 - The facility should be located away from the other wards with preferably a separate passage for the patients to access the toilets.
 - The facility should have adequate ventilation (natural and/or assisted ventilated) to ensure >12 ACH at all times, preferably >15 ACH. This would be possible only if adequate fixed unrestricted openings, e.g. ventilator windows, are open at all times during the day and night in all seasons. Similarly if assisted ventilation is being used (e.g. exhausts) to maintain the adequate ACH it should ensured that these are kept switched on at all times.
 - Use of UVGI may be considered for such facilities as an alternative, if ventilation standards cannot t be achieved at all times of the day and seasons
 - In case of frequent power cuts in a setting requiring mechanical or UVGI to maintain safety, a power back-up facility (i.e. generator set) is recommended along with adequate provision for fuel and maintenance.
 - The distance between 2 adjacent beds should be optimal (at least 6 feet)
 - Visitors should be restricted to the greatest extent practical.
- General Hygiene:
 - Hand washing facility (Universal Precaution) shall be in place for doctors, health care workers and patients.
 - Running water, soap and alcohol hand rub solution shall be provided.
 - Frequent wet mopping of the ward shall be undertaken.
 - Lavatory shall be kept clean.

- Patient education should be conducted on the following at each admission, and reinforced frequently by staff.
 - Cough hygiene
 - Cough etiquettes
 - Sputum disposal
 - Proper use of surgical masks.
 - Restricted visitor entry

- Cough Hygiene:
 - Display sign boards in the ward demonstrating cough hygiene.
 - All patients admitted in the ward should be issued surgical masks.
 - Adequate measures for safe collection and disposal of sputum

- Sputum Disposal
 - Patients should be provided with individual container with lid, containing 5% phenol, for collection of sputum
 - Patients should be instructed on spitting the sputum directly in the container or in a tissue paper which is then thrown in the container.
 - The container should be emptied daily and the sputum should be disposed of as per the infection control guidelines

- Avoid posting of HCW working in MDR wards if they are immuno-compromised or are on immuno-suppressants for any indication

- Training of MDR TB Ward staff:
 - All the staff of the MDR TB ward shall be trained in Universal Workplace Precaution, Waste segregation and disposal and Air borne Infection Control Practices, with special reference to tuberculosis.

- Personal Respiratory Protection – i.e. N95 particulate respirators – must be made available for optional use by any staff working in the ward area. Regardless of whether or not staffs choose to use the respirator, all staff should be provided sensitization and appropriate training on how to choose, use and maintain the respirator.

ART centres

Table 8: Summary of recommendations for ART Centres

<ul style="list-style-type: none">• ART centres should be located not adjacent to DMC/DOT centers, with waiting area that is not shared by DMC/DOT centers• ART centres should have a well ventilated waiting & seating areas.• Screening of patients for respiratory symptoms & TB diagnosis would be done as soon as possible in the ART centres for early referral for diagnosis and initiation of treatment.• Fast-tracking of chest symptomatic should be done to ensure that there are minimum chances of contact of these patients with healthy ones.• Separate, well-ventilated waiting area for respiratory symptomatic should be made available wherever possible.• Health education on cough etiquette should be stressed upon by staff. IEC material on cough etiquette should be prominently displayed.• Ventilation standards for specialized care environments (e.g., airborne infection precaution rooms, protective environments, or operating rooms) should be adhered to.• As far as possible, use of re-circulating air conditioners in the waiting area should be avoided as these have been found to leading to no air exchange.

Special infection control considerations for ART centres

- Location and design
 - ART centres should be preferably located as away from Direct Microscopy Centre /DOT Centres.
 - It should have a well ventilated waiting & seating area. Separate, well-ventilated waiting area for respiratory symptomatic should be made available wherever possible (larger ART Centres).
 - Adherence to ventilation standards for airborne infection control (>12-15 ACH throughout during all hours of operation, in all seasons) should be ensured.
 - Open outdoor roofed additional waiting areas are encouraged, as are token systems to decompress crowded areas.
 - As far as possible, use of re-circulating air conditioners in the waiting area should be avoided as these have been found to leading to no air exchange.
 - Where natural ventilation is of concern, augmented ventilation through the well-planned use of supply and/or exhaust fans may be considered, if installations are properly designed and maintained, and electrical power is consistently available.
 - Use of UVGI may be considered for such facilities as an alternative, if ventilation standards could not be achieved at all times of the day and seasons
- General Hygiene:
 - Hand washing facility (Universal Precaution) shall be in place for doctors, health care workers and patients
 - Running water, soap and alcohol hand rub solution shall be provided

- Frequent wet mopping of the patient area shall be undertaken
 - Lavatory shall be kept clean
 - An appropriate Waste segregation and Disposal system shall be in place
- Cough Hygiene for persons with respiratory infection:
 - Cover their mouth and nose with a tissue when coughing and dispose of used tissue in waste containers;
 - Use a mask if coughing. Surgical mask may be issued to coughing patients
 - Perform hand hygiene (use an alcohol-based hand rub or wash hands with soap and water) after contact with respiratory secretions; and
 - Display sign boards requesting patients and family members with acute febrile respiratory illness use respiratory hygiene/cough etiquette.
 - Educate HCWs, patients, family members, and visitors on the importance of containing respiratory aerosols and secretions to help prevent the transmission of influenza and other respiratory viruses.
 - Posting signs requesting that persons with acute febrile respiratory illness refrain from visiting the health-care facility.
- Fast Tracking of known pulmonary TB patients and persons with respiratory infection:
 - Nurse of the ART Centre shall streamline the entire Fast Tracking of the patients at the ART Centres. More personnel may be involved to manage larger / crowded ART centres
 - Known pulmonary TB patients and persons with respiratory infection shall be identified at the Registration area
 - They will be helped by the nurse to get them counseled by the counselors, examined by the doctors and provided with the drugs quickly, without making them waiting in the regular queue. Fast-tracking of chest symptomatic will ensure that there are minimum chances of contact of these patients with healthy ones.
 - TB suspects shall be referred to the DMC / DOTS centre for their sputum smear examination as a part of Intensified Case finding. This will facilitate early recognition and identification of possible pulmonary TB patients.
 - Display of the Fast tracking system within the ART centre to dispel any confusion among waiting patients.
- Training of ART staff:
 - All the team members of ART Centre shall be trained in Universal Workplace Precaution, Waste segregation and disposal and Air borne Infection Control Practices, with special reference to tuberculosis.

Bronchoscopy/procedure rooms

Diagnostic procedures such as bronchoscopy and induced sputum collection are extremely effective in the generation of large numbers of respiratory aerosols. Bronchoscopes are well-established to lead to pathogen transmission if the scope or accessories are inadequately disinfected. Airborne infection control in such a high risk setting must follow the standard hierarchy of control measures:

- (a) Administrative measures to reduce risk of exposure to health care personnel and other patients inside or close to bronchoscopy room
- (b) Engineering controls to prevent spread and reduce concentration of infective aerosols within and around the bronchoscopy room, and
- (c) Judicious use of personal respiratory protective equipment by health care personnel involved in bronchoscopy and specimen handling.

For optimal results, good control at a previous level must be ensured before proceeding to the next level.

Administrative measures

- Strong commitment is needed from the hospital administrators for providing infrastructure, facilities and funds for implementing airborne infection control measures for bronchoscopy/procedure rooms. This should include necessary renovation/re-location of the procedure room, installation of necessary equipment, along with periodic maintenance and replacement.
- A comprehensive airborne infection control plan written specifically for the bronchoscopy room should be in place, and must be periodically updated based on past performance and new scientific evidence.
- Staff in the bronchoscopy room should have training regarding both tuberculosis transmission and airborne infection control guidelines for bronchoscopy. Compliance should be assessed routinely as part of performance evaluation.
- Appropriate signage advising need and techniques of cough etiquette and sputum disposal must be prominently placed in the area. Healthcare workers or volunteers in the bronchoscopy room can utilize the opportunity for additional emphasis on these measures and further train patients.
- In general, bronchoscopy should be avoided unless the desired clinical information cannot be obtained through other less invasive procedures. If bronchoalveolar lavage is planned for diagnostic purposes, the patient should have at least two negative sputum smear results before the procedure.
- Patient schedule should be structured to minimize exposure to other persons. Tuberculosis suspects should be brought to the bronchoscopy room / waiting area only prior to the actual procedure. The general policy of asking patients to report at a fixed time and wait for their turn should be avoided. If possible, a separate time, or day of the week, could be assigned for these patients to limit the time of potential spread of infection in the bronchoscopy room.

Engineering controls

- The bronchoscopy room must exceed 15 air exchanges per hour. Air flow should be directional, from room entrance to the back and outside.
- The room should have local exhaust ventilation that vents room air to the outside, and not into the corridor or waiting area. The air exhausted should be at least 2 meters from any open window.
- If resources are available, specific air cleaning methods such as ultraviolet germicidal irradiation (UVGI) or HEPA filtration may be installed. However, they merely complement, and are not a substitute for, the more general measures listed above. They may prove especially useful in closed air-conditioned suites, or if the exhausted air cannot be vented outside or is discharged into a general ventilation system. These measures can also be used to further clean air that is exhausted outside. If these systems are in use, they must be carefully installed and meticulously maintained to ensure optimum function.
- Adequacy of ventilation, and number of air exchanges, should be objectively assessed at periodic intervals.

Personal respiratory protection measures

- Patients should be instructed to wear disposable face masks while waiting for procedure or immediately after the procedure. Cough etiquette must be enforced.
- Healthcare workers in the bronchoscopy room should use respiratory protection using N95 particulate respirators. Simple surgical face masks may be insufficient to ensure protection against infective aerosol. Healthcare workers must be given time and training to adjust to these infection control measures. Disposable N95 respirator masks may be an economically suitable option; these may be reused by the same person till they lose fit or get soiled. The mask selected should be well-fitting. A seal check must be conducted each time the respirator is donned. The respirator should be continuously used both during the bronchoscopy procedure as well as during specimen handling. Manufacturer recommendations must be strictly adhered to for all aspects of respirator use.

Intensive Care Units

Closed health-care areas such as intensive care unit (ICU) pose specific challenges in ensuring airborne infection control. It is therefore imperative that these necessary infection control procedures remain in place and are used routinely. As in other areas, a comprehensive and hierarchical approach using administrative control measures, environmental controls, and personal protective measures (in that order) is necessary to achieve this objective.

These measures below are recommended **in addition to Standard Precautions** (as described in the Background, p. 11) and infection control measures for inpatients (p 20).

Managerial activities

- ICUs should develop airborne precaution rooms or areas.
- It is important to have a detailed infection control protocol in place.
- The clinical and nursing staff should receive training on Standard Precautions, general hygiene, and specific infection control measures in the ICU.
- Sufficient material should be available to (a) ensure general hygiene (e.g. soap and running water, alcohol-based hand rubs, disposable towels, etc.), and (b) perform cleaning and disinfection of patient bed and other material at periodic intervals. Adequate supply of personal protective equipment should also be ensured.

Administrative controls

- Segregation of patients with known or suspected respiratory infections should be practiced in ICUs.
- Proper disposal of respiratory secretions generated through suctioning in mechanically ventilated patients, as well as used personal protection equipment, is mandatory.
- Visitor entry should be restricted to the minimum possible number. The visitors should also be advised to take necessary precautions, in line with the general hygiene practices followed in the ICU.

Environmental controls

The necessary environmental controls are most important in two aspects: (a) engineering aspects related to the distribution of space for patients and health care workers in the designated ICU area, and (b) control of ventilation.

Required

- Regular cleaning and disinfection activities should be conducted. Surface cleaning (using cloth or mop moistened with water or a liquid detergent) should precede disinfection, taking care to minimize aerosolization. There is little scientific evidence that periodic fogging of unoccupied cubicles reduces risk for subsequent patients.
- At least 12 air exchanges are recommended hourly, though more may be preferred. Alternatively, 80 l/sec/patient ventilation rate should be achieved.
- The environmental air ventilation should be controlled (i.e. mixed-mode or mechanical ventilation). Such ventilation can be combined with air conditioning and/or special filtration

systems. If split A/C is used for cooling, there should still be an additional system to ensure adequate ventilation in the environment.

- While using mechanical ventilators for intubated patients with conditions of potential concern regarding airborne transmission, bacterial/viral filters should be used on exhalation valves. These should be regularly changed as per manufacturer guidelines, and used filters judiciously disposed off. Ventilator tubing, etc. should also be disinfected as per manufacturer recommendations.

Desirable

- As far as possible, an open area with patient beds spaced around, without any segregation of patients from each other or from health care providers, should be discouraged. It is ideal to have individual cubicles for each patient with sufficient space for patient bed and other equipment necessary for providing critical and respiratory care. This not only prevents nosocomial transmission to other patients and staff in the ICU, but also makes disinfection easier after the patient leaves the ICU. If this is not feasible due to space or financial constraints, then two or three patient beds may be grouped in a single cubicle, with wide separation between beds.
- Have separate airborne precaution rooms for patients having respiratory infections having a high potential for airborne spread that has a significant clinical and/or public health impact. If feasible these should be designed for directional control of airflow. Air should flow into the airborne precaution area, and be exhausted out without re-circulation.
- Use non-recirculating ventilation, which will exhaust air to the atmosphere outside well away from any habited area, air intake, or open windows. If air is either being re-circulated back into the ICU or to other areas in the health care facility, then the air inflowing into the ICU or the other areas must be decontaminated of (for instance using HEPA filters, or passing the exhaust through a duct with in-line UV treatment).

Personal protection

- Health care workers should take adequate precautions (including general hygiene measures like hand disinfection) while providing care to patients in the ICU.
- If aerosol generating procedures (especially nebulization, cardiopulmonary resuscitation, endotracheal intubation, manual ventilation, oral/airway suctioning, or bronchoscopy) are performed, in addition to other personal protective equipment like gloves, gowns, and goggles, N95 particulate respirators should be used.
- Every time personal protective equipment is removed, hand hygiene should be performed immediately thereafter.

Radiology Areas

The general administrative, environmental and personal protective measures applicable to a general outpatient setting are also relevant to the radiology department.

In addition, radiology departments should attempt to routinely practice the following principles.

- Provide patients who are coughing, or who are known to have TB or other infectious diseases with high potential of airborne transmission, with disposable face masks and cloth/tissue for covering their mouth while coughing.
- Provide priority to potentially infectious patients sent for chest radiography, to minimize their stay in the department.
- Schedule inpatient chest radiographs on TB suspects and other infectious patients for non-busy times (for instance in the afternoon, or towards the end of the routine morning schedule).
- Ensure that the room where chest radiographs are taken is adequately ventilated; if multiple rooms are used for radiography, the room with the best ventilation should be assigned to potentially infectious patients.

These administrative procedures for safer radiology areas should be posted on the walls in all radiology suites.

Autopsy Suites

- The dead bodies must be completely sealed in impermeable cadaver bags prior to transfer to mortuary or autopsy room. This transfer should be made as early as possible after death.
- If autopsy cannot be performed immediately, the cadaver must be maintained under refrigeration at the mortuary till autopsy.
- Mortuary staff and autopsy team must be alerted prior to transportation of any cadaver that possesses infective risk.
- Entry to and exit from the autopsy suite should be into separate non-connected areas. The former should be used to dress in, and the latter to dress out and to dispose used personal protective equipment.
- Autopsies should be conducted in well ventilated suites with at least 12 air exchanges per hour. Exhaust systems around the autopsy table should direct air and aerosols away from personnel conducting the autopsy.
- Wherever possible, avoid splashes during removing, handling and/or washing organs.
- Several methods can be used to reduce aerosol generation, such as avoiding high pressure water sprays, opening intestines and other hollow viscera under water, and avoiding use of power-saws as far as possible.
- Wherever possible containment devices should be used (e.g. bio-safety cabinets for handling and examining individual organs).
- After autopsy, all contaminated surfaces and used instruments should be cleaned with water and detergent, and then disinfected using chemicals with sufficiently long contact time.

- Personnel handling the dead bodies, prior to and during autopsy, should wear disposable waterproof gowns, gloves, surgical masks, and face-shields. If aerosol generation during autopsy is contemplated or the patient is known or suspected to have had TB, persons involved in autopsy should use a particulate respirator (N95).
- After removal of personal protective equipment, all personnel should follow hand hygiene before returning to subsequent duties.

TB laboratories

Designated Microscopy Centers

Direct sputum microscopy is a relatively low-risk activity as long as safe work practices are implemented properly. The following work practices are recommended to ensure that microscopy laboratory technicians are not exposed to aerosols from sputum specimens.

1. *Sputum collection*: Sputum must be collected in a well ventilated area with direct sunlight. It should not be collected in laboratories, toilets, waiting rooms, reception rooms, or any other enclosed space. If indoor sputum collection is required due to space constraints, specifications for a safe indoor sputum collection area are provided in **Appendix 6**.
2. *Smear preparation*: Smears should be prepared in a well ventilated environment, near an open flame.
3. *Work bench*: Work Benches should be cleaned daily with 70% Alcohol.
4. *Sputum container/applicator sticks/slides*: sputum containers, applicator sticks and slides should be disinfected with 5% Phenol overnight before discarding. They may be discarded in deep burial pits or may be tagged for appropriate disposal via the hospital biomedical waste management system.
5. *Sputum pots in the inpatient wards*: These may be disinfected with 5% Phenol for one hour, and then emptied into the routine drain.

TB Bacteriology Laboratories

Note: No amount of Environmental control or Personal protection can be a substitute for Good Microbiological Procedures.

The Laboratory microbiologist is the responsible officer for TB infection control measures. The laboratory microbiologist in turn can assign these responsibilities to other senior laboratory personnel, in case of her/his absence. Given the large list of activities that may generate unsafe *M. tuberculosis* bio-aerosols (**Table 9**), laboratories require special attention to infection control. Careful attention to laboratory practices can also reduce opportunities for cross-contamination; hence will contribute the quality of routine patient specimen testing.

Table 9: TB Bacteriology laboratory activities that may generate aerosols

Activity	
1	Preparing specimens for centrifugation and AFB culture
2	Centrifugation of specimens
3	Inoculating cultures from specimen sediment
4	Handling unopened primary- isolation plates or tubes

5	Staining smear of material from culture
6	Manipulating cultures (suspension preparation, vortex, and transferring) of <i>M. tuberculosis</i> complex on solid medium
7	Transferring large volumes of cultures or suspensions of bacilli
8	Disposing of cultures of <i>M. tuberculosis</i> complex
9	Inactivation of specimens for isolation of DNA and other macromolecules on <i>M. tuberculosis</i> complex species
10	Shipping cultures or specimens of <i>M. tuberculosis</i> complex

Administrative Controls for TB bacteriology laboratories

The following Administrative TB control measures should in place, at the minimum, to reduce the risk for exposure to TB infectious aerosols, in IRL -laboratory setting.

Administrative controls consist of the following activities:

- Written TB infection control measures for lab are available, and LTs are trained/oriented in ensuring airborne precautions
- Standard operating procedures are in place, and lab staff trained on their use, for all laboratory procedures from sputum handling through culture manipulation and waste disposal.
- Orientations/trainings/refresher activities for laboratory activities are performed, periodically, once in a year.
- Emphasis is placed on timely availability of laboratory results & reporting.
- Appropriate signs, check-lists are posted in laboratory, especially the discarding bins/buckets/containers.
- Monthly analysis & abstracting of results and assessment of laboratory procedures is carried out.
- Shipping of cultures to reference laboratory need to follow bio-safe-triple packaged containers.

Specific procedural considerations and bio-safe practices are summarized in **Table 10**.

Table 10: Summary of recommended administrative and bio-safe practices for TB bacteriology laboratories

Activity	Administrative controls	Bio-safe practice and procedure
Preparing specimens for centrifugation and AFB Culture	Train personnel in safety procedures	Conduct all work in the BSC on a tissue-wad moistened with a tuberculocidal agent; use aerosol-containing safety cups for centrifugation
Centrifugation of specimens with live TB bacteria	Bio-safe centrifuge & biocontainment devices	Use aerosol containing safety cups for centrifugation; open only in the BSC.
Inoculating cultures from specimens	Use BSC and follow biosafety practices and procedures	Follow aseptic techniques; autoclave all wastes from the BSC
Handling unopened primary-isolation culture bottles/Mccartney bottles	Treat all cultures as potentially infectious	Carry all the materials in trays and in designated racks; and not individually in hands. Label the racks and trays.
Staining smear of material from culture	Bio-safety cabinet class II	Prepare slides in a BSC. Before removal from BSC, heat-fiz to kill tubercle bacilli. Do not carry individual slides in hands, carry as a whole on a slide-carrying tray
Manipulating grown	Label Culture bottles as containing M.	Open all culture bottles only in BSC. Irradiate inoculation loops before

cultures of <i>M. tuberculosis</i> complex species on solid medium	tuberculosis complex; and screw-caps tightened. Bio-safety cabinets Class II B.	and after use, in the flame.
Transferring suspensions of bacilli	Ensure BSC is certified annually using calibrated instruments by qualified person; maintain directional air flow and room air changes; Adhere to spill protocol for management of accidents.	Vortex and sonicate suspensions in BSC in closed tubes that are opened only in BSC. Use aerosol-containing centrifuge cups and open only in BSC. Manage waste safely.
Disposing of cultures of <i>M. tuberculosis</i> complex	Identify material with proper disposal labels and autoclave prior to disposal.	Discard liquid waste into a tuberculocidal 5% phenolic disinfectants solution; transfer to autoclave carefully for sterilization.
Shipping cultures or specimens of <i>M. tuberculosis</i> complex	Provide approved and safe shipping containers	Ship in triple – packaged container. Follow SOP and regulations for transport of diagnostic specimens and infectious substances.

Environmental controls required for TB bacteriology laboratories

The minimum environmental control measures for TB bacteriology laboratories are listed below:

Table 11: Summary of environmental controls recommended for TB bacteriology laboratories

<ul style="list-style-type: none"> • <i>The laboratory meets at minimum complete WHO Biosafety laboratory level 2 standards, in accordance with the RNTCP laboratory committee recommendations for culture and DST laboratories.</i>
<ul style="list-style-type: none"> • Laboratory is either placed at the blind-end of building and/ physically Isolated from the common lab/hospital environments • Access to the culture and DST rooms is through an anteroom. The entry to lab is restricted to trained laboratory personnel. • The containment room where culture and DST is carried out is sealable in case of spill and aerosolization for decontamination. • Biological safety cabinets (BSC) class II, with 100% exhaust (i.e. ducted outside) is provided and used. • Bio-safety cabinets ducted to outside, while switched ON, would maintain an inward air flow into the culture and DST facilities • Bio-safe centrifuges, with aerosol-seal buckets is provided and used. • Hand-wash sink is provided in the culture & DST room with effective disinfectant • Autoclave (steam sterilization facility) is provided within the laboratory facility.

Personal Protection measures for TB bacteriology laboratory staff

Following protection measures to be followed in the lab by lab staff

- (a) For sputum collection & smear microscopy:
 - a. Proper cough hygiene needs to be explained to the patients
 - b. Collection should be in an open area, or in a properly designed and maintained indoor sputum collection booth (**Appendix 5**)
 - c. LT would maintain at least one arm length distance and upwind when a patient is collecting a sputum sample.
 - d. Wear lab coats while performing the lab work.
- (b) For culture and DST activities:

- a. All personnel working in culture laboratory need to wear separate clothing, not the common lab coat. Separate closed-toe foot-wear to be used at all times. Chappals or sandals are not appropriate.
- b. All personnel are to wear an N95 particulate respirator while performing DST, or manipulating cultures for any reason.**
- c. Decontaminate lab coat before laundering or disposal.
- d. In case of accidents and spillages, lab personnel should strictly adhere to the procedure given below:
- e. Personal Protective equipment (PPE) should be worn in the following order
i) Disposable gloves, ii) Coats/suits/overalls, iii) Respirator/mask
- f. PPE should be removed in the following order before leaving the laboratory
i) Respirator/mask, ii) Coats/suits/overalls, iii) Disposable gloves

Accidents and Spillages

Any major accidents in the laboratory should be entered in the register along with remedial measures taken before undertaking further work.

Laboratory personnel who are accidentally exposed to an infectious TB aerosol or solution should report the incident as soon as possible to the Laboratory Microbiologist/ Director. The Laboratory Director will see that necessary treatment or health monitoring is organized without delay.

Spills inside biological safety cabinet

A Bio-safety Cabinet is designed to contain spills and associated aerosols which are released during work within the cabinet. A spill of a TB material should be attended to immediately.

Decontamination of the work zone is done by direct application of 5% phenol disinfectant solution along with a thorough wipe down procedure. Formaldehyde gas decontamination may be required to treat inaccessible sections of the cabinet interior following a spill.

Table 12: Procedures for spills inside and outside biological safety cabinet

Inside Biological Safety Cabinet:

- 1) All workers using the Bio-safety Cabinets should keep absorbent materials (gauge cloth/adsorbent sheet) and 5% phenol within the cabinet.
- 2) Alert all people in lab of immediate area of in the event of spill.
- 3) Spread 5% phenol soaked wipe immediately, while the biological safety cabinet continues to operate. Wait for 15-20 minute.
- 4) Wear double pair of gloves during decontamination procedure.
- 5) Contain the spill and decontaminate.
- 6) Use paper towels to wipe up the spill, working from the edges into the center.
- 7) Decontaminate equipment. Items that are not readily or easily surface decontaminated should be carefully placed into autoclave bags and removed for further treatment (e.g., decontamination by autoclaving)
- 8) Contaminated gloves and clothes (sleeves are most likely to be contaminated and, remove and decontaminate the lab coat by autoclaving or soaking in decontaminant).
- 9) Individuals involved in the spill and clean-up should remove protective clothing (disposing and decontaminating), wash their hands and face with an appropriate detergent soap, and report to the Lab in-charge.

Spills outside biological safety cabinet

Spills on equipment (such as vortex, centrifuge, incubator, refrigerator etc.), laboratory benches, walls, or floors:

- 1) Immediately indicate to all personnel working in the lab, and evacuate for 1 hour to allow dissipation of aerosols created by the spill (negative air pressure system would clear the aerosols).
- 2) Leave the biological safety cabinet operating and cultures inside cabinet.
- 3) Leave the containment facility following exit procedures.
- 4) Close laboratory doors and post warning signs to prevent others from entering the laboratory.
- 5) Thoroughly wash hands and other apparently contaminated areas with soap and water. Put on clean disposable gloves.
- 6) If personal clothing is contaminated, remove all outer clothing and place it in the autoclave or container for autoclaving. Put on clean garments.
- 7) Wear the N95 particulate respirator, cover-all and double pair gloves, and reenter
- 8) Upon returning to the laboratory to start decontamination Cover the spill area with paper towels soaked in 5% Phenol solution. Do not pour decontamination solution directly onto the spill in order to avoid additional release of aerosols.
- 9) Let stand for 20 minutes then wipe up with paper towels.
- 10) Wipe up the spill with the soaked paper towels and place the used towels in an autoclave bag and autoclave.
- 11) Place gloves and paper towels in autoclave bag and autoclave.
- 12) Spill is inside the centrifuge bucket/tube: Always use the aerosol containment cups for centrifuging. Always open the centrifuge buckets inside the bio-safety cabinet. Autoclave the buckets.
- 13) Wash hands and other apparently contaminated areas again with soap and water.
- 14) Remove all protective equipment immediately upon leaving the work area and as soon as possible if overtly contaminated. De-Contaminate and DISPOSED.

Waste disposal and handling

All infectious waste should be discarded in the bio-safety disposal bin. All infectious solid waste-wipes, swabs, plastic, paper towels, gauze pads, gloves, etc., should be placed inside the double autoclave bags, sealed with autoclave tape and sterilized at 121°C for 30 min in the autoclave.

Liquid waste, in the steel discarding bins, should be disinfected in 5% phenol for at least 1 hour, before sealing the caps and autoclaved at 121° c for 30 min.

All reusable material such as glass ware should be autoclaved in the autoclave steel trays for 121°c for 30 min before washing and repacked for sterilization.

For more details, refer to the waste disposal guidelines in the RNTCP SOP for Culture and DST.

Health worker safety and Capacity development

Health care worker safety

HCW are essential in the fight against TB and HIV and they need to be protected from nosocomial transmission. This is even more pressing in the current context of staff shortages in many resource constrained countries. Staff working in congregate settings such as prisons, are also at increased risk and need to be protected as well. Moreover, HCW also have an important role in providing a safe environment not just for their patients, but also for themselves and others working in healthcare settings. Understanding the importance of TB IC policies and practices as well as the role and responsibilities specific to each cadre of staff underpin the effectiveness of IC strategies.

The risk to staff will never be zero. The best contribution to worker safety is the implementation of recommended work practices and administrative controls. Work practice and administrative control measures will reduce the time HCWs are exposed to persons with undiagnosed and untreated TB. Environmental controls will improve ventilation and thus dilution of any *M. tuberculosis* particles in the environment. In certain instances where HCWs will be working in high risk environments such as sputum-induction rooms, personal respiratory protection may be warranted.

Encouraging and enabling health care workers to know their HIV status should be a priority of all health care services, and HIV care programs, in particular. Uptake of testing can be facilitated by providing accessible, acceptable, confidential HIV counseling and testing, including periodic retesting, and by recognizing and ameliorating any stigma attached to HIV counseling and testing. Provision of care and treatment including access to antiretroviral drugs, and options for reassignment of HIV positive staff away from high risk work environments should be considered.

Personal respiratory protection

Particulate respirators, if properly fitting and correctly used, provide some additional protection to the user against airborne infection. Particulate respirators effective against airborne pathogens include those certified as N95, as FFP2, or greater protection ratings.

Masks, meaning facial coverings without certification against 0.3 micron particles (including typical 3-layer surgical masks) are effective in source control for patients, i.e. to reduce the production of respiratory droplets of all sizes. Masks for HCW may be useful for protection from large respiratory droplets, and protection of mucous membranes. The use of masks by HCW remains an important part of droplet precautions.

HCW should understand the appropriate role of personal respiratory protection. Proper implementation of administrative and environmental controls is first and second line of defense against acquisition of airborne infection. Respirators only add a layer of insurance where the risk to HCW is especially high.

Settings in India where particulate respirators are recommended for protection against airborne infection

- Laboratories: When manipulating cultures (solid or liquid media), despite use of biosafety hood or negative pressure facility
- Bronchoscopy: for all staff in bronchoscopy suite
- MDR Wards (optional): Respirators should be made available for optional use by staff, with all staff receiving training and sensitization on their use.
- As recommended by MoHFW to contain spread of disease of public health importance and unknown transmission (e.g. Influenza H1N1)

Proper selection of a good fitting respirator should be ensured; a range of different sizes or types should be available to fit different staff. Quantitative or qualitative fit testing, if properly conducted, are optimal. However, subjective fit testing is acceptable and more feasible. Subjective fit testing implies the use of positive and/or negative pressure seal-checks to ensure that a comfortable, snug, and effective fit is possible. Everyone provided a respirator should be given training on how to use it.

Hand hygiene should be conducted before donning and after removal of respirator. Respirator fit should be confirmed each use with a quick positive and/or negative pressure seal check, which only requires a few seconds.

Under routine conditions, respirators may be re-used till soiled or till proper fit is no longer possible. Separate guidance on re-use may be forthcoming in specific situations if concern for respirator as fomite requires periodic disposal.

Surveillance for TB disease among health care workers

Surveillance for TB disease among staff can provide data that are essential for informing the implementation of TB infection control measures. As a disease with clear airborne transmission, the implementation of airborne infection control activities should reduce the number of new infections and hence the number of TB cases among staff. Other illness are also possible proxies for effectiveness of implementation of airborne infection control activities, such as seasonal respiratory illness or influenza; however, the large component of contact and droplet transmission for these mostly viral diseases makes them a less specific indicator of airborne transmission risk.

Routine reporting of instances of TB disease among health care workers is a recommended activity for all health care facilities. Facility infection control focal points and administrators should be aware of instances of TB disease among staff, perhaps through inclusion of questions regarding TB in periodic health checks. Regardless, this information should be compiled at the facility level on a routine, annual basis.

Specific methods for reporting such information to districts are being assessed through operational research, and are hence not included in these guidelines.

Capacity development

Capacity development (knowledge and skill building) is an essential component of human resource development. HCWs need to receive training in the basic concepts of infection control. Both pre-service and in-service training curricula need to be addressed.

Pre-service: The curricula that are provided in pre-service training for all health and allied health professional at training institutes, colleges and universities needs to be reviewed and where appropriate, strengthened to reinforce good practices in infection control. This will require active participation of representatives from the Ministry of Education (MOE) and the Ministry of Health (MOH).

In-service: Staff currently employed in health care and congregate settings need to consider infection control as part of their daily practice. Provision of training to all those involved in care – from the clerks and receptionists of the facility to the front – line workers, laboratory technicians, managers and finance officers responsible to ensure the operational efficiency of the facility should be involved.

Follow-up: Methods to follow-up training to ensure the knowledge and skills acquired are being implemented should be incorporated into regular monitoring and supervisory activities. Tools or checklists should be reviewed and where necessary, adapted for this purpose.

Trainings on Airborne Infection Control

Trainings on AIC are an integral part of Medical Education Department and State Institutes of Health and Family Welfare with organizational support from NRHM and technical support from RNTCP. Budgets for the training of staff of the individual programmes are to be borne by the respective health facilities through their annual institutional budgets, for their respective facility personnel. The State TB Cell and State TB Training and Demonstration Centre would play a crucial role in providing the necessary technical support for these training. Detailed guidelines for trainings on AIC measures are in the table below.

Table 13: Recommended training for State and District Officials, and Health-care facility administrators on airborne infection control

Title	Organizers	Trainers	Specific Trainees	Level at which training occurs	Days	Training materials
National level Workshop of State Officials on AIC Guidelines	CTD and NAICC	NAICC	SAICC, State Master Trainers, State Institute of Health and Family Welfare (SIHFW), Medical Education Dept, SACS, STC and STDC Officials	National Level	5 days	<ul style="list-style-type: none"> • Guidelines on Airborne Infection Control in Health Care and other settings. • Field visits for facility risk assessments • Presentations, Exercises, Group work
State level Workshop of District Officials and	SIHFW / STDC (in coordination)	NAICC representatives, SAICC, SIHFW, State Master	Facility Administrators (Dean, Medical Superintendents, COE I/Cs, PHC MO)	State level	4 days	<ul style="list-style-type: none"> • Guidelines on Airborne Infection Control in Health Care and other settings.

Health Care Facility Administrators on National Airborne Control Guidelines	with STC, CTD and NAICC)	Trainers	District Officials / Supervisors (District Subcommittee for BMW/IC, District Health Officers, District Training Team, BHOs, District Programme Managers)			<ul style="list-style-type: none"> •Field visits for facility risk assessments •Presentations, Exercises, Group work
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Since the administrators and superintendents of the facilities would be mainly dealing with all levels of infection control measures viz. administrative, environmental controls and personal protective measures including the managerial controls of these measures at the facility level, the national guidelines for airborne infection control in health care and other settings would be the principle training course material for them. Important portions of the training module for HCWs would also be shared with them. The training course would comprise of reading guidelines, presentations, exercises, group work, field visits and risk assessment exercises.

Training of frontline health care workers on Respiratory Infection Prevention and Control & Standard Precautions

This activity revolves around strengthening of basic infection control practices at the health care worker level, with emphasis on Standard Precautions and inclusive of elements of Airborne Infection Control that are relevant for health care workers at the field level.

Standardized training material for the training of health care workers in a package of Respiratory Infection Prevention and Control (RIPC) in Health Care Facilities has been developed and published by WHO and partners. The RIPC training package would cover a comprehensive approach to include standard precautions including the use of personal protective equipments (PPE) for all forms of infectious respiratory microorganisms including TB and influenza. This will equip the health care workers on preventive and control measures for respiratory pathogens transmitted by droplet, contact and airborne modes of transmission. This package would be used for training of all cadre of health care workers including doctors, nurses, paramedical staff, other support staff (class IV), contractual support staff etc.

This package is being adapted and aligned with the national guidelines on airborne infection control in health care and other setting for the training of health care workers in India. The trainings on RIPC for all the programme personnel and other field staff are to be integrated into the individual induction programme trainings, with one full-day of induction training dedicated for RIPC.

Patient Counseling and Household Precautions

Early case detection and initiation of treatment remain the most important interventions for reducing the risk of airborne infection transmission in the household. For TB patients, all adult and child household and close contacts should be assessed for cough of any duration or other TB symptoms. Any TB contacts with cough should be investigated without delay.

Counseling

Patients with respiratory infections are potentially infectious. Patients and their family members should also be educated on the importance and proper practice of hand washing, cough etiquette and respiratory hygiene. Cough etiquette and sputum disposal should be discussed as important general hygiene issues, for anyone with respiratory symptoms – not just the TB patient.

All TB patients should be educated on the various aspects of the disease and intensively counseled on the importance of treatment adherence and completion. Counseling for family members should ensure that patients are not unnecessarily stigmatized, and that the importance of proper anti-TB treatment to render patients non-infectious is highlighted. Particular emphasis on cough etiquette for the TB patient at the beginning of treatment can be made.

Household Precautions for TB patients

Some specific measures to reduce exposure in households include:

- Houses should be adequately ventilated, particularly rooms where people with infectious TB spend considerable time. Natural ventilation is mostly sufficient to provide adequate ventilation. Windows should be open as much as possible.
- Smear positive TB patients should spend as little time as possible in enclosed, crowded settings or in public transport, till they are smear-negative.

Patients and family members should be educated on collection of sputum and disposal. Simple options for safe sputum disposal that patients can be counseled about include:

- Dispose of sputum in paper (tissue or any other paper), and burn or bury it in the evening.
- Dispose of sputum in a pot with ash or lime, and bury the contents in the evening.

MDR-TB

Since patients with MDR-TB usually sputum convert later than those with drug-susceptible TB such patients remain infectious for much longer period even if treatment is initiated. This may prolong the risk of transmission in the household. In households with culture-positive MDR-TB patients, the following guidance should be observed, in addition to the measures given above:

- MDR patients require more frequent counseling to ensure treatment adherence, considering that the treatment is prolonged.
- Culture-positive MDR-TB patients should always practice cough etiquette and wherever possible patients should be encouraged to use masks

- Ideally, family members living with HIV, or family members with strong clinical evidence of HIV infection, should not provide care for patients with culture-positive MDR-TB.
- Children below five years of age should spend as little time as possible in the same living spaces as culture-positive MDR-TB patients. Such children should be followed up regularly with TB screening.

Monitoring and Evaluation

Well structured monitoring and evaluation systems at all levels provide managers and decision makers with relevant information for the purposes of policy formulation, advocacy and program design. The information generated is also used to ensure the most efficient use of resources and serves to demonstrate the impact of the efforts and resources on achieving program goals and objectives. Monitoring and evaluation are particularly relevant to a new strategy of which experience is limited such as in TB IC.

Establishing the system for monitoring and evaluation, including supervision activities, of the set of airborne infection control measures should involve collaboration and sharing of indicators between the general health system and health programmes (e.g. programmes related to TB, HIV, occupational health, quality control and quality assurance, and infection prevention and control).

Monitoring and evaluation: what is it and why is it important?

Monitoring is the routine tracking of service and programme performance using input, process and outcome information collected on a regular and ongoing basis from policy guidelines, routine record-keeping, regular reporting and surveillance systems, and occasional health facility observations and client surveys. This information is used to assess the extent to which a policy or programme is achieving its intended activity targets on time. In a well-designed M&E system, monitoring will contribute greatly to evaluation.

Evaluation is the episodic assessment of results that can be attributed to programme activities; it uses monitoring data and often indicators that are not collected through routine information systems. Evaluation allows the causes of failure to achieve expected results on schedule to be explored and any necessary mid-course corrections to be applied. **Process evaluation** assesses progress in programme implementation and coverage. **Outcome and impact evaluation** measures the effect of programme activities on the target population.

Goals and objective: The goal of M&E in airborne infection control is to ensure that facility-level policies and practices are in place to minimize the risk of transmission of airborne infections in health-care settings.

Baseline Facility Risk assessment

A standardized facility risk assessment tool (**Appendix 7**) would be used at all key sites. The baseline risk assessment would be undertaken by a State and District level experts trained in the national guidelines, with technical support from the SAICC and NAICC. The facility-specific recommendations on administrative control measures, environmental / engineering control measures and personal protective measures would be provided for remedial action to the facility administrators. This would be followed up by periodic repeat assessment to review the progress made by implementation of the remedial actions recommended during the baseline assessments and extend further trouble shooting support for un-resolved issues.

Reporting formats on Airborne Infection Control Activities

Reporting on infection control activities is proposed to be done on a quarterly basis from facility, District, and State levels using standard quarterly reporting formats on airborne infection control activities (**Appendix 9**). The administrator of the health facility, the chairperson of district sub-committee on infection control, or the chairperson of the state infection control committees would be responsible for timely submission of the correct and complete reports. Reports should be submitted to the designated responsible State Official by the 15th of the subsequent month after completion of a quarter.

Monitoring Indicators

An initial set of monitoring indicators are proposed for monitoring airborne infection control activities in health care and other settings (Table 13). Detailed descriptions of each indicator is provided in **Appendix 8**. Most of the data required to derive the monitoring indicators on airborne infection control policies and practices would be collected routinely through the quarterly reports (**Appendix 9**) while some data can be collected during baseline and repeat facility risk assessments (**Appendix 7**), collected periodically from each facility at the time of supervisory visits and/or external review of airborne infection control activities.

Table14: Monitoring indicators for infection control activities

Indicator	Data Source	Numerator	Denominator
Proportion of health care facilities in the district / state that have <u>infection control practices</u> that include airborne infection control.	Quarterly Report on Airborne Infection Control – District and State Level. Facility Risk Assessment Reports.	Number of health-care facilities in the district / state with demonstrable infection control practices that include airborne infection control that are consistent with national guidelines.	Total number of health-care facilities reported / evaluated in district / state. (Also give the total number of each type of facility to indicate the proportion reported / evaluated.)
Proportion of health-care facilities in the district / state <u>providing services for people living with HIV that have infection control practices</u> that include airborne infection control (Process Indicator)	Quarterly Report on Airborne Infection Control – District and State Level. Facility Risk Assessment Reports.	Number of health-care facilities providing services to people living with HIV in the district / state with demonstrable infection control practices that include airborne infection control that are consistent with national guidelines.	Total number of health-care facilities providing services to people living with HIV reported / evaluated in district / state.
Proportion of health-care facilities in the district / state that have a <u>written infection control plan</u> that include airborne infection control (Input Indicator)	Quarterly Report on Airborne Infection Control – District and State Level. Facility Risk Assessment Reports.	Number of health-care facilities in the district / state has a written infection control plan that includes airborne infection control that are consistent with national guidelines.	Total number of health-care facilities reported / evaluated in district / state.
Proportion of health-care facilities	Quarterly Report on	Number of health-care	Total number of

in the district / state that have a <u>person from the infection control committee responsible for implementing the written infection control plan</u> that include airborne infection control (Input Indicator)	Airborne Infection Control – District and State Level. Facility Risk Assessment Reports.	facilities in the district / state has a written infection control plan that includes airborne infection control that are consistent with national guidelines.	health-care facilities reported / evaluated in district / state.
Proportion of tertiary health-care facilities in the district / state that have been subjected to facility risk assessment for airborne infection control (Output Indicator)	Quarterly Report on Airborne Infection Control – District and State Level. Facility Risk Assessment Reports.	Number of health-care facilities in the district / state that have been subjected to facility risk assessment for airborne infection control that are consistent with national guidelines.	Total number of health-care facilities reported / evaluated in district / state.
Proportion of health-care facilities in the district / state where <u>respiratory symptomatics (TB Suspects) are identified on arrival at the facility and separated from other patients each day</u> (Output Indicator)	Quarterly Report on Airborne Infection Control – District and State Level. Facility Risk Assessment Reports.	Number of health-care facilities in the district / state where respiratory symptomatics (TB Suspects) are identified on arrival at the facility and separated from other patients each day, that are consistent with national guidelines.	Total number of health-care facilities reported / evaluated in district / state.
Proportion of health-care facilities in the district / state where <u>TB and other infectious respiratory cases among health-care workers routinely monitored and reported</u> (Output Indicator)	Quarterly Report on Airborne Infection Control – District and State Level. Facility Risk Assessment Reports.	Number of health-care facilities in the district / state where TB and other infectious respiratory cases among health-care workers routinely monitored and reported	Total number of health-care facilities reported / evaluated in district / state.
Proportion of <u>health-care workers</u> , employed in facilities providing care and support, <u>who developed TB or other infectious respiratory disease during the quarter / year</u> . (Impact Indicator)	Facility health worker staffing and occupational health records. Quarterly Report on Airborne Infection Control – District and State Level. Facility Risk Assessment Reports.	Proportion of <u>health-care workers</u> , employed in facilities providing care and support, <u>who developed TB or other infectious respiratory disease during the quarter / year</u> . (Impact Indicator)	Total number of health-care workers employed in health care facility during that same period.

Appendices

Appendix 1: Composition and Terms of Reference for the National Airborne Infection Control Committee (NAICC)

Composition

1. Medical college representatives
2. Programme representatives
 - a. Central TB Division
 - b. National AIDS Control Organization
 - c. State TB Programme representatives
 - d. Director, Nursing Administration and Training
3. Engineers & architects
 - a. Directorate General of Health Services, Central Design Bureau
4. National Institutes
 - a. National Center for Disease Control (NCDC)
 - b. National TB Institute, Bangalore (NTI)
 - c. Tuberculosis Research Centre, Chennai (TRC)
 - d. Lala Ram Sarup TB and Chest Diseases Institute (LRS)
5. Other relevant agencies
 - a. IMA representative
 - b. World Health Organization
6. Civil society representatives

Terms of Reference

1. Review international guidelines and best practices for airborne infection control in health care facilities, and current infection control practices in health care facilities in India.
2. Develop technical and operational guidelines for airborne infection control.
3. Support the implementation of the guidelines, and serve as resources for advocacy, capacity building, and evaluations.
4. Coordinate with other relevant agencies, patient safety initiatives, and seek the inclusion of airborne infection control measures in universal precautions.
5. Develop technical recommendations for engineering and architectural measures to reduce the risk of transmission of respiratory infections, and advocate for inclusion into Indian Public Health Standards and national and state regulations for health care facilities.
6. Develop and disseminate tools for health care facilities to assess risk, identify simple solutions, and monitor effectiveness of interventions to reduce risk of airborne disease transmission.
7. Revise and update guidance to account for the best available evidence and experiences.
8. Assist DGHS and RNTCP in legal matters pertaining to infection control
9. Facilitate the implementation of the guidelines

Appendix 2: Composition and Terms of Reference for the State Airborne Infection Control Committee (SAICC)

To ensure smooth implementation and regular review of adoption and integration of the national guidelines on airborne infection control in health care and other settings in the hospital infection control plans of various health care facilities in the states, a State Airborne Infection Control Committee chaired by Principal Health Secretary need to be established at the State level under the umbrella society of NRHM. These coordination committee meetings should be organized on quarterly basis. The composition and proposed TOR of SAICC are detailed below.

Composition:

1. Chairman : Secretary, Health
2. Vice Chairman : Mission Director, National Rural Health Mission
3. Vice Chairman : Director Health Services (Nodal Officer)
4. Member : Director Medical Education and Research
5. Member : Project Director, SACS
6. Member : Additional Project Director, SACS
7. Member Secretary: State TB Officer
8. Member : Regional / Divisional Dy. Directors
9. Member : Chairperson, State Task Force for Medical Colleges
10. Member : Representative of IMA (State Body)
11. Member : Architects and Engineers from State PWD
12. Member : Director, Nursing Administration and Training
13. Member : Representative of State Pollution Control Board
14. Member : RNTCP / NACP Consultants
15. Member : NGO / CBO

Terms of Reference

1. Ensure adoption and integration of the national guidelines on airborne infection control in the facility infection control plans of various facilities in the State
2. Review the status of training of Sub-Committee on Biomedical Waste Management / Infection Control (under the District Health Society) (SC-BMW/IC) members, facility administrators and health care providers in Airborne IC modules and formulate strategies for ensuring that all the SC-BMW/IC members, facility administrators and health care providers are trained in these modules
3. Disseminate National Guidelines on Airborne Infection Control in Health Care and Other Settings in the state.
4. Facilitate the planning and implementation of the guidelines through the SC-BMW/IC in various districts of the state, and serve as resources for advocacy, capacity building, and evaluations of airborne infection control measures at facility levels in the state.
5. Coordinate with other relevant agencies, patient safety initiatives, and seek the inclusion of airborne infection control measures in universal precautions.
6. Conduct facility risk assessment and develop technical recommendations for administrative, engineering and architectural measures to reduce the risk of transmission

of respiratory infections, and advocate for inclusion into state regulations for health care facilities.

7. Develop and disseminate tools for health care facilities to assess risk, identify simple solutions, and monitor effectiveness of interventions to reduce risk of airborne disease transmission.
8. Assist DHS and RNTCP in legal matters pertaining to infection control

Scope of Work of the Committee

The SAICC will advocate the adoption and application of the national guidelines on airborne infection control, review the functioning of SC-BMW/IC, assist facilities in development and review the facility based infection control plans using facility risk assessment tools in the respective state, formulate strategies and recommendations for strengthening the airborne infection control activities, provide guidance and facilitate for the implementation of the National Guidelines on Airborne Infection Control in Health Care and Other settings in various districts of the respective state. The committee should hold a meeting once every month initially and every three months after the implementation process is streamlined.

The Chairman of the Committee if need arises can invite a person as special invitee whenever required for the betterment of the programme. In case the Chairman is not available for the meeting, a nominee of the chairperson may preside over the deliberations. The committee should also review the planning and implementation status of various SC-BMW/IC at least once in a quarter.

The SAICC can be used to obtain administrative approvals and endorsements for the facility infection control plans approved by the SC-BMW/IC and guided by the National Guidelines on Airborne Infection Control in Health Care and Other Settings. **Minutes of SAICC meetings should be sent to NAICC and CTD at naicc@rntcp.org.**

Based on the discussions and risk assessment reports and recommendations, feedback should be sent to the facilities on the interventions required for improvements of identified issues in administrative control, environmental control and personal protective equipments. **Follow up action taken should be monitored and minutes of the meetings forwarded to and CTD at naicc@rntcp.org.**

Appendix 3: Role of the Sub-Committee on Biomedical Waste Management / Infection Control (SC-BMW/IC) under the District Health Society in Airborne Infection Control Activities:

To ensure smooth implementation and regular review of adoption and integration of the national guidelines on airborne infection control in the hospital infection control plans of various health care facilities in the districts, the Sub-Committee on Biomedical Waste Management / Infection Control (BMW / IC) under the District Health Society (DHS) need to play a key role. The SC-BMW/IC should review the status of implementation of the national airborne infection control guidelines as an integral part of their review of the BMW measures at their committee meetings at periodic intervals.

If required, the following additional members may be invited to this committee meeting to discuss and review the status of airborne infection control activities in the district:

- PD / APD, DACS (wherever applicable) / DAPCU Nodal Officer / DNO AIDS
- Dean / MS, Medical College / District Hospital
- STF Member / IRL Microbiologist / Chairperson DP Site Committee (where applicable)
- Director, Nursing Administration and Training or equivalent
- Representative of Pollution Control Board Office at the district
- Representative of IMA (Local Body) / NGO / CBO

Scope of Work of the Committee

The SC-BMW/IC will advocate the adoption and application of the national guidelines on airborne infection control, assist facilities in development and review the facility based infection control plans using facility risk assessment tools in the respective district, formulate strategies and recommendations for strengthening the airborne infection control activities, provide guidance and facilitate for the implementation of the National Guidelines on Airborne Infection Control in Health Care and Other settings in the respective district. The committee would also scrutinize the facility infection control plans and approve the plans under intimation of SAICC. Facilities that need further support or clarification in infection control plans may be forwarded to the SAICC for approval. The committee should hold a meeting once every month initially and every three months after the implementation process is streamlined to monitor the facility wise interventions based on the initial risk assessment report and facilitate them.

The Chairman of the Committee if need arises can invite a person as special invitee whenever required for the betterment of the programme. In case the Chairman is not available for the meeting, a nominee of the chairperson may preside over the deliberations.

Key Functions of the Committee in AIC:

1. Disseminate, ensure adoption and integration of the National Guidelines on Airborne Infection Control in Health Care and Other Settings in the facility infection control plans of various facilities in the district under guidance of SAICC. Serve as resources for

advocacy and evaluations of airborne infection control measures at facility levels in the district.

2. Review the status of training of facility administrators, supervisors and health care providers in Airborne IC modules and formulate strategies for ensuring that all the facility administrators, supervisors and health care providers are trained in these modules
3. Carry out all activities for planning, preparation, implementation, supervision, monitoring, review and evaluation of the measures as per the national guidelines at all facilities in the district under intimation and guidance of SAICC.
4. Conduct facility risk assessment and develop technical recommendations for administrative, engineering and architectural measures with support of SAICC, to reduce the risk of transmission of respiratory infections, and advocate for inclusion into district regulations for health care facilities.
5. Ensure effective utilization of the tools for health care facilities to assess risk, identify simple solutions, and monitor effectiveness of interventions to reduce risk of airborne disease transmission.

The committee can provide administrative approvals for the facility infection control plans guided by the National Guidelines on Airborne Infection Control in Health Care and Other Settings under intimation of SAICC. If required, the facility infection control plans that call for interventions from state level may be referred for approval and support to the SAICC. Minutes of meetings should be sent to SAICC, SHS, STO, DHS and DTO on email.

Based on the discussions and risk assessment reports and recommendations, feedback should be sent to the facilities on the interventions required for improvements of identified issues in administrative control, environmental control and personal protective equipments. Follow up action taken should be monitored and minutes of the meetings forwarded to SAICC and STO by email.

Appendix 4: Generic facility infection control plan

Use of this generic plan: The tremendous variety of health care facilities makes it impossible to predict which specific administrative and environmental controls would be selected, or how those controls could be implemented. This “generic facility infection control plan” merely provides a guide to how the policy and procedures for a given facility could be included in the overall facility infection control plan, with detail on the airborne infection control component.

General Information:

- Name of the Facility
- Contact details including address, telephone number, fax, email, website etc.
- Name and Designation of the Facility Administrator:
- Contact details including address, telephone number, fax, email, website etc

Infection Control Committee:

- Details of the Facility Infection Control Committee:
- Name, designation and contact details (address, phone, email) of the infection control committee members.
- Delegation of responsibilities of various infection control activities amongst the committee members.
- Date of establishment of Infection Control Committee:

Broad Areas of Infection Control suggested to be covered in facility infection control plan:

1. Facility procedures for Standard precautions
 - a. Hand hygiene
 - b. Personal protection (gloves, gowns, masks, shields)
 - c. Respiratory hygiene and cough etiquette
 - d. Prevention of injury from needles or other sharp objects
 - e. Cleaning and disinfecting medical equipments
 - f. Cleaning the patient care environments
 - g. Linen and waste management
2. Facility bio-medical waste management protocol
- 3. Procedures for de-compression of crowded areas**
- 4. Airborne infection control protocol**
5. Regular assessment of TB in all facility staff
6. Infection control training of HCWs

The airborne component of the plan should include the following elements, and answer in simple terms “Where”, “Who”, and “How”:

1. **Screening** patients to identify persons with symptoms of respiratory ailment
2. **Cough etiquette:** Providing face masks or tissues to persons with symptoms of respiratory ailment (including TB suspects), and providing waste containers for disposal of tissues and masks.
3. **Segregation:** Placing respiratory suspects (including TB suspects) and cases in a separate well-ventilated waiting area.

4. **Fast tracking** respiratory suspects (including TB) and cases to the front of the line to expedite their receipt of services in the facility.
5. **Appropriate use of respirators** (if applicable, e.g. bronchoscopy suites).
6. Procedures for using and maintaining **environmental control** measures (like regular opening of windows).
7. **Surveillance of HCWs:** Educating staff periodically on signs and symptoms of TB and other respiratory diseases, specific risks for TB for HIV-infected persons, and need for diagnostic investigation for those with signs or symptoms of respiratory diseases or TB.
8. **Training and educating** staff on RIPC, TB, TB control, and the facility infection control plan (including airborne infection control).
9. **Monitoring** the airborne infection control plan's implementation.

(sample) Policy and Procedures

Purpose: Early identification, separation, receipt of services, and referral of patients with TB and other respiratory diseases is essential in preventing spread of airborne infections including TB.

Lead: _____ has the responsibility for overseeing the implementation of these policies and its procedures, and reports to (*District health Society, etc.*)

Policy 1: Screening patients to identify persons with symptoms or recent history of TB or other respiratory disease.

Procedures:

1. Before patients enter an enclosed part of the facility, a designated staff person should ask each adult and any child capable of coughing forcefully (usually age 14 or older) about symptoms or recent history of TB or other respiratory disease. The questioning should occur before patients wait in line for long periods to register or obtain services.
2. Many combinations of symptoms have been recommended as sensitive and specific for TB or other respiratory diseases. A simple screen is
 “Do you have a cough?” If patient answers “yes,” ask
 “For how long have you been coughing?”

An adult who has coughed for two weeks or more may be considered a “TB suspect” for pulmonary TB.

To determine whether a patient may be under investigation or a diagnosed case of TB, who may still be infectious, ask

“Are you being investigated or treated for TB?”

If the answer to either is “yes,” the screen classifies the patient as a TB suspect or case, and he should be managed as described in the procedures under policies 2 – 5 below.

3. As patients who are not identified as a TB or respiratory suspect or case on the initial symptoms screen enter an examination room with the clinical officer, nurse, or counselor, they should again be asked the simple screening questions. Those patients who report a cough of two or more weeks or who are being investigated or treated for TB should be managed as follows in the procedures under policies 2 – 5 below. Staff seeing patients in examination rooms should report patients they find to be a suspect or case to the infection control officer in a timely manner so that factors contributing to the potential exposure

(e.g., an emergency or short staffing interfering with the designated person screening all patients) can be documented and corrected.

Policy 2: Instructions on cough hygiene

Procedures:

1. Patients who are found to be TB or respiratory suspects or cases should immediately be informed about the importance of cough hygiene and should be handed tissues (or pieces of cloth) and instructed to cover their mouths and noses when they cough. Alternatively, patients should be given a face mask, and asked to wear it while in the facility. Patients should also be instructed to dispose of used tissues or masks in identified no-touch receptacles and not on the ground.

When tissues, cloths or face masks are not available, clients should be instructed to lift their arm up and cover their nose and mouth with the inner surface of the arm or forearm when they cough or sneeze. M. tuberculosis cannot be spread from the hands, but other serious lung infections can.

2. No-touch receptacles for disposal of used tissues and masks should be available in the waiting areas.

Policy 3: Placing TB or respiratory suspects and cases in a separate waiting area

Procedures

1. A staff person should direct or escort the patient to a separate waiting area. This special waiting area should have the highest natural ventilation possible. Patients should be assured of their place in the line for registration and/or services.

Policy 4. Fast-tracking TB or respiratory suspects and cases to the head of the line to receive services in the facility

Procedures

1. TB or respiratory suspects and cases should be moved to the head of the line for whatever services they want or need, e.g., ICTC, laboratory, medication refills, or medical investigation. This reduces the duration of potential exposure while they wait in the facility and may be an incentive to disclose information during screening.

Policy 5. Appropriate use of particulate respirators

Procedures

1. _____ is the designated staff person who will conduct sensitization on proper use and care of particulate respirators.
2. Particulate respirators should be used by all staff in bronchoscopy suite for procedures involving any patient with unknown chest disease or known infectious respiratory disease.

Policy 6. Using and maintaining environmental control measures

Procedures

1. _____ is the designated staff person to check on environmental control measures and maintain a log of monitoring and maintenance.
2. Windows and doors should be checked on a daily basis to assure they are in proper position (open or closed as called for in the plan). Generally, all windows and doors should be open when natural ventilation is the primary environmental control to allow for the free,

unencumbered movement of air (e.g., across room, from window to door or vice versa). Generally, all windows and doors should be closed when using mechanical ventilation to ensure air movement in a controlled manner (air from supply vent and from slots either under or in door toward the exhaust vent).

3. At nights, upper part of window to be kept open at all times; lower part of window may be closed for patient comfort if indicated.
4. Fans should be checked on a monthly basis to assure they are clean, are pulling (or pushing) the correct amount of air, and are pulling (or pushing) air in the correct direction.

Policy 7. Surveillance of TB among Health Care Workers

*Policy 8. **Training of staff** on all aspects of infection control (e.g. RIPC, TB and the TB infection control plan)*

Procedures

1. _____ is the designated staff person to provide training to new staff as it is hired and to maintain a log indicating who has had initial training.
2. _____ is the designated staff person to provide annual training to all staff and to maintain a log indicating who has attended training. This may be incorporated into a broader training topic or be stand alone RIPC training.

*Policy 9. **Monitoring** the Airborne infection control plan's implementation*

Procedures

1. Determine the frequency of the infection control plan evaluation
 - a. Example: bi-weekly sanitary rounds to conduct detailed assessment of a randomly chosen ward or OPD
 - b. When procedures are running well, less frequent evaluation will be necessary – at a minimum, bi-monthly.
2. Evaluate the implementation of administrative precautions
 - a. Were patients with significant cough missed when entering the facility and only detected at a later time or in the examination room?
3. Evaluate the implementation of environmental controls – were windows and doors regularly opened in all identified areas? Were fans running as per plan? HVAC maintainance?
4. Training: Did all new staff receive training on RIPC during their induction?

Appendix 5: Considerations for planning UVGI installations.⁶

Determining If Upper-Air UVGI Is Suitable for a Particular Room

A room must meet the following criteria if upper-air UVGI is to be used:

- High risk setting where adequate ventilation cannot be achieved under all times and climactic conditions.
- Ceilings must be > 8 feet high, sufficiently high so that people cannot look into the lamps or bump into them
- Room air mixing fans (of any type) are recommended to help mix the disinfected air in the upper-air with the potentially contaminated air below. The fans or ventilation system should operate continuously when the space is occupied.

A poorly installed upper-air UVGI system could result in:

- Harmful radiation levels in the occupied space, and
- Ineffective radiation levels in the upper-air bacterial kill zone.

Preparing for an Upper-Air UVGI Installation

- Find a suitable consultant and contractor. Only a qualified contractor should attempt the design, installation, and testing of an upper-air UVGI system.
- Specialized expertise and equipment are required to establish effective upper-air UVGI.
- UVGI lamp manufacturers or lamp sales representatives may have names of local contractors experienced in UVGI installation.

Choosing fixtures

- If installed lower than 9 feet height, fixtures should be equipped with multi-bladed horizontal louvers to confine emissions to a narrow horizontal band and to shield the eyes of the occupants from exposure to the bare lamps.

Planning an Installation⁷

- Expect to install a 30 W total UV lamp power (added if multiple bulbs) for each 200 ft² (19 m²) of floor area.
- Locate UVGI fixtures so that the radiation kill zone in the upper-air is uniform and continuous to the greatest extent possible. A bacterial kill zone would be expected where irradiance exceeds 10 µw/cm².
- In the installation contract, include measurements of radiation levels after installation, periodic monitoring of UV intensity in kill zones and staff/patient areas, and bulb replacement.
- Use the lamps only after safety is confirmed by UV intensity readings, taken in a number of locations corresponding to where people will be exposed.
- Take radiometer readings at each lamp to ensure that the radiation intensity meets the manufacturer's specifications.
- Non-reflective paint may need to be added to ceilings and walls. This should be included in the budget for the planned installation. Paint containing titanium dioxide is recommended for reducing reflection from surfaces.
- Post warning signs, in all appropriate languages, on the UVGI fixtures and on the walls. The signs should warn against working in the upper part of the room when the lamps are switched on.

⁶ Adapted from: Francis J. Curry National Tuberculosis Center, 2007: *Tuberculosis Infection Control: A Practical Manual for Preventing TB*, (available at <http://www.nationaltbcenter.edu>), and from South Africa Medical Research Council Tuberculosis Research Centre, 2009. *Guidelines for the Utilization of Ultraviolet Germicidal Irradiation (UVGI) in Controlling Transmission of Tuberculosis in Health Care Facilities in South Africa*, (available at <http://www.sahealthinfo.org/tb/guidelines.pdf>).

⁷ For detailed guidance please see: First MW and Nardell EA, Guidelines for the Application of Upper-Room Ultraviolet Germicidal Irradiation for Preventing Transmission of Airborne Contagion—Part II: Design and Operation Guidance. ASHRAE Transactions 1999:105. (Available at http://ghdnetwork.org/uploads/GUIDELINES_PART_2.PDF)

- Sensitize staff about use of UV lamps and their safety in this setting, and post an information sheet on the wall of the room.
- The on/off switch for the lamps should be accessible to appropriate staff members but not located where patients or clients may turn off the fixtures

Example A: Wall mounted fixture with horizontal louvers to confine radiation emissions to a narrow horizontal band.



Example B: Ceiling-mounted 360-degree radiation fixture, for irradiation of larger volume of air, with horizontal louvers to confine emissions to a narrow horizontal band



Monitoring and Maintenance

- Designate a staff member to be the in-house monitor for UVGI fixtures. This person should be trained in the basic principles of UVGI operation and safety and should be responsible for cleaning, maintaining, and replacing the lamps.
- A "UVGI Maintenance Register" should be kept of all monitoring and maintenance. This should document bulb check, cleaning, bulb replacements, and periodic UV intensity measurements.

On a weekly basis, the following monitoring should be done:

- Check that lamps are not burned out or broken. If lamps are working, they emit a visible violet blue glow that can be seen from below.
- Turn off lamps and check that lamps and fixtures are free of dust and lint. Clean with spirit and new, clean cotton gauze. Do not use water or other cleaning solution, as these may leave residues which can block UV radiation).

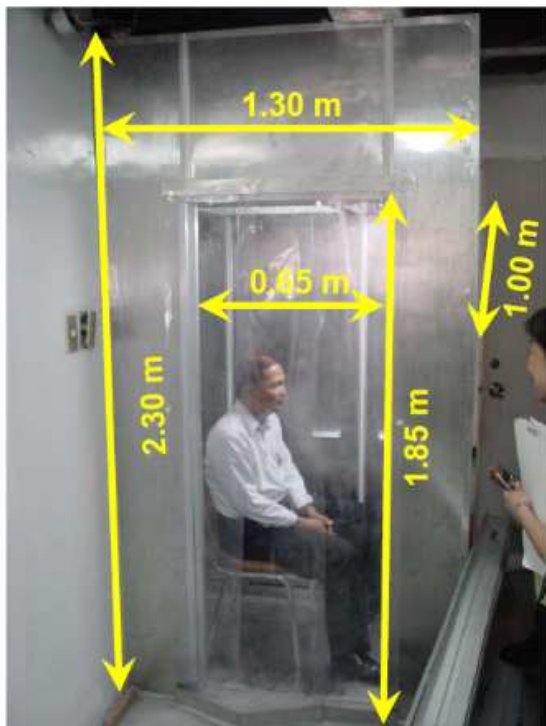
On a 6-month basis, the following should be done:

- Check that the radiation level at each fixture meets the lamp manufacturer's recommendation. Dispose of used lamps as recommended by the lamp manufacturer. Replace lamps once a year or as recommended by the manufacturer, or when UV intensity is below the manufacturer specification.

Appendix 6: Specifications for an indoor sputum collection booth

Sputum collection outdoors is greatly preferred, due to the rapid dilution of any infectious particles that are produced. There are some circumstances where contained sputum collection is preferred, such as large crowded hospitals in urban environments, where there are no safe outdoor locations available. The following specifications for sputum collection booth are suggested:

- Single occupant booth, with clear window so health care worker can
- >20 air changes per hour minimum. In a small volume booth, this will be easy to accomplish with a single modestly-sized exhaust fan.
- Air exhausted from the top of the collection chamber
- Exhaust air to be ducted outside, at least 3 meters from and door or window, *or* should be subject to HEPA filtration. Any HEPA filtration device used should be regularly maintained.
- UVGI is neither necessary nor useful in such devices.
- The work practice of at least 5 minutes of exhaust ventilation after each patient use, before any worker or patient enters the chamber, should be very rigorously practiced.



Sputum Booth should be exhausted from the top of the booth, resulting in an air exchange rate of 20-24 air changes per hour (ACH).

Volume of Booth = 1.30 m X 1.00 m X 2.30 m
= 3.00 m³

Flowrate_{20 ACH} = 20 ACH X 3.00 m³
= 60 m³/h
= 16.6 L/s

Flowrate_{24 ACH} = 24 ACH X 3.00 m³
= 72 m³/h
= 19.9 L/s

The air should be exhausted either up and away of people, air intakes, open windows, etc., or it should be HEPA filtered. The fan (ventilator) should be strong enough to overcome any pressure losses in the duct work and maintain a minimum flow rate of 60-72 m³/h (16.6-19.9 L/s).

Appendix 7: Health Care Facility Airborne Infection Risk Assessment Tool

(Disclaimer: The information collected in this risk assessment tool is solely for the purpose of quality improvement pertaining to the Airborne Infection Control policies and practices in the facility. The information thus collected either through interviews, observations and measurements would be kept confidential within the health system.)

Initial Assessment – General information

Date of Assessment Visit:

Members of the Risk Assessment Team:

SN	Name	Designation	Signature

A. General Information:

1. State and District:
2. RNTCP TB Unit where facility located:
3. Name of the Health Care Facility:
4. Type of Health Care Facility: (choose from list below)
<ul style="list-style-type: none"> a. Tertiary Care Facility: Medical College Private Multi-Specialty Hospital b. Secondary Care Facility: District Hospital. General Hospital , Sub-District Hospital (SDH) , Rural Hospital (RH) , Community Health Center (CHC), Private Nursing Homes c. Primary Care Facility: Primary Health Centre (PHC), Block Primary Health Centre (BPHC), Urban Health Centre (UHC), [Urban Health Dispensary or Private Health Clinic / Dispensary]

B. Health Care Facility Information:

5. Total Number of Staff (including all departments):	
a. Number of Doctors (including PG Residents):	
b. Number of other paramedical staff – Class III (including pharmacists, technicians...):	
c. Number of Nursing Staff	
d. Number of other paramedical staff - Class IV (including sweepers, dressers, janitors etc.):	
e. Number of Trainee Doctors (UG, Interns):	
f. Number of Trainee Nurses:	
g. Number of Trainee paramedics:	

6. Departments available in the facility: (Check all the apply)	
a. Outpatient Department	
– Medicine OPD	
– Chest OPD	
– Surgery OPD	
– OBGY OPD	
– Pediatric OPD	
b. Indoor Facilities:	
– Medical ward	
– Chest ward	
– Surgical ward	
– OB/GY ward	
– Pediatric ward	
c. Diagnostic Facilities:	
– Designated Microscopy Centre	
– Sputum Collection Area	
– Integrated Counseling and Testing Centre	
– Radiology Department	
– Bronchoscopy Suites	
– PFT room	
d. Special Settings:	
– Culture and DST Laboratory	
– TB ward	
– MDR TB ward (including but not limited to RNTCP DOTS Plus Site)	
– Airborne precaution ward	
– Airborne precaution rooms (individual rooms; give number)	
– ART Centre	
e. Treatment Centres:	
– DOT Centre	
– Dispensary / Pharmacy	
f. Other hospital settings :	
– General registration section	
– Department registration section	
– Emergency Department	
– Autopsy Room	
– Minor OT	
– Operation Theatre	
7. Number of in-patient beds (including emergency dept.):	
8. Average monthly all in-patient occupancy (from medical records):	
9. Average daily OPD (reported by administrators):	

10. Average total OPD of last three months (irrespective of quarters):	
--	--

C. Burden of Airborne Infection:

At the Facility level: In the last 3 months (irrespective of quarter):

If RNTCP DMC exists:

11. Number of TB suspects examined by smear microscopy:
12. Number of TB cases diagnosed by smear microscopy:

All facilities, regardless of whether DMC exists:

13. Number of TB patients enrolled for DOTS at the DOT center:
14. Number of TB patients managed indoor at the facility level:

At TB Unit, District and State Level: TB notification rates and trends over the past 2 years

	Indicator / Value	TB Unit	District	State
	Population in lacs			
TB Cases Notified in the last quarter reported (Quarter/Year):				
	Number of New Smear Positive (NSP) Pulmonary TB Cases registered for treatment:			
	Number of New Smear Negative (NSN) Pulmonary TB Cases registered for treatment:			
	Number of New Extra Pulmonary (NEP) TB Cases registered for treatment:			
	Number of Re-treatment (RT) Smear Positive Pulmonary TB Cases registered for treatment:			
	Total Number of All TB Cases registered for treatment:			
TB Case Notification Rates in the last quarter (Quarter/Year):				
	Annualized NSP TB Case Detection Rate per lac population:			
	Annualized RT SP TB Case Detection Rate per lac population:			
	Annualized Total TB Case Detection Rate per lac population:			

D. Airborne Infection Control Policies:

15. Facility level infection control (IC) committee or bio-medical waste (BMW)
--

management committee in place: Yes / No
16. Composition of the IC Committee / BMW Management Committee (including departments covered): a. b.
17. How often does the committee meet?
18. When was the <i>most recent</i> committee meeting?
19. Are the minutes of these meetings available for review? Yes / No
20. Facility IC / BMW management plan available in written form? Yes / No

If a written plan for infection control or BMW is available describe the contents:

21. Elements / Areas of infection control covered in the plan: a. b.
22. Is Airborne infection control covered in the plan (including measures like triage, segregation, adequate air exchange, fast tracking policy for respiratory symptomatics etc.): Yes / No
If Yes, enumerate the measures included in the policy. a. b.

E. Infection Control Training:

23. Staff training plan for Infection Control /or bio-medical waste in place: Yes / No
24. Standardized training material on IC training of staff available: Yes / No
25. Content of training material if available (review training material): Enumerate broad areas covered: a. b.
26. Is “Standard Precautions” part of the training material? Yes / No
27. Has IC Training of staff conducted in the past 12 months: Yes / No
28. How often are IC trainings conducted?
29. IC training conducted as part of : Induction training / Special training

Cadre of staff	No. in place	No. trained in IC in past 6 months	% of staff trained in IC in past 6 months
Doctors (including PG)			
Nurses			
Other paramedics – Class III (Pharmacists, technicians...)			
Other paramedics - Class IV (sweepers, janitors, dressers)			

Trainee Doctors (UG, Interns)			
Trainee Nurses			
Trainee Paramedics			

F. Passive Surveillance of TB/other nosocomial infection in Health Care Workers:

30. Disease Surveillance in HCWs is a part of the facility IC/BMWM plan: Yes/No
31. Does it contain active screening for TB in staff: Yes / No
32. Does it contain passive reporting of TB diagnosed/treated among staff?
33. Who is responsible for collecting TB in health care worker information?
34. Describe total number of staff treated for TB from any source (RNTCP or private) in past 12 months, by cadre of staff above:

Follow-up Assessment – General Information

Date of Assessment Visit:

Members of the Risk Assessment Team:

SN	Name	Designation	Signature

General Information:

1. State and District:
2. RNTCP TB Unit where facility located:
3. Name of the Health Care Facility:
4. Type of Health Care Facility: (choose from list below)
<ul style="list-style-type: none"> a. Tertiary Care Facility: Medical College Private Multi-Specialty Hospital b. Secondary Care Facility: District Hospital, General Hospital, Sub-District Hospital (SDH), Rural Hospital (RH), Community Health Center (CHC), Private Nursing Homes c. Primary Care Facility: Primary Health Centre (PHC), Block Primary Health Centre (BPHC), Urban Health Centre (UHC), [Urban Health Dispensary or Private Health Clinic / Dispensary]

Specific Facility Managerial Interventions on AIC in past 6 months:

(Based on review of reports, documents and interview of facility head and staff)

Specific Interventions	Done in past 6 months Yes / No	Recommendations in bullet points	Action Taken in bullet points	Remarks*
Previous Facility Risk Assessment				
Designate focal points for AIC				
Facility IC plan put in place, including AIC measures				

Re-think or re-organize space available and renovate to optimize controls				
Decompression of crowded places & waiting areas, if recommended				
AIC training of frontline HCWs (doctors, nurses, paramedical staff)				
Supervision / Monitoring of applied AIC measures				
Budget for AIC measures & maintenance provided				
Surveillance of TB in HCWs				
Provision of IEC on cough hygiene in facility for patients and visitors				

* Specify any un-intended consequence or non-feasibility reported for any AIC measure implemented by facility.

Training assessment:

SN	Cadre of staff	No. in place	No. trained in IC in past 6 months	% of staff trained in IC in past 6 months
1	Doctors (including PG)			

2	Nurses			
3	Other paramedics – Class III (Pharmacists, technicians...)			
4	Other paramedics - Class IV (sweepers, janitors, dressers)			
5	Trainee Doctors (UG, Interns)			
6	Trainee Nurses			
7	Trainee Paramedics			

Passive Surveillance of TB/other nosocomial infection in Health Care Workers:

1. Disease Surveillance in HCWs is a part of the facility IC/BMWM plan: Yes/No
2. Does it contain active screening for TB in staff: Yes / No
3. Does it contain passive reporting of TB diagnosed/treated among staff?
4. Who is responsible for collecting TB in health care worker information?
5. Describe total number of staff treated for TB from any source (RNTCP or private) in past 12 months, by cadre of staff above:

Infection Control Material Stock Assessment:

Does the facility has the following materials in place and used:

1. Personal Protective Equipments:
 - a. Gloves
 - b. Gowns
 - c. Surgical Masks
 - d. Protective eye wear
 - e. Tissues
 - f. N 95 Respirators
2. Hand Hygiene
 - a. Soap / 70% Alcohol based hand wash
 - b. Water Supply
3. Communication materials:
 - a. Respiratory Infection Prevention and Control - Quick Reference Card
 - b. Materials on cough etiquette / cough hygiene
 - c. Materials on sputum disposal techniques in lab
 - d. Materials on sputum disposal at home and in community

Appendix 8: Detailed Infection Control indicators

Indicator 1: Proportion of health care facilities in the district / state that have infection control practices that include airborne infection control. (Process Indicator)

Definition: Number of health-care facilities in the district / state, with demonstrable infection control practices that include airborne infection control, expressed as a proportion of the total number of health-care facilities reported / evaluated.

Numerator: Number of health-care facilities in the district / state with demonstrable infection control practices that include airborne infection control that are consistent with national guidelines.

Denominator: Total number of health-care facilities reported / evaluated in district / state. (Also give the total number of each type of facility to indicate the proportion reported / evaluated.)

Data Source:

- Quarterly Report on Airborne Infection Control – District and State Level.
- Facility Risk Assessment Reports.

Indicator 2: Proportion of health-care facilities in the district / state providing services for people living with HIV that have infection control practices that include airborne infection control (Process Indicator)

Definition: Number of health-care facilities in the district / state providing services for people living with HIV, with demonstrable infection control practices that include airborne infection control, expressed as a proportion of the total number of health-care facilities reported / evaluated.

Numerator: Number of health-care facilities providing services to people living with HIV in the district / state with demonstrable infection control practices that include airborne infection control that are consistent with national guidelines.

Denominator: Total number of health-care facilities providing services to people living with HIV reported / evaluated in district / state. (Also give the total number of each type of facility to indicate the proportion reported / evaluated.)

Data Source:

- Quarterly Report on Airborne Infection Control – District and State Level.
- Facility Risk Assessment Reports.

Scope: This indicator can also be adapted for MDR TB services, Culture & DST service, Bronchoscopy services, prisons, refugee camps, military barracks and other congregate settings.

Indicator 3: Proportion of health-care facilities in the district / state that have a written infection control plan that include airborne infection control (Input Indicator)

Definition: Number of health-care facilities in the district / state that have a written infection control plan that include airborne infection control, expressed as a proportion of the total number of health-care facilities reported / evaluated.

Numerator: Number of health-care facilities in the district / state has a written infection control plan that includes airborne infection control that are consistent with national guidelines.

Denominator: Total number of health-care facilities reported / evaluated in district / state. (Also give the total number of each type of facility to indicate the proportion reported / evaluated.)

Data Source:

- Quarterly Report on Airborne Infection Control – District and State Level.
- Facility Risk Assessment Reports.

Indicator 4: Proportion of health-care facilities in the district / state that have a person from the infection control committee responsible for implementing the written infection control plan that include airborne infection control (Input Indicator)

Definition: Number of health-care facilities in the district / state that have a person responsible for implementing the written infection control plan that include airborne infection control, expressed as a proportion of the total number of health-care facilities reported / evaluated.

Numerator: Number of health-care facilities in the district / state that have a person responsible for implementing the written infection control plan that include airborne infection control, that are consistent with national guidelines.

Denominator: Total number of health-care facilities reported / evaluated in district / state. (Also give the total national number of each type of facility to indicate the proportion evaluated.)

Data Source:

- Quarterly Report on Airborne Infection Control – District and State Level.
- Facility Risk Assessment Reports.

Indicator 5: Proportion of tertiary health-care facilities in the district / state that have been subjected to facility risk assessment for airborne infection control (Output Indicator)

Definition: Number of tertiary health-care facilities in the district / state that have been subjected to facility risk assessment for airborne infection control, expressed as a proportion of the total number of health-care facilities reported.

Numerator: Number of health-care facilities in the district / state that have been subjected to facility risk assessment for airborne infection control that are consistent with national guidelines.

Denominator: Total number of health-care facilities reported in district / state. (Also give the total number of each type of facility to indicate the proportion reported.)

Data Source:

- Quarterly Report on Airborne Infection Control – District and State Level.
- Facility Risk Assessment Reports.

Indicator 6: Proportion of health-care facilities in the district / state where respiratory symptomatics (TB Suspects) are identified on arrival at the facility and separated from other patients each day (Output Indicator)

Definition: Number of health-care facilities in the district / state where respiratory symptomatics (TB Suspects) are identified on arrival at the facility and separated from other patients each day, expressed as a proportion of the total number of health-care facilities reported / evaluated.

Numerator: Number of health-care facilities in the district / state where respiratory symptomatics (TB Suspects) are identified on arrival at the facility and separated from other patients each day, that are consistent with national guidelines.

Denominator: Total number of health-care facilities reported / evaluated in district / state. (Also give the total number of each type of facility to indicate the proportion reported / evaluated.)

Data Source:

- Quarterly Report on Airborne Infection Control – District and State Level.
- Facility Risk Assessment Reports.

Indicator 7: Proportion of health-care facilities in the district / state where TB and other infectious respiratory cases among health-care workers routinely monitored and reported (Output Indicator)

Definition: Number of health-care facilities in the district / state where TB and other infectious respiratory cases among health-care workers routinely monitored and reported, expressed as a proportion of the total number of health-care facilities reported / evaluated.

Numerator: Number of health-care facilities in the district / state where TB and other infectious respiratory cases among health-care workers routinely monitored and reported.

Denominator: Total number of health-care facilities reported / evaluated in district / state. (Also give the total number of each type of facility to indicate the proportion evaluated.)

Data Source:

- Quarterly Report on Airborne Infection Control – District and State Level.
- Facility Risk Assessment Reports.

Indicator 8: Proportion of health-care workers, employed in facilities providing care and support, who developed TB or other infectious respiratory disease during the quarter / year. (Impact Indicator)

Definition: Number of health-care workers, employed in facilities providing care and support, who develop TB or other infectious respiratory disease in a period of time (quarter or year), expressed as a proportion of the total number of health-care workers employed in the health care facilities during that same period.

Numerator: Number of health-care workers employed in health care facilities who develop TB in a period of time (quarter or year).

Denominator: Total number of health-care workers employed in health care facility during that same period.

Data Source:

- Facility health worker staffing and occupational health records.
- Quarterly Report on Airborne Infection Control – District and State Level.
- Facility Risk Assessment Reports.

Appendix 9: Infection control reporting formats for Facility, District, and State

Quarterly Report on Airborne Infection Control (AIC) Measures Health Facility Level

Note: All PHCs/ CHCs/ Referral Hospitals/ Major Hospitals/ Specialty Clinics/ TB hospitals/ Medical colleges to submit their quarterly reports in this format.

Name of Health Facility: _____
TU: _____ District: _____ State: _____
Quarter: _____ Year: _____

A. General Information

1. Level of Health Facility: Tertiary / Secondary / Primary
2. Type of Health Facility: _____
3. Health Sector: Government / NGO/ Private
4. Departments available in the facility:
 - a. Out patient facilities: Medicine / Chest / Surgery / OBGY / Pediatric / Others specify:

 - b. Indoor facilities: Medicine / Chest / Surgery / OBGY / Pediatric / Others specify:

 - c. Diagnostic facilities: Designated Microscopy Centre / Sputum Collection Area / Integrated Counseling and Testing Centre / Radiology Department / Bronchoscopy Suites / PFT room / Others specify:

 - d. Special Settings: Culture and DST Laboratory / TB ward / MDR TB ward / Airborne precaution rooms / ART Centre / Operation Theatre / Others specify:

 - e. Treatment Centres: DOT Centre / Dispensary / Pharmacy / Other Specify:

 - f. Other hospital settings: General registration / Departmental registration section / Emergency Department / Autopsy Room / Minor OT / Dressing Room / Others specify:

5. Number of in-patient beds: _____
6. Average monthly all in-patient occupancy (of last three months): _____
7. Total OPD of last three months: _____
8. Average daily OPD (of last three months): _____

B. Burden of Airborne Infection:

1. If DMC exists:
 - a. Number of TB suspects examined by smear microscopy in the quarter: _____
 - b. Number of TB cases diagnosed by smear microscopy in the quarter: _____
2. If no DMC exists:
 - c. Number of TB patients enrolled for DOTS at the DOT center: _____

- d. Number of TB patients managed indoor at the facility level: _____
(from Indoor Register)

C. Human Resource:

35. HRD plan for Infection Control in place: Yes / No

36. Standardized training material (RIPC modules): Yes / No

37. Respiratory Infection Prevention and Control (RIPC) Training status of staff:

SN	Cadre of staff	No. In place	Total no. trained in RIPC module	% of staff trained in RIPC module
1	Doctors (including PG)			
2	Nurses			
3	Other paramedics – Class III (Pharmacists, technicians, ANM, MPW etc)			
4	Other paramedics - Class IV (sweepers, janitors, dressers etc)			
5	Trainee Doctors (UG, Interns)			
6	Trainee Nurses			
7	Trainee Paramedics			

D. Airborne Infection Control Policies and Practices:

1. Health Facility Infection Control / BMW Management Committee in place: Yes / No
2. Name and Designation of the person responsible for implementing airborne infection control measures at the facility level: _____
3. Number of IC committee meetings held in the quarter? _____
4. Are the minutes of these meetings sent to District Health Society? Yes / No
5. Health Facility IC / BMW management plan available in written form? Yes / No
6. When was a facility risk assessment for airborne infections conducted: _____
7. Compliance report submitted on recommendations of facility risk assessment to District Health Society: Yes / No
8. Personal Protective Measures for Health Care Workers:
 - a. Has all rooms in the facility being provided with soap / 70% alcohol based hand wash: Yes / No
 - b. Do all health care worker practice hand hygiene: Yes / No
 - c. Are PPE like gowns, gloves, tissues available and used regularly by the health care workers at the facility: Yes / No
 - d. Are N95 respirators provided and used by health care workers posted at high risk settings like Culture & DST Lab, MDR TB Ward, Bronchoscopy suits etc: Yes / No
 - e. Are surgical masks and counseling to use them provided to respiratory symptomatics before entering the facility: Yes / No
 - f. Is disposal of sputum done as per the BMW management plan: Yes / No
 - g. Are there adequate disposal facilities for used surgical masks in the facility: Yes / No

9. Personal Protective Measures for Patients:

- a. Are there adequate IEC material on cough hygiene displayed / handed over to patients in the facility: Yes / No
- b. Do patients receive any counseling on cough etiquette / hygiene practices before entering the facility: Yes / No
- c. Are the following Airborne infection control measures in place:
 - i. Triage of respiratory symptomatics: Yes / No
 - ii. Segregation of respiratory symptomatics: Yes / No
 - iii. Fast tracking policy for respiratory symptomatics: Yes / No
 - iv. Any other measure specify: _____

E. Passive Surveillance of TB / Other nosocomial infection in Health Care Workers:

- 1. Does the staff undergo pre-employment medical examination: Yes / No
- 2. Is Disease Surveillance in HCWs practiced in the facility: Yes / No
- 3. Number of staff subjected to sputum examination in the quarter: _____
- 4. Number of staff diagnosed as TB in the quarter: _____
- 5. Number of staff put on treatment for TB in the quarter: _____
- 6. Number of staff treated for any respiratory ailment other than TB in the past quarter: -

**Quarterly Report on Airborne Infection Control (AIC) Measures
District Level**

Name of District: _____

Total projected population of District / Reporting Unit (in numbers): _____

Quarter: _____ Year: _____

A. General Information

Basic information on health facilities in the district:

Level	Type of Health Facility	Government	NGO / Private	Total
Tertiary	Medical Colleges			
	Multi-Speciality Hospitals			
	Total			
Secondary	District Hospitals			
	General Hospitals			
	Sub-District Hospitals			
	Referral Hospitals			
	Rural Hospitals			
	Community Health Centre			
	Nursing Homes			
Total				
Primary	Block Primary Health Centre			
	Primary Health Centre			
	Urban Health Centre			
	Health Clinic/ Dispensary			
	Total			

Information on Special Settings available in various health facilities in the district:

Special Settings	Tertiary	Secondary	Primary	Total
Sputum Collection Centre				
Designated Microscopy Centre				
Integrated Counseling and Testing Centre				
Radiology Department				
Bronchoscopy Suits				
PFT Room				
Culture and DST Laboratory				
TB wards				
MDR TB Wards				
Airborne precaution Rooms				
ART Centre				
Operation Theatre				
DOT Centre				

B. Burden of Airborne Infection: TB notification rates

SN	Indicator / Value	District
1	Population in lacs	
TB Cases Notified in the quarter:		
2	Number of New Smear Positive (NSP) Pulmonary TB Cases registered for treatment:	
3	Number of New Smear Negative (NSN) Pulmonary TB Cases registered for treatment:	
4	Number of New Extra Pulmonary (NEP) TB Cases registered for treatment:	
5	Number of Re-treatment (RT) Smear Positive Pulmonary TB Cases registered for treatment:	
6	Total Number of All TB Cases registered for treatment:	
TB Case Notification Rates in the quarter:		
7	Annualized NSP TB Case Detection Rate per lac population:	
8	Annualized RT SP TB Case Detection Rate per lac population:	
9	Annualized Total TB Case Detection Rate per lac population:	

C. Human Resource:

1. Training status of Facility Administrators in National Guidelines on Airborne Infection Control in Health Care and Other Settings:

Level	Type of Health Facility	Total number of facilities	Total no. trained in NAIC Guidelines	% trained in NAIC Guidelines
Tertiary	Medical Colleges			
	Multi-Speciality Hospitals			
	Total			
Secondary	District Hospitals			
	General Hospitals			
	Sub-District Hospitals			
	Referral Hospitals			
	Rural Hospitals			
	Community Health Centre			
	Nursing Homes			
	Total			
Primary	Block Primary Health Centre			
	Primary Health Centre			
	Urban Health Centre			
	Health Clinic/ Dispensary			
	Total			

2. Training status of health care workers in Respiratory Infection Prevention and Control (RIPC):

SN	Cadre of staff	No. In place	Total no. trained in RIPC module	% trained in RIPC module
1	Doctors (including PG)			
2	Nurses			
3	Other paramedics – Class III (Pharmacists, technicians, ANM, MPW etc)			
4	Other paramedics - Class IV (sweepers, janitors, dressers etc)			
5	Trainee Doctors (UG, Interns)			
6	Trainee Nurses			
7	Trainee Paramedics			

D. Airborne Infection Control Policies and Practices:

1. Total number of Health Care Facility in the district: _____
2. Number of Health Facility with IC Committee in place (including AIC): _____
3. Number of Health Facility with IC plan (including AIC) available in written form? _____
4. Number of Health Facility with at least 1 IC Committee meeting held in the quarter: _____
5. Number of Health Facility whose IC Committee meeting minutes available at district level: _____
6. Number of Health Facilities where facility risk assessment for airborne infections conducted by SC-IC/BMW Committee: _____
7. Number of Health Facilities with compliance report submitted on recommendations of facility risk assessment to SC-IC/BMW Committee: _____
8. Number of Health Facilities reporting the intervention of triage, segregation and fast-tracking of respiratory symptomatics in place: _____
9. Is the district level SC-IC/BMW Committee in place: _____
10. Name and Designation of the person responsible for monitoring implementation of airborne infection control measures at the district level: _____
11. Number of SC-IC/BMW committee meetings held in the quarter? _____

E. Passive Surveillance of TB / Other nosocomial infection in Health Care Workers:

1. Number of Health Facility subjecting staff to pre-employment medical examination: _____
2. Number of Health Facility conducting Disease Surveillance in HCWs of the facility: _____

3. Consolidated status of disease surveillance from health facilities in the district:

SN	Cadre of staff	No. In place	No. diagnosed of TB in the quarter	No. treated for TB in the quarter	No. treated for other respiratory ailment other than TB in the quarter
1	Doctors (including PG)				
2	Nurses				
3	Other paramedics – Class III (Pharmacists, LTs, ANM, MPWetc)				
4	Other paramedics - Class IV (sweepers, janitors, dressers etc)				
5	Trainee Doctors (UG, Interns)				
6	Trainee Nurses				
7	Trainee Paramedics				

Quarterly Report on Airborne Infection Control (AIC) Measures
State Level

Name of State: _____

Total projected population of State (in numbers): _____

Quarter: _____ Year: _____

A. General Information

Basic information on health facilities in the state:

Level	Type of Health Facility	Government	NGO / Private	Total
Tertiary	Medical Colleges			
	Multi-Specialty Hospitals			
	Total			
Secondary	District Hospitals			
	General Hospitals			
	Sub-District Hospitals			
	Referral Hospitals			
	Rural Hospitals			
	Community Health Centre			
	Nursing Homes			
Total				
Primary	Block Primary Health Centre			
	Primary Health Centre			
	Urban Health Centre			
	Health Clinic/ Dispensary			
	Total			

Information on Special Settings available in various health facilities in the state:

Special Settings	Tertiary	Secondary	Primary	Total
Sputum Collection Centre				
Designated Microscopy Centre				
Integrated Counseling and Testing Centre				
Radiology Department				
Bronchoscopy Suits				
PFT Room				
Culture and DST Laboratory				
TB wards				
MDR TB Wards				
Airborne precaution Rooms				
ART Centre				
Operation Theatre				
DOT Centre				

B. Burden of Airborne Infection: TB notification rates

SN	Indicator / Value	State
1	Population in lacs	
TB Cases Notified in the quarter:		
2	Number of New Smear Positive (NSP) Pulmonary TB Cases registered for treatment:	
3	Number of New Smear Negative (NSN) Pulmonary TB Cases registered for treatment:	
4	Number of New Extra Pulmonary (NEP) TB Cases registered for treatment:	
5	Number of Re-treatment (RT) Smear Positive Pulmonary TB Cases registered for treatment:	
6	Total Number of All TB Cases registered for treatment:	
TB Case Notification Rates in the quarter:		
7	Annualized NSP TB Case Detection Rate per lac population:	
8	Annualized RT SP TB Case Detection Rate per lac population:	
9	Annualized Total TB Case Detection Rate per lac population:	

C. Human Resource:

1. Training status of Facility Administrators in National Guidelines on Airborne Infection Control in Health Care and Other Settings:

Level	Type of Health Facility	Total number of facilities	Total no. trained in NAIC Guidelines	% trained in NAIC Guidelines
Tertiary	Medical Colleges			
	Multi-Speciality Hospitals			
	Total			
Secondary	District Hospitals			
	General Hospitals			
	Sub-District Hospitals			
	Referral Hospitals			
	Rural Hospitals			
	Community Health Centre			
	Nursing Homes			
	Total			
Primary	Block Primary Health Centre			
	Primary Health Centre			
	Urban Health Centre			
	Health Clinic/ Dispensary			
	Total			

2. Training status of health care workers in Respiratory Infection Prevention and Control (RIPC):

SN	Cadre of staff	No. In place	Total no. trained in RIPC module	% trained in RIPC module
1	Doctors (including PG)			
2	Nurses			
3	Other paramedics – Class III (Pharmacists, technicians, ANM, MPW etc)			
4	Other paramedics - Class IV (sweepers, janitors, dressers etc)			
5	Trainee Doctors (UG, Interns)			
6	Trainee Nurses			
7	Trainee Paramedics			

C. Airborne Infection Control Policies and Practices:

1. Total number of Districts in state: _____
2. Number of Districts with SC-IC/BMW Committees in place: _____
3. Number of Districts with at least 1 SC-IC/BMW Committee meeting held in the quarter: _____
4. Number of Districts whose SC-IC/BMW Committee meeting minutes available at state level: _____
5. Number of Health Facilities where facility risk assessment for airborne infections attended by SAIC Committee members: _____
6. Number of Health Facilities with compliance report submitted to SAIC Committee on recommendations of facility risk assessment attended by SAIC Committee members: _____
7. Total number of Health Care Facility in the state: _____
8. Number of Health Facility with IC Committee in place (including AIC): _____
9. Number of Health Facility with IC plan (including AIC) available in written form? _____
10. Number of Health Facility with at least 1 IC Committee meeting held in the quarter: _____
11. Number of Health Facility whose IC Committee meeting minutes available at district level: _____
12. Number of Health Facilities reporting the intervention of triage, segregation and fast-tracking of respiratory symptomatics in place: _____
13. Is the State Airborne Infection Control Committee in place: Yes / No
14. Name and Designation of the person responsible for monitoring implementation of airborne infection control measures at the state level: _____
15. Number of SAIC committee meetings held in the quarter? _____

D. Passive Surveillance of TB / Other nosocomial infection in Health Care Workers:

1. Number of Health Facility subjecting staff to pre-employment medical examination in the state: _____
2. Number of Health Facility conducting Disease Surveillance in HCWs of the facility in the state: _____
3. Consolidated status of disease surveillance from health facilities in the district:

SN	Cadre of staff	No. In place	No. diagnosed of TB in the quarter	No. treated for TB in the quarter	No. treated for other respiratory ailment other than TB in the quarter
1	Doctors (including PG)				
2	Nurses				
3	Other paramedics – Class III (Pharmacists, LTs, ANM, MPWetc)				
4	Other paramedics - Class IV (sweepers, janitors, dressers etc)				
5	Trainee Doctors (UG, Interns)				
6	Trainee Nurses				
7	Trainee Paramedics				

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