THE DRAFT NATIONAL INFECTION PREVENTION AND CONTROL POLICY FOR TB, MDRTB AND XDRTB.

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This draft policy has been adapted from:

WHO Policy on TB Infection Control in Health-Care Facilities, Congregate Settings and Households, 2009.
ABBREVIATIONS AND DEFINITIONS

Bacille Calmette-Guérin (BCG) vaccine: A live vaccine against TB derived from an attenuated strain of *Mycobacterium bovis*.

Disinfection: A process of reducing microbial load without complete sterilization. Disinfection refers to the use of a physical process or chemical agent to destroy vegetative pathogens, but not bacterial spores.

Droplet nuclei: Microscopic particles that are estimated at 1-5 microns in diameter and are produced when a person coughs, sneezes, shouts or sighs. Such particles may remain suspended in the air for hours.

Environmental control measures: Measures that can be used in high-risk areas to reduce the concentration of droplet nuclei in the air (e.g., maximizing natural ventilation or controlling the direction of airflow).

Exhaust ventilation: An efficient environmental control technique (e.g. laboratory hoods, tents, booths, ventilation device) to contain airborne particles near the source before they can disperse widely into the air.

Facemask: A cloth or paper mask (e.g. surgical mask) that prevents the spread of micro-organisms from the wearer to others by capturing the large wet particles near the source (mouth); it does not provide sufficient protection from inhaling airborne infectious though.

Health care associated infection (nosocomial or hospital-associated infection): An infection acquired in a health care facility by a health care user, health care worker, or a visitor to a health care facility, who was in the facility for a reason other than that infection. Such an infection should have neither been present nor incubating at the time of admission or at the time when the initial contact with the health care facility was made. This includes infections acquired in the hospital, but appearing after discharge, including any infection in a surgical site up to six weeks post operatively. Also included are occupational infections among staff of the facility.

Health care workers: A group of people that includes nurses, physicians, nursing and medical students, laboratory workers, counsellors, and others who work in health care facilities and may be exposed to patients with communicable diseases.

HIV: Human immunodeficiency virus, the causative agent of AIDS.

Infection with *M. tuberculosis*: The sub-clinical, latent infection with the organisms that cause TB, manifested by a positive tuberculin skin test, but without clinical evidence of disease.

Infection prevention and control: Specific measures and work practices that reduce the likelihood of transmitting *M. tuberculosis*. 


Infection Prevention and Control Committee: A multidisciplinary committee that deals with infection prevention and control issues. Each member of the committee makes inputs as they relate to his/her discipline in order to share information and to cooperate. The committee is made up of medically trained microbiologists, clinicians, management representatives, and other health care workers representing, pharmacy, sterilizing service, housekeeping and training services.

Infection Prevention and Control Programme: A comprehensive programme that encompasses all aspects of infection prevention and control, covering education & training, surveillance, environmental management, waste management, outbreak investigation, development and updating of infection prevention and control policies, guidelines and protocols, cleaning, disinfection and sterilization, employee health, and quality management in infection control.

Infection Prevention and Control Team: The team of health care workers involved in carrying out the day-to-day infection prevention and control programme activities.

Isolation room: A single patient room with negative pressure ventilation where an infectious TB patient can be isolated from other patients.

Mechanical ventilation: Methods used to direct airflow to dilute and remove air, and to produce negative pressure in isolation rooms (e.g. window fan, and exhaust ventilation systems).

Medical devices: All equipment, instruments and tools, used in health care for diagnosis, prevention, monitoring, treatment or rehabilitation. Devices could thus include products such as contact lenses, condoms, heart valves, hospital beds, resuscitators and radiotherapy machines, surgical instruments and syringes, wheelchairs and walking frames, etc.

Multidrug-resistant tuberculosis (MDRTB): TB caused by strains of *M. tuberculosis* that are resistant to both Isoniazid and Rifampicin with or without resistance to other drugs.

*Mycobacterium tuberculosis*: The bacterium that causes TB.

Natural ventilation: Defined as natural air movement to achieve dilution and air exchange in an area with free-flow of ambient air (e.g. through the open windows).

PMTCT: Prevention of mother-to-child transmission of HIV infection.

Personal protective equipment: This refers to items specifically used to protect the health care worker from exposure to body substances or from droplet or airborne organisms. Personal protective equipment includes gloves, aprons, gowns, caps, masks and protective eye wear.

Respirators: A special type of closely fitted mask with the capacity to filter particles 1 micron in size to protect from inhaling infectious droplet nuclei.

Risk management: All the processes involved in identifying, assessing and judging risks, assigning ownership, taking actions to mitigate or anticipate them, and monitoring and reviewing progress.
Smoke tubes: Devices used to monitor proper airflow direction and to determine the correct function of ventilation systems.

Sterilisation: A process that destroys or removes all viable micro-organisms, including spores. Sterilisation can be achieved by the use of heat, stream, gas or chemicals.

Tuberculin skin testing (TST): Intracutaneous injection of purified protein derivative (PPD) to identify persons who have been sensitized to mycobacterial antigens by infection with \textit{M. tuberculosis}, environmental mycobacteria or administration of BCG.

Tuberculosis (TB): A clinically active, symptomatic disease caused by bacteria belonging to the M. tuberculosis complex (\textit{M. tuberculosis, M. bovis, M. africanum}).

Ultraviolet germicidal irradiation (UVGI): An environmental control measure to kill or inactivate micro-organisms like \textit{M. tuberculosis} through exposure to UVGI.

VCT: Voluntary counselling and testing for HIV infection.

Waste management system: All the activities, administrative and operational, involved in the production, handling, treatment, conditioning, storage, transportation and disposal of waste generated by health care establishments.

Work practice and administrative controls: Defined as managerial or administrative measures that guide work practices to reduce significantly the risk of TB transmission by preventing the generation of droplet nuclei. These include early diagnosis, prompt isolation or separation of infectious TB patients, prompt initiation of appropriate anti-tuberculosis treatment.
1. **BACKGROUND**

People with undiagnosed, untreated and potentially contagious TB are frequently seen in health care settings. In an era of increased access to HIV services such as Voluntary Counselling and Testing, Prevention of Mother to Child Transmission and Antiretroviral Therapy, increasing numbers of HIV positive patients are also seen in these facilities. HIV positive patients are particularly vulnerable to TB with a 10% annual risk of developing TB compared to a 10% lifetime risk in those with normal immunity. It is estimated too, that 10% of those newly diagnosed with HIV have undiagnosed TB; half of these are infectious. The increasing numbers of undiagnosed TB, TB suspects, TB patients and immuno-compromised patients all present in the same environment create the potential for high levels of nosocomial transmission of TB.

An increased risk of TB has been documented amongst all categories of health care personnel (including facility staff, community health workers and volunteers) compared to the general population. The prevalence of HIV amongst health care personnel correlates with that in the general population. Health care personnel are at risk due both to frequent exposure to patients with infectious TB and because they may also be immuno-compromised due to HIV.

It is the responsibility of management and staff to minimise the risk of TB transmission in health settings. Infection control measures should be established to reduce the risk of TB transmission to both the general population and to health care personnel. Since the majority of patients are seen at primary health care level, it is important to ensure that measures to prevent the spread of infection focus not only on hospitals, but are implemented also at primary health care level.

Persons with undiagnosed, untreated and potentially contagious TB are often also seen in HIV care settings. TB is the most common opportunistic infection and a leading cause of death in persons living with HIV and AIDS (PLWHA).

In high TB burden settings, surveys have shown that up to 10% of persons with HIV infection may have previously undiagnosed TB at the time of HIV voluntary counselling and testing (HCT), including at centres providing prevention-of-mother-to-child HIV transmission (PMTCT) services. Up to half of these may be infectious TB cases.
Between 30% and 40% of PLWHA living in high burden TB settings will develop TB in their lifetime, in the absence of Isoniazid preventive therapy or antiretroviral therapy. The risk of developing TB disease doubles in the first year after becoming HIV-infected and gets progressively higher over time. Persons without TB disease at the time of HIV diagnosis may still develop TB in later years, and will then be at risk of spreading *M. tuberculosis* in the community as well as to fellow patients, healthcare workers, and staff at their HIV and/or other primary health care clinics and in community programmes.

Persons with HIV-associated immuno-suppression may become infected or re-infected with TB if they are exposed to someone with infectious TB disease. They can progress rapidly from TB infection to disease – over a period of months rather than a period of years as is common for persons with a normal immune system.

Health care workers and other staff are also at particularly high risk of infection with TB because of frequent exposure to patients with infectious TB disease. Health care workers and staff may themselves be immuno-suppressed due to HIV infection and be at higher risk of developing TB disease once infected.

The rising incidence of multidrug-resistant tuberculosis (MDR-TB) and extensively drug-resistant tuberculosis (XDR-TB) with high mortality have led to a stronger focus on TB infection control. Multiple TB outbreaks affecting HIV-infected patients and health care workers due to health care facility exposures were documented in industrialized countries in the nineties.

World Health Organization (WHO) recommends that TB infection control requires action at national and subnational level to provide managerial direction, and at health facility level to implement TB infection control measures.
2. TRANSMISSION OF TUBERCULOSIS

Tuberculosis is usually spread from person-to-person through the air by droplet nuclei that are produced when a person with pulmonary or laryngeal tuberculosis coughs, sneezes or sings. Droplet nuclei may also be produced by aerosol-producing investigations such as sputum induction, bronchoscopy and through manipulation of lesions or processing of tissue or secretions in the laboratory.

People with active tuberculosis generate droplets of different sizes. The larger droplets containing higher numbers of bacteria do not serve as effective vehicles for TB transmission as they do not remain airborne for long periods. If they are inhaled, they do not reach the alveoli because they deposit in the upper airways where they are trapped in the mucous blanket, carried by mucociliary action to the oro-pharynx and swallowed or expectorated.

Micro-droplets, which are small particles 1 to 5 µm in diameter containing 1-5 bacilli, are highly infectious. They are so small that air currents normally present in any indoor space can keep them airborne for long periods of time. These droplets are small enough to reach the alveolar spaces within the lungs, where the organisms replicate.

One cough can produce 3,000 droplet nuclei and a sneeze up to a million droplets; about 10-200 droplets can cause infection. The most infectious cases are those with smear positive pulmonary TB, particularly with lung cavities. Smear negative pulmonary TB cases are much less infectious. Extra-pulmonary cases are almost never infectious, unless they have pulmonary tuberculosis as well. Individuals with latent tuberculosis infection are not infectious, as they do not have replicating bacteria and cannot transmit the organism.

Transmission generally occurs indoors, in dark, damp spaces where droplet nuclei can stay airborne for a long time. Direct sunlight quickly kills tubercle bacilli, but they can survive in the dark for several hours. Close contact and prolonged exposure increases the risk of transmission.

Once infected, the progression to active disease is dependent on the immune status of the individual. In those with normal immunity, 90% will not progress and only 10% will develop active disease (half
of these now and half later on in life). The risk is highest in the first two years after infection, when half the cases will occur. Those most at risk include children <5 years of age and the elderly.

People with suppressed immunity are more likely to develop active TB than those with normal immunity; 50-60% of HIV positive people infected with TB will go on to develop active disease. The annual risk of TB in an HIV positive person is 10% compared to a lifetime risk of 10% in a healthy individual. Other immunosuppressive conditions with such as silicosis, diabetes mellitus, and where corticosteroids and other immunosuppressive drugs are used, also increase the risk of progression to active TB.

BCG immunisation gives variable protection against the progression of TB from infection to disease. The main benefit of BCG is the protection against the development of the serious forms of TB in children, such as TB meningitis and miliary TB.

Three factors determine the likelihood of transmission of M. tuberculosis:

- The number of organisms expelled into the air
- The concentration of organisms in the air, determined by the volume of the space and its ventilation
- The length of time an exposed person breathes the contaminated air

2.1 Factors that determine those most likely to spread TB infection

1. Site of Disease - Only patients who have pulmonary TB can spread TB infection.
2. Sputum Bacteriology – infectiousness is associated with the number of infectious droplets that are excreted during a cough or sneeze. The mycobacterium can be identified in the sputum on smear microscopy or culture.
3. Radiological changes - Patients who have cavitary disease on chest x-ray are more infectious than those who have non cavitary disease
4. Age – children less than 8 years of age are less infectious as they have pauci bacillary disease
5. HIV Status – people who are HIV positive and have a high CD4 count would be as infectious as HIV negative patients. Those with low CD4 count are considered less infectious as they would have paucibacillary disease due to severe immune suppression.
6. Administration of Effective Treatment – Once started on treatment patients become less infectious if treatment is effective therefore the risk of spreading the infection decreases over time.

The characteristics of the TB patient influence the number of organisms generated and thereby increase the risk of transmission. Infectiousness is dependent on the location and extent of disease. Patients should be considered infectious if they have any of the following:

- Coughing
- Sputum smear positive
- Chest x-rays shows cavities in the lungs
- Not on / have just started TB treatment
- Show poor clinical response to TB treatment

The period of infectiousness ends when any of the following criteria are fulfilled:

- The patient has been on effective treatment for a period of at least two weeks
- There has been clinical improvement – symptoms and signs have subsided, patient feeling better and clinically looks well
- There has been satisfactory bacteriological response – reduction in the sputum positivity grading, smear conversion from positive to negative

The risk of transmission of infection is determined by:

- The infectiousness of the person with TB (i.e. a person with a smear positive grading of 3+++ is more infectious than 1+)
- The environment in which exposure occurred (i.e. in a poorly ventilated room with no sunlight the risk is higher than in a well ventilated room with sunlight).
- Duration of exposure (i.e. spending eight continuous hours with an infectious person has higher risk than two hours)
- Virulence of the *M tuberculosis* strain (i.e. the more virulent the strain the higher the risk)
2.2 Environmental risk factors

Inadequate ventilation results in failure of air dilution or removal of infectious droplet nuclei thereby increasing the risk of transmission in a small enclosed space. For example, transmission is less likely in a big well ventilated room than in a small poorly ventilated one.

2.3 Host characteristics

Co-morbidities may be associated with an increased risk for progression from infection to disease. HIV infection, diabetes and malnutrition are well documented risk factors for progression from TB infection to TB disease. The risk of infection may be increased by silicosis, inhalation of smoke (e.g. tobacco, exposure to cooking fires).
3. REDUCING THE RISK OF TRANSMISSION OF TB INFECTION IN HEALTH CARE FACILITIES

It is the responsibility of management and staff to minimise the risk of TB transmission in health settings. Infection control measures should be established to reduce the risk of TB transmission to both the general population and to health care personnel. Since the majority of patients are seen at primary health care level, it is important to ensure that measures to prevent the spread of infection focus not only on hospitals, but are implemented also at primary health care level.

In all health-care facilities, particularly those in which persons are at risk for TB work or receive care; policies and procedures for TB control should be developed, revived periodically, and evaluated for effectiveness to determine the actions needed to minimize the risk of transmission of M. tuberculosis.

3.1 Managerial Control
The managerial control provides a framework for the implementation of the infection control measures. Managerial controls are activities aimed to provide a framework for TB infection control interventions at all levels (national, provincial and facility) and settings (health-care facilities, congregate settings and households). They are designed to support and facilitate the implementation, operation, maintenance and evaluation of all TB infection control activities. At all levels the programme managers must put in place a managerial framework for TB infection Control implementation at all settings.

3.1.1 National and provincial level managerial control activities include:
1. Ensure that health facility design, construction, renovation and use are appropriate.
2. Ensure that medical surveillance of TB disease for all health workers is conducted.
3. Ensure that risk assessment is conducted in health facilities and in congregate settings.
4. Develop information, education and communication (IEC) materials on infection control
5. Conduct social mobilization on infection control engaging civil society.
6. Monitor and evaluate the set of TB infection control measures.
7. Enable and conduct operational research.
3.1.2 District and facility level managerial activities

The district and facility level managerial activities should be aligned and complement the provincial managerial activities. The activities include:

- The district and or facility manager should establish an infection control committee and appoint an infection prevention and control officer who will develop and ensure implementation of infection prevention and control plan.
- Conduct health facility TB risk assessments
- Conduct medical surveillance of TB disease among health workers
- Train and educate health workers, patients and visitors on infection control measures.
- Monitor and evaluate the implementation of TB infection control interventions.
- Participate in research activities.

Each hospital should establish a multidisciplinary Infection Prevention & Control Committee where appropriate. This committee should comprise of the officer in charge of infection prevention and control in the facility, a microbiologist, the persons in charge of all the relevant medical disciplines, a pharmacist, a housekeeping supervisor, a food service manager, a laundry service manager, a maintenance manager, and the hospital manager. Where the facility does not have certain categories in its establishment, the committee should arrange access to their services.

The roles and responsibilities of this committee are to:

- Oversee the implementation of the infection control plan
- Review and approve a yearly programme of activities for surveillance and prevention
- Review epidemiological surveillance data and identify areas for intervention
- Develop facility policies for the prevention and control of infection
- Assess and promote good practices at all levels of the health facility
- Ensure appropriate staff training in IC and safety management
- Ensure provision of safety materials such as PPE (personal protective equipment)
In hospitals an Infection Prevention and Control Team should be appointed. This team should comprise at least a clinician (ideally a medically trained microbiologist) and a registered nurse, trained in infection prevention and control. The number of infection control officers should ideally be one nurse per 200 patient beds.

Clinics and Community Health Centres should each have at least one identifiable person responsible for overseeing the Infection Prevention and Control function. Where the availability of medical staff does not permit it, district infection control officers should provide the technical support to the staff at the clinic.

The TB infection-control program is based on three levels of hierarchy of infection control (IC) measures:
- Administrative control, including appropriate work practices
- Environmental control
- Personal respiratory protection

3.2 Administrative control

In general, administrative control (work practices) measures have the greatest impact on preventing TB transmission and they are the first priority in any setting regardless of available resources. Administrative measures aim to reduce droplet nuclei containing Mycobacterium tuberculosis in health facilities and thus to reduce the exposure of staff and patients.

The goals of administrative controls are to:
- prevent TB exposure to staff, patients and visitors,
- reduce the spread of infection by ensuring rapid diagnosis and treatment of patients and staff with TB symptoms.

Administrative controls have the greatest impact on TB control and should be the priority. Ideally, if generation of droplet nuclei is eliminated then exposure is eliminated; no further controls are needed. However, since it is not possible to eliminate all exposure, environmental control measures must be added to reduce the concentration of droplet nuclei in the air. Although many environmental control measures require resources not available in resource-limited settings, some can be implemented, and staff can be trained in their purpose, capabilities, proper operation, and maintenance.

The five components to good administrative controls are:
- An infection prevention and control plan;
• Administrative support for procedures in the plan, including quality assurance;
• Training of staff;
• Education of patients and increasing community awareness; and
• Coordination and communication with the TB programme.

An infection control officer should be identified who will be responsible for conducting the risk assessments, develop the IPC plan; monitoring it and arranging training for health care personnel on the IPC measures for the facility. The plan needs to clearly identify high-risk areas within the health facility and interventions to reduce risk.

3.2.1 Infection control plan

Each facility must have a written TB infection prevention and control plan that outlines a protocol for the prompt recognition, separation, provision of services, investigation for TB and referral of patients with suspected or confirmed TB disease. The plan will include, but not be limited to, the following measures:

• Early recognition of people with TB symptoms through symptomatic screening of all patients entering facility or soon after arrival. A staff member\(^1\) should be assigned to screen patients using the TB screening tool. The form must be completed and included in the patients file. Those with a prolonged duration of cough must have their sputum collected either before or after consultation with health care provider.
• People with chronic cough must wait in a designated, well ventilated waiting area. Where this is not possible they must be educated on cough hygiene and provided with a face mask or tissue to cover their mouth and nose when coughing. Tissues and facemasks should be provided in the waiting areas and discarded in the bins after use. Hand washing should be encouraged after contact with respiratory secretions.
• Fast tracking confirmed TB cases coming for follow up appointments or to take/ collect their treatment to ensure that they spend as little time as possible in the facility.
• Educating health care personnel, patients and communities to seek health care early when signs or symptoms of TB are present and to protect themselves and others e.g. through appropriate cough hygiene and good ventilation in the household.

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\(^1\) This can be a community health worker/ lay counsellor, cleaner, administrative clerk trained
• Improved TB and HIV integration in the health facility, with symptomatic TB screening of HIV positive patients at routine clinical visits and appropriate tests for those who are symptomatic, to aid early diagnosis.

3.2.2 Training of facility staff on IPC plan
Infection prevention and control is effective only if all staff working in a facility understands the importance of the infection prevention and control policies and their role in implementing them. As part of training, each health care worker and staff member, including any lay workers, should receive job category-specific instruction. Training should be conducted before initial assignment and continuing education should be provided to all employees and volunteers annually.

Training should include the following:
• Basic concepts of *M. tuberculosis* transmission and pathogenesis
• Risk of TB transmission to health care workers and staff
• Symptoms and signs of TB;
• Impact of HIV infection on increasing risk of developing TB disease and the importance of TB as a major cause of disease and death in PLWHA;
• Importance of the infection prevention and control plan and the responsibility that each staff member has to implement and maintain infection prevention and control practices;
• Specific infection prevention and control measures and work practices that reduce the likelihood of transmitting TB; and
• Measures staff can take to protect themselves from TB.
• TB disease surveillance among HCW

3.2.3 Community education and awareness
Educating communities and patients to recognize symptoms of TB and to seek health care and further investigations should be routine in all settings providing care for patients, especially HIV-infected persons. In addition, patients should understand how to protect themselves, and others, from exposure to TB by simple cough hygiene measures.
3.3 Environmental control measures

Environmental controls are the second line of defence in preventing the spread of TB. They are only effective if administrative controls are in place and include:

- Ventilation (natural and mechanical)
- Filtration
- Ultraviolet germicidal irradiation

Ventilation is the movement of air through a building so that it is replaced by air from outside. Natural ventilation relies on open doors and windows. There should be adequate numbers of windows and doors opening to the outside to allow good ventilation. Windows on opposite sides of the room allow good cross ventilation. Controlled natural ventilation implies that measures are in place to ensure that windows and doors stay open. Open windows on opposite sides of the room offer the most effective natural ventilation. Assisted ventilation using propeller fans on the ceiling, desk, floor or window mounted is an inexpensive way to improve natural ventilation. Good natural ventilation plays an important role in preventing TB particularly in waiting areas, examination rooms and sputum collection areas. Open-air shelters with a roof to protect patients from sun and rain could be used as waiting areas where space is a challenge.

3.3.1 Controlled natural ventilation

Natural ventilation is controlled when openings are deliberately secured open to maintain airflow. This can be attained by use of propeller fans.

Propeller fans increase the effectiveness of natural ventilation by increasing the mixing of airborne infectious droplet nuclei. They also assist in the directing the air movement by pushing or pulling of the air.

There are different types of propeller fans – ceiling fans, desk top fans, free standing and wall/ window mounted fans.

Figure 1. Propeller fans
3.3.2 Air mixing and removal

Propeller fans help mix air in a room. The aim is to reduce pockets of high concentrations in the vicinity of patients in areas where natural ventilation is inadequate. The total number of infectious particles in the room will not change with mixing; however, the concentration of particles near the source will be reduced, and the concentration in other parts of the room may increase. The combination of this mixing with air replacement in the room by opening windows and doors will result in marked reduction of infectious droplet nuclei in the room. Therefore the risk of infection is reduced by combining air mixing and removal.

3.3.3 Checking natural ventilation

People can usually feel the existence or lack of air movement in a space. A ventilated space has a slight draft. In the absence of ventilation, air will feel stuffy and stale and odours will linger. Use the following checklist to assess natural ventilation in your waiting areas and examination rooms:

1) Check air mixing and determine directional air movement in all parts of rooms or areas. One way to visualize air movement is to use incense sticks as described in these six steps.
   - Hold two incense sticks together and light them.
   - As soon as the incense starts to burn, blow out the flame. Now the incense should produce a continuous stream of smoke.
   - Observe the direction of the smoke.
   - Observe how quickly the smoke dissipates. This is a subjective test that may require some practice. It does not give a definite result but is useful for comparing one room or area to another.

2) Natural ventilation should be checked once a year or whenever changes in the physical environment are made to confirm free movement of air.

3) Records of all routine activities and dates must be kept.

3.3.4 Directional airflow

Fans can be used to enhance flow of air in and out of the room when installed in the windows or wall opening where there are inadequate windows. They can also be used to exhaust air outside, away from people. For example, in a room which has a door/ window on one side and nothing on the
opposite side, when the window/door is kept open, the overall effect of installing fans on the opposite side is to draw in fresh air through the front of the building and exhaust air out. It is therefore important to be mindful of the direction of airflow in a room to ensure that the sitting arrangement is such that air will blow from behind the health care worker over the patient and out of the room.

3.3.5 Exhaust fans
There are a wide variety of exhaust fan systems. The simplest could be a propeller fan installed in the wall, a ceiling grille and a duct leading to the outside on the wall or roof to expel the contaminated air. Over time, dust and lint accumulate on exhaust fan blades, motors, and ducts rendering the system less effective. For this reason, these systems should be cleaned regularly.

3.3.6 Checking fans
1) Fans must be cleaned and checked monthly.
   - A cloth or vacuum cleaner may be used to remove dust and lint from fans, grilles, and ducts.
   - To check the working condition of fans that have a grille, hold a tissue or piece of paper against the grille. If the exhaust fan is working, the tissue or paper should be pulled against the grille.

2) Flow rates through exhaust fans and grilles can be measured using a simple velocity meter. The airflow rates can be calculated from simple velocity measurements (see Boxes 1 and 2).
3) Air exchange rates (also called air-changes per hour) can be calculated as shown in boxes below. If mechanically ventilating a room, the fan should provide a minimum of six air exchanges per hour.

4) Keep records of all routine activities and dates.
4. INPATIENT SETTINGS

Mechanical ventilation can be used in areas where there may be high concentrations of infectious droplets. These are systems that facilitate air entry into the room and extraction from the room to the outside. The most cost effective are exhaust fans that are placed in windows. It is important to ensure that airflow is adequate and that air flows across the room.

Exhaust ventilation systems allow for exchange of air in the room as well as extraction of air to the outside. In negative pressure ventilation, the room is kept at negative pressure by directly exhausting air to the outside, thus ensuring that fresh air is drawn into the room.

Ultraviolet germicidal irradiation (UVGI) may be used as an adjunctive measure. Ultraviolet rays kill the bacilli. For this to be effective the contaminated air has to come into contact with the rays; therefore circulation of air is important. It is ineffective in humid and dusty environments. UVGI lamps are expensive, have to be installed properly for maximum effect and require a regular programme of maintenance. If not adequately maintained, lamps are ineffective and can cause acute or chronic skin and eye problems.

4.1 Personal respiratory protection

Personal protection refers to the use of respirators that contain a special filter material that protects the wearer from inhaling the bacilli. Respirators can protect health care workers from inhaling *M. tuberculosis*. Without appropriate administrative and environmental control measures, respirators alone will not adequately protect the HCWs from infection. However, They serve as a valuable complement to administrative and environmental control measures. They are used as the last resort where all the other measures have not completely eliminated the risk. They are most appropriately used for short-term protection against high-risk exposures e.g. during sputum inducing procedures and bronchoscopy. Long-term use of respirators is not feasible due to the discomfort, difficulty in speaking clearly through the mask and the cost involved.

A respirator is a device for personal respiratory protection that covers the mouth and nose and is certified to have specific filtration capacity. Unlike surgical masks, they contain a filter and are designed to fit tightly to the face to prevent leakage between the face and the edge of the mask.
The recommended respirator is the type that covers the mouth and nose and is fitted with a special particulate filter to filter out very small particles. U.S. certified N95 or greater or E.U. specified FFP2 or greater are recommended for use in health care settings.

4.4.1 How to put on an N95 Mask
- N95 masks must be fit tested to ensure an adequate fit for the user.
- Inspect the mask to ensure that it is not damaged.
- Place mask over nose, mouth and chin with the lower elastic strap stretched out over the head. Ensure that the bottom flap is pulled out.
- Secure the lower elastic at the top of your neck and the upper elastic above your ears, at the back/top of the head.
- Press down the edges of the mask starting at the nose bridge right down to the chin to ensure comfortable fit.
- Inhale rapidly, the mask should collapse slightly and exhale. Check for leaks around the edges as you exhale, if there are leaks adjust the nosepiece.

4.4.2 How to remove an N95 Mask
- Wash hands using soap and water
- Avoid touching the front part of the mask with wet and greasy hands
- Support the front part of the mask and remove by lifting the top and then the bottom elastic over the head.

Masks are disposable but can be re-used repeatedly over the course of an 8 hour shift for up to 5 days under the following conditions:
- It is only to be used by one healthcare worker;
- It is stored in a clean and dry location.

Do not write on the mask.

Do not store in a plastic bag

Do not leave mask hanging around your neck.
Facemasks, such as surgical masks (cloth or paper):
- Are meant to prevent the spread of microorganisms from the wearer into the air or to others by capturing the exhaled large wet particles near the source (mouth).
- Do not provide adequate protection to the wearer from inhaling infectious droplet nuclei in the air.
- Masks usually have limited filtration capacity and are loosely fitted over the mouth and nose, allowing free entrance of aerosolised M. tuberculosis.

4.4.3 Use of surgical masks on patients
Although not the highest priority intervention, disposable/cloth masks can be used to reduce infectious TB aerosols generated from potentially infectious TB patients. Disposable or surgical masks should be considered for people with chronic cough and known infectious TB patients leaving the ward for medically essential procedures or other reasons. Use of such masks is likely to reduce amount of infectious TB aerosols generated by the patient. The concern is that they could perpetuate stigma. They are recommended for infectious patients/staff on a short-term basis.

4.5 Protection of health care personnel
All categories of health care personnel have an increased risk of TB when compared to the general population and HIV-infected health care workers are at increased risk of developing TB disease if exposed in the workplace.

In addition to reducing their exposure, specific measures that target health care personnel are required:
- Informing health care personnel of the signs and symptoms of TB and encouraging early recognition of symptoms and presentation for sputum tests
- Ensure that all health care personnel with signs and symptoms are evaluated as “high risk TB suspects” and have a sputum specimen sent for evaluation.
- Providing VCT and encouraging health care personnel to know their HIV status
- Advocating / providing precautionary measures for HIV positive staff, such as TB preventive therapy and antiretroviral therapy.
- Appropriate placement of HIV positive staff in low TB risk areas of the facility.
- Annual medical surveillance of all staff
5. **INFECTION PREVENTION AND CONTROL IN HOSPITAL WARDS**

One of the most effective means to reduce the risk of transmission of *M. tuberculosis* in hospital settings is to manage TB 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.

Ideally, infectious TB patients should be isolated from other patients so that others are not exposed to the infectious droplet nuclei that they generate. If sputum smear is performed at the time of admission, those who have positive sputum smear results, and thus most infectious, should be isolated or separated from other patients.

The hospital administration should attempt to:
- Limit the number of areas in the facility where exposure to potentially infectious TB patients may occur.
- Establish separate wards, areas or rooms for confirmed infectious TB patients. These wards/areas should be located away from wards with non-TB patients, especially wards with paediatric or immuno-compromised patients.

As in the outpatient setting, early identification, diagnosis, and treatment of TB cases is the highest priority. Assigning the role of “ward cough officer” to a staff member, who assures sputum specimen collection, rapid transport of specimens to the laboratory, and the delivery of results to the ward medical team, can be effective. The ward cough officer may help to identify patients in need of investigation and to enforce TB infection control policies.

Radiology departments in hospitals often provide services to a variety of patient who may be at particularly high risk for TB, such as young children or immuno-compromised patients.
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.
6. CORRECTIONAL FACILITIES AND OTHER CONGREGATE SETTINGS

In many areas the proportion of persons with HIV infection in drug rehabilitation centres and correctional institutions is much higher than in the general population. TB is spread even more readily in these settings than in outpatient settings because of the longer duration of potential exposure, crowded environment, poor ventilation, and limited access to health care services.

7. OPERATIONAL RESEARCH PRIORITIES

Operational research can further inform practice. Areas in which carefully collected and analyzed data would be useful include:

- Screening tools and algorithms to quickly identify potentially infectious TB patients presenting for HIV services;
• Mechanisms for referrals and links between HIV and TB services;
• Strategies for increasing the proportion of health care workers who know their HIV status and are able to access adequate care, including antiretroviral therapy and Isoniazid preventive therapy;
• Designs for enhancing total air flow and air flow direction through controlled natural ventilation;
• Utility of ultraviolet germicidal irradiation in resource-limited settings;
• Feasibility of prolonged treatment with Isoniazid for prevention of TB in immuno-compromised health care workers; and
• Interventions with health care workers that reduce stigma towards HIV and TB/HIV patients.
ANNEXURE A: REFERENCES


8.5 Corbett E et al. The growing burden of tuberculosis: global trends and interactions with the HIV epidemic. Archives of Internal Medicine, 2003, 163:1009-1021.


Additional Resources

8.11 http://www.who.int/docstore/gtb/publications/prisonsNTP/PDF/tbprisonsntp.pdf TB Infection Control and TB/HIV Collaborative Activities


8.13 Guidelines for Preventing the Transmission of Mycobacterium tuberculosis in Health-Care Settings, Morbidity and Mortality Weekly, 2005 http://www.cdc.gov/mmwr/preview/mmwrhtml/rr5417a1.htm


The following guidelines were developed for US domestic situation but contain useful material:


8.21 Isoniazid Preventive Therapy

MDRTB


Correctional Institutions

http://www.who.int/docstore/gtb/publications/prisonsNTP/PDF/tbprisonsntp.pdf

The following guidelines were developed for US domestic situation but contain useful material:

http://www.nationaltbcenter.edu/jailtemplate/docs/tb_section1.pdf

Laboratory Issues

ANNEX B: SAMPLE INFECTION PREVENTION AND CONTROL PLAN

A. The plan will include, but not be limited to, the following policy areas:

1. Screening patients to identify persons with symptoms of TB disease or who report being under investigation or treatment for TB disease.

2. Providing face masks or tissues to persons with symptoms of TB disease (“TB suspects”) or who report being under investigation or treatment for TB disease (“TB suspects or cases”), and providing waste containers for disposal of tissues and masks.

3. Placing TB suspects and cases in a separate waiting area.

4. Triaging TB suspects and cases to the front of the line to expedite their receipt of services in the facility.

5. Referring TB suspects to TB diagnostic services and confirming that TB cases are adhering with treatment.

6. Using and maintaining environmental control measures.

7. Educating staff periodically on signs and symptoms of TB disease, specific risks for TB for HIV-infected persons, and need for diagnostic investigation for those with signs or symptoms of TB.

8. Training and educating staff on TB, TB control, and the TB infection prevention and control plan.

9. Monitoring the TB infection and control plan’s implementation.

B. The facility will implement each policy by following the procedure(s) that accompany it.

Policy and Procedures
Purpose: Early identification, separation, receipt of services, and referral of patients with TB disease is essential in preventing spread of TB.

Lead: _____________________ has the responsibility for overseeing the implementation of these policies and its procedures, and reports to (District health executive committee, etc).

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

Procedures:

(i) 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. The questioning should occur before patients wait in line for long periods to register or obtain services.

(ii) Many combinations of symptoms have been recommended as sensitive and specific for TB. 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.
(iii) As patients who are not identified as a TB suspect or case on the initial symptoms screen enter an examination room with the clinical officer, nurse, or counsellor, 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:

(i) Patients who are found to be TB suspects or cases should immediately be informed about the importance of cough hygiene and be handed tissues (or pieces of cloth) and instructed to cover their mouths and noses when they cough. Alternatively, patients should be given a facemask, 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 or on the benches.

When tissues, cloths or facemasks 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.

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

**Policy 3: Placing TB suspects and cases in a separate waiting area.**
Procedures

(i) 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: Triaging TB suspects and cases to the head of the line to receive services in the facility

Procedures

(i) TB suspects and cases should be moved to the head of the line for whatever services they want or need, e.g., VCT, 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: Referring TB suspects to TB diagnostic services.

Procedures

(i) ____________________ is the designated staff person to counsel patients about obtaining TB diagnostic services.

(ii) Patients will be referred to ____________________________ (a TB diagnostic centre with whom the health care facility has a previously negotiated agreement with).

(iii) Patients should be given a card with the name, location, and operating hours of the TB diagnostic centre. The card should also have the name of the referring facility on it, with date of referral marked. These cards can be collected at the TB centre and used as an anonymous check on number of referrals that successfully obtain TB services. (See also the TB suspect and case form listed in Annex A2 below, which can be used to cross-reference referrals that are made/successful).
**Policy 6: Using and maintaining environmental control measures.**

**Procedures**

(i) ____________________ is the designated staff person to check on environmental control measures and maintain a log of monitoring and maintenance.

(ii) 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).

(iii) 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: Providing Medical surveillance to health care workers and staff.**

**Procedures**

(i) Health care workers and all other staff working at the facility should be educated about the signs and symptoms of TB and encouraged to seek investigations promptly if they develop symptoms and signs suggestive of TB.

Health care workers and other staff should be informed about the special specific risks for TB for HIV-infected persons

(iii) Health care workers and staff should be encouraged to undergo HIV testing, and given information on relevant HIV care resources.

(iv) Staff training should include reduction of stigma of TB and HIV.
(v) _____________________ is responsible for determining when staff who develop TB disease may return to work.

(vi) Staff who develop TB disease may return to work when determined to be no longer infectious after:

a. Having completed at least two weeks of standard anti-TB therapy;
b. Exhibiting clinical improvement;
c. Having continued medical supervision and monitoring of treatment until cured; and
d. Where possible, having had three consecutive negative sputum smears obtained on three different days with at least one morning specimen. (Note: Frequent evaluation of sputum smear status may not be done routinely in resource-limited settings.)

Policy 8: Training of staff on all aspects of TB and the TB infection prevention and control plan.

Procedures

(i) _____________________ is the designated staff person to provide training to new staff as they are employed and to maintain a log indicating who has had initial training.

(ii) _____________________ 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 it could be stand-alone TB infection control training.

Policy 9: Monitoring the TB infection prevention and control plan’s implementation.

Procedures
(i) Determine the frequency of the infection prevention and control plan evaluation.
   a. During initiation of procedures, monitoring and evaluation should be done frequently, perhaps monthly or bi-monthly.
   b. When procedures are running well, less frequent evaluation will be necessary – at a minimum, annually.

(ii) Evaluate the screening process.
   a. Were patients with significant cough missed when entering the facility and only detected at a later time or in the examination room?
   b. What correctable factors were associated with these potential exposures?

(iii) Evaluate the success of referrals to the TB diagnostic centre.
   a. Did referred patients access care?
   b. Did referred patients have TB disease?
   c. What changes in screening or referral process should be made, if any?

(iv) Evaluate the training process.
   a. Did all new staff receive training on TB infection prevention and control during their induction?
   b. Did all staff receive annual re-training on TB infection control?

(v) Revise the infection prevention and control plan to reflect changes in staff responsibilities, policies, and procedures.

(vi) Develop a plan for correcting inappropriate practices or failure to adhere to institutional policies.
   a. Identify incentives to participate fully and adhere to policies.
   b. Identify corrective actions if policies are not followed.

ANNEX B2. SAMPLE MONITORING TOOLS
_______________ has the responsibility for overseeing the evaluation of the TB infection control policies and its procedures, and reports to ________________ (Program director, District health executive committee, etc).

_______________ has the responsibility for filling out The “TB case and suspect log” on a daily basis, entering the date, names of patients who were found to be a case or suspect that day, whether they were missed at intake screening, and to which facility they were referred.

_______________ has the responsibility for conducting follow up on patients referred to a TB diagnostic facility and recording the outcomes of their investigation in the log.

_______________ has the responsibility to summarize and present the results of the screening process to relevant management and staff periodically.

**TB Case and Suspect Log**

<table>
<thead>
<tr>
<th>Date</th>
<th>Patient Name</th>
<th>Case or Suspect (c/s)</th>
<th>Missed at intake?* (y/n)</th>
<th>Referred to (name of facility)</th>
<th>Outcome** (TB, not TB, NS)</th>
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* Missed at intake = symptoms or history detected only after patient enters private room with clinician or counsellor instead of upon entry to the facility; or after numerous visits while symptomatic yet undetected: y=yes, n=no

** Outcomes:  TB diagnosed or confirmed=TB; TB ruled out after diagnostic investigation=not TB; Did not present to referral facility for investigation=NS (not seen).

**Staff TB Infection Control Training Log**

<table>
<thead>
<tr>
<th>Staff Name</th>
<th>Start Date</th>
<th>Date first IPC training</th>
<th>Date annual training</th>
<th>Date annual training</th>
<th>Date annual training</th>
<th>Date annual training</th>
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## ANNEX C: EDUCATION MATERIALS ABOUT TB FOR PATIENTS

*Guide for use by Health care workers to educate patients about TB*

<table>
<thead>
<tr>
<th>What is TB?</th>
<th>TB is an illness (i.e., disease) caused by a germ that is breathed into the lungs. TB germs can settle anywhere in the body, but we most often hear about TB of the lungs. When lungs are damaged by TB, a person coughs up sputum (mucus from the lungs) and cannot breathe easily. Without correct treatment, a person can die from TB.</th>
</tr>
</thead>
<tbody>
<tr>
<td>What kind of symptoms do you think people with TB have?</td>
<td>People with TB of the lungs have a chronic cough, generally lasting for more than two weeks. They can also cough up blood. People with TB in any part of the body have fevers, night sweats, and weight loss. People with these symptoms should tell a health care provider so they can be evaluated for TB.</td>
</tr>
<tr>
<td>Have you ever known anyone with TB? What happened to that person?</td>
<td><em>(just listen to their response)</em></td>
</tr>
<tr>
<td>Do you know that TB can be completely cured?</td>
<td>TB can be cured with the correct drug treatment. The patient must take all of the recommended drugs for the entire treatment time (six or eight months) to be cured. Drugs for treatment of TB are provided free of charge, and treatment can be done without interrupting normal life and work.</td>
</tr>
<tr>
<td>How do you think that TB spreads?</td>
<td>TB spreads when an infected person coughs or sneezes, spraying TB germs into the air. Others may breathe in these germs and become infected. It is easy for germs to pass to family members when many people live closely together. Anyone can get TB. However, not everyone who is infected with TB will become sick.</td>
</tr>
<tr>
<td>How can someone with TB avoid spreading it?</td>
<td>There are several ways that a person with TB can prevent infecting others. An important step is to take regular treatment to become cured. Another measure to prevent infecting others is for infected persons to cover their noses and mouths when coughing or sneezing. Finally, infected persons should open windows and doors to allow fresh air into their homes.</td>
</tr>
<tr>
<td>Is TB a problem for people with HIV infection?</td>
<td>People living with HIV and AIDS are at extra risk of getting sick from TB because their body cannot fight off germs very well. If someone develops symptoms of coughing for more than two weeks, coughing up blood, weight loss, fevers or night sweats, it is important to get checked for TB. TB can be cured even in persons with HIV and AIDS.</td>
</tr>
</tbody>
</table>

*Source: Stop TB Department, WHO: Management of Tuberculosis Training for Health Facility Staff, Geneva, 2003.*
ANNEX D: FREQUENTLY ASKED QUESTIONS ON MULTI-DRUG-RESISTANT TB (MDRTB)

What is MRDTB?
Multi-drug resistant TB, usually called MDRTB, is TB that is resistant to at least the two most important anti-TB drugs, Isoniazid and Rifampicin. This means the two drugs do not effectively treat the TB disease.

Why is MDRTB a problem?
Because the two most important anti-TB drugs are not effective in treating MDRTB, treatment requires drugs which are more toxic, more expensive, take longer to work and do not work as well (called “second line” drugs). Also, these second line drugs are not widely available in resource-limited settings.

What causes MDRTB?
MDRTB may result from poor anti-TB treatment adherence or by incorrect treatment. Adherence means taking the correct drugs with the correct doses at the correct time. If the wrong drugs or the wrong combinations of drugs are prescribed, or providers fail to ensure that they are taken correctly on schedule, the bacteria causing TB may develop resistance to the drugs. When this happens, the patient who initially had non-resistant TB develops drug-resistant TB. If the patient who has MDRTB spreads TB to others, they will have MDRTB as well.

How is MDRTB prevented?
MDRTB is a condition that can be prevented by following the international TB control strategy called DOTS, which stands for Directly Observed Treatment, Short-course. Health care providers should always adhere to the National Tuberculosis Programme Guidelines and use only the recommended anti-TB treatment regimens, drug combinations and drug dosages. Anti-TB drugs, preferably Fixed Dose Combinations (one tablet contains all the drugs), of high quality should be available in regular and sufficient quantities. Adherence to anti-TB treatment must be ensured with support, encouragement and monitoring of adherence by a relative, community volunteer, or a clinic nurse.

How do we know if a patient has MDRTB or XDRTB?
The diagnosis of XDR and MDRTB can only be made in a laboratory that can test sputum specimens for the presence of \textit{M. tuberculosis} (the TB germ isolated by culture) and then test those TB isolates
for drug resistance. Patients who report interrupted treatment for TB, or failure to have symptoms improve after one to two months of TB treatment, may have drug-resistant TB, and should be separated, especially from persons with HIV infection, until their condition is evaluated.

**Is there MDRTB in my community?**
The District Medical Officer and national TB programme can provide information on rates of MDRTB in specific communities.