TUBERCULOSIS INFECTION CONTROL
IN THE ERA OF EXPANDING HIV CARE AND TREATMENT

Addendum to WHO *Guidelines for the Prevention of Tuberculosis in Health Care Facilities in Resource-Limited Settings, 1999*

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CONTENTS

A.3. Training material for staff
A.4. Education materials for patients
B. Information on Ventilation and Fans
C. Inpatient settings
D. Multi-drug resistance – Frequently Asked Questions

PREFACE

WHY THIS ADDENDUM WAS DEVELOPED

The goal of this addendum is to help management and staff minimize the risk of TB transmission at facilities in resource-limited settings in which:

- HIV-infected persons receive diagnosis, care, treatment, and/or support, such as voluntary counseling and testing centers, clinics for HIV care including primary health care clinics, antiretroviral therapy (ART) clinics, and support clubs for people living with HIV/AIDS; and
- There is a high prevalence of HIV infection, both known and undiagnosed, in settings such as prisons, jails, other detention centers, and drug rehabilitation centers.

In this era of increasing access to HIV counseling and testing, care, and treatment for people living with HIV, more people living with HIV-associated immunosuppression are attending health care and community facilities than ever before. Persons, including health care workers, with HIV-associated immunosuppression are particularly vulnerable to developing TB disease if they become infected with *Mycobacterium tuberculosis (M. tuberculosis,* the germ that can cause TB) as a result of exposure in these settings.

The *Guidelines for the Prevention of Tuberculosis in Health Care Facilities in Resource-Limited Settings*[1] published by the World Health Organization in 1999 addresses issues related to inpatient facilities. This document supplements rather than replicates that guidance and addresses inpatient facilities only in Annex C. It aims to give the reader a greater understanding of the following issues in the context of HIV care settings:

- TB transmission in facilities providing services to people living with HIV infection and disease;
- Infection control procedures to reduce the risk of *M. tuberculosis* transmission in HIV/AIDS care facilities;
- Protection of health care workers and staff through HIV voluntary counseling and testing (VCT), increasing awareness of TB in staff and preventive action;
- Importance of TB infection control in drug rehabilitation centers; correctional institutions including prisons, jails, other detention centers; and other facilities where large numbers of HIV infected individuals gather;
- Issues of multi-drug resistant TB (MDRTB).

WHO SHOULD USE THIS ADDENDUM

This document is for policy makers, health care workers, administrators, and stake holders in the public, private, and nongovernmental health sector involved in providing care and treatment to persons with HIV/AIDS. It can also be helpful

for persons or institutions responsible for the health and well-being of large numbers of persons living with HIV/AIDS (PLWHA). Settings include VCT centers, community-based outreach centers, ARV and other HIV care clinics, hospices, general health care facilities, drug rehabilitation centers, and correctional institutions including prisons and jails.

NOTE ON THE USE OF "TB", *M. TUBERCULOSIS* AND "TB SUSPECT"

The words "tuberculosis (TB)" and "*M. tuberculosis,*" the bacterium that causes TB, are used in different ways. This document uses "TB" to describe clinical events, such as TB infection, TB transmission, and TB disease; *M. tuberculosis* is used when describing potentially infectious germs that a person with TB disease of the lungs or larynx expels when coughing. "TB suspect" refers to a person who presents with symptoms or signs suggestive of TB disease, in particular a cough of long duration.

INTRODUCTION

WHY IS TB A PROBLEM IN HIV CARE SETTINGS?

Persons with undiagnosed, untreated and potentially contagious TB are often seen in HIV care settings. TB is the most common opportunistic infection and a leading cause of death in persons living with HIV/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 counseling and testing (VCT), including at centers providing prevention-of-mother- to-child HIV transmission (PMTCT) services. [2,3,4] 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.[5] The risk of developing TB disease doubles in the first year after becoming HIV-infected and gets progressively higher over time. [6] 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 care clinics and in community programs.

Persons with HIV-associated immunosuppression 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 immunosuppressed due to HIV infection and be at higher risk of developing TB disease once infected.

Multiple TB outbreaks affecting HIV-infected patients and health care workers due to health care facility exposures were documented in industrialized countries in the 1990s. [7] These coincided with the early period of the HIV epidemic, before TB infection control procedures in health care facilities were strengthened. This document provides information on measures that can be taken, even in resource-limited settings, to prevent unnecessary morbidity and mortality due to TB transmission in health care settings.

Work practice, administrative control measures and environmental control measures are the focus of this addendum. Other issues addressed are HIV and TB in health care workers and staff, and protecting their health; MDRTB; and specialized facilities such as drug rehabilitation centers.

HOW IS TB SPREAD?

TB is caused by *M tuberculosis.* People who have TB disease in their lungs can release tiny particles containing *M. tuberculosis* into the air by coughing. These particles are called droplet nuclei. They are invisible to the naked eye. Droplet nuclei can remain airborne in room air for many hours, until they are removed by natural or mechanical ventilation.

To spread, there must be a source, a person with TB disease who produces *M. tuberculosis*, and an exposed person to inhale droplet nuclei containing the bacteria. Although TB is not usually spread by brief contact, anyone who shares air with a person with TB disease of the lungs in an infectious stage is at risk. A person who inhales one or more of the droplet nuclei can become infected with *M. tuberculosis*.

HOW IS TB DISEASE IN THE LUNGS DIAGNOSED

The most common part of the body to have TB disease is the lungs. In resource-limited settings TB disease in the lungs is diagnosed by examining samples of sputum with a microscope. The sputum is smeared onto a small glass plate, stained with chemicals, and viewed under the microscope. If *M. tuberculosis* bacilli are present, they can often (but not always) be seen. These diagnostic tests are referred to as “sputum smears”. Sometimes chest radiography is done to assist with making the diagnosis.

VACCINATION WITH BCG

The Bacille Calmette-Guérin (BCG) vaccine is a live vaccine derived from a strain of *Mycobacterium bovis* (similar to *M. tuberculosis*) first administered to humans in 1921. Since that time, many different strains have been derived and are used today throughout the world to prevent TB disease. BCG vaccination reduces the risk for progression from latent TB infection to TB disease, especially disseminated or central nervous system disease in children. BCG vaccination may cause a positive reaction to a tuberculin skin test.

THE DIFFERENCE BETWEEN TB INFECTION AND TB DISEASE

TB Infection

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

- TB infection does not cause a person to feel sick, and there are no symptoms, nor are there signs detected upon medical evaluation.

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

- Only one out of 10 people with TB infection and a normal immune system will develop TB disease **in their lifetime**. For persons with HIV infection and TB infection, one out of 10 **each year** will develop TB disease.

- Treatment for TB infection with the anti-TB drug isoniazid can reduce the risk that TB disease will develop, though the protective benefit only lasts about two years.

TB Disease

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

- A person with TB disease of the lungs usually has a cough and sometimes coughs up blood.

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

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

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

TB Infection versus TB Disease

TB Infection	**TB Disease (in the lungs)**
M. tuberculosis in the body	
Tuberculin skin test reaction usually positive	
No symptoms	**Symptoms** such as cough, fever, weight loss
Chest x-ray usually **normal**	Chest x-ray usually **abnormal**
Sputum smears and cultures **negative**	Sputum smears and cultures usually **positive***
Not infectious	**Often infectious** before treatment
Not a case of TB	**A case** of TB

* Sputum smears more often negative in HIV-infected TB cases

WHEN TB IS INFECTIOUS

TB can be infectious when it occurs in the lungs or larynx. In general, a person with TB disease of the lungs or larynx should be considered infectious until the person:

- Has completed at least two weeks of standard anti-TB therapy, preferably with direct observation by a TB program-appointed treatment supervisor; and
- Has had three consecutive negative sputum smears on three different days, with at least one morning specimen;* and
- Has improvement in symptoms.

A TB suspect should be considered infectious until a diagnostic investigation is completed.

* Note: Frequent evaluation of AFB sputum smear status may not be done routinely in resource-limited settings.

HOW TO REDUCE THE RISK OF SPREADING *M. TUBERCULOSIS* IN HIV CARE SETTINGS

It is very likely that persons with infectious TB will be found in HIV care settings. There is also a strong likelihood that these persons will spread *M. tuberculosis* to other persons, including immunocompromised patients or staff. However, there are interventions which can significantly reduce this risk.[8] There are two main ways in which even settings with limited resources can reduce the chances that TB will spread:

1. **work practice and administrative control measures**

2. **environmental control measures**

In general, work practice and administrative control measures have the greatest impact on preventing TB transmission within settings, and they are **the first priority** in any setting regardless of available resources. These measures prevent droplet nuclei containing *M. tuberculosis* from being generated in the facility, and thus reduce exposure of patients and staff to TB. 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.

WORK PRACTICE AND ADMINISTRATIVE CONTROLS

Work practice and administrative control measures have **the greatest impact** on preventing TB transmission within facilities caring for PLWHA. They serve as the first line of defense for preventing the spread of TB in HIV care settings. Their goals are [1] to prevent TB exposure to staff and patients, and [2] to reduce the spread of infection by ensuring rapid and recommended diagnostic investigation and treatment for patients and staff suspected or known to have TB. This can best be accomplished through the prompt recognition, separation, provision of services, and referral of persons with potentially infectious TB disease.

There are five components to good work practice and administrative controls:

- Infection 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 program.

INFECTION CONTROL PLAN

Each facility should have a written TB infection 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.

Early **recognition** of patients with suspected or confirmed TB disease is the first step in the protocol. A staff member should be assigned to screen patients for prolonged duration of cough immediately after they arrive at the facility. Patients with cough should be allowed to enter, register, and get a card without standing in line with other patients.

Patients who are identified as TB suspects on the screening must be given advice on **respiratory hygiene/cough etiquette**, and provided with a face mask (e.g., surgical mask) or tissues to cover their mouths and noses. They should then be **separated** from other patients and requested to wait in a separate well-ventilated waiting area.

Placing symptomatic patients at the front of the line, to quickly provide care and reduce the amount of time that others are exposed to them, is recommended.

Some patients who are found to have symptoms suggestive of TB may have attended the clinic for another reason. If possible, these patients should **receive the services** they were originally accessing (e.g. VCT, medication refills) before being investigated for TB or referred to the TB diagnostic center. In an integrated service delivery setting, if possible, the patient should receive the services they are accessing before TB investigation.

TB suspects should promptly be **investigated** for TB following national protocols. If TB diagnostic services are not available onsite, the facility should have an established link with a TB diagnostic center to which symptomatic patients can be **referred.** Also, each facility should have a linkage with a TB treatment center to which those who are diagnosed with TB can be **referred** (see *Coordination and Communication between TB and HIV/AIDS Care Programs*). Ideally, sputum samples should be collected and sent to the nearest laboratory. Sputum collection always should be done in a designated area with a lot of air circulation and away from other people, not in small rooms such as toilet rooms or other enclosed areas. If this is not possible the patient should be referred to the

nearest TB diagnostic center. Every attempt should be made to facilitate this referral (e.g., through subsidizing transport costs or incentives) as further delays in diagnosis will increase the risk of exposing others to TB infection.

The plan should designate a staff member to be the infection control officer who is responsible for ensuring the infection control procedures are implemented. The plan will include, but not be limited to, the following policy areas:

1. Screening all patients as soon as possible after arrival at the facility to identify persons with symptoms of TB disease or persons who are being investigated or treated for TB disease.

2. Instructing the above designated persons identified through screening in **respiratory hygiene/cough etiquette.** This includes instructing them to cover their nose and mouth when coughing for sneezing, and when possible providing face masks or tissues to assist them in covering their mouths.

Face masks help prevent the spread of *M. tuberculosis* from the patient to others. The face mask can capture large wet particles near the mouth and nose of the patient, preventing the bacteria from being released into the environment. Face masks could be provided to persons who have a positive symptom screen to wear until they leave the facility. Cloth masks can be sterilized and reused. Paper tissues provided to these persons, with instructions to cover their mouths and noses when coughing or sneezing, are less costly and also less likely to identify people as TB suspects with attendant risk of stigma. However, they are less likely to be used effectively. (See *A Note on Personal Respiratory Protection*)

Tissues and face masks should be disposed in waste receptacles. Clients and especially staff should be encouraged to wash their hands after contact with respiratory secretions. *M. tuberculosis* cannot be spread from the hands, but other serious lung infections can.

3. Placing TB suspects and cases in a separate well-ventilated waiting area such as a sheltered open-air space is ideal in warm climates.

4. Speeding up management of these persons so that they spend as little time as possible at the facility.

5. Ensuring rapid diagnostic investigation of TB suspects, including referring TB suspects to TB diagnostic services if not available on site; and ensuring that persons reporting TB treatment are adhering with their treatment.

6. Using and maintaining environmental control measures (see *Environmental Control Measures*).

7. Training and educating all staff on TB and the TB infection control plan (training should include special risks for TB for HIV-infected persons, and need for diagnostic investigation for those with signs or symptoms of TB).

8. Providing voluntary, confidential HIV counseling and testing for staff with adequate access to treatment.

9. Monitoring the TB infection control plan's implementation and correcting any inappropriate practices or failure to adhere to institutional policies.

(See Annex A.1. Sample infection control plan**)**

Five Steps for Patient Management to Prevent Transmission of TB in HIV Care Settings		
Step	**Action**	**Description**
1.	**Screen**	Early **recognition** of patients with suspected or confirmed TB disease is the first step in the protocol. It can be achieved by assigning a staff member to screen patients for prolonged duration of cough immediately after they arrive at the facility. Patients with cough of more than two weeks duration, or who report being under investigation or treatment for TB*, should not be allowed to wait in the line with other patients to enter, register, or get a card. Instead, they should be managed as outlined below.
2.	**Educate**	Instructing the above mentioned persons identified through screening in **cough hygiene**. This includes instructing them to cover their noses and mouths when coughing or sneezing, and when possible providing face masks or tissues to assist them in covering their mouths.
3.	**Separate**	Patients who are identified as TB suspects or cases by the screening questions must be **separated** from other patients and requested to wait in a separate well-ventilated waiting area, and provided with a surgical mask or tissues to cover their mouths and noses while waiting.
4.	**Provide HIV services**	Triaging symptomatic patients to the front of the line for the services they are seeking (e.g. voluntary HIV counseling and testing, medication refills), to quickly provide care and reduce the amount of time that others are exposed to them is recommended. In an integrated service delivery setting, if possible, the patient should receive the HIV services they are accessing before the TB investigation.

5.	**Investigate for TB or Refer**	TB diagnostic tests should be done onsite or, if not available onsite, the facility should have an established link with a TB diagnostic center to which symptomatic patients can be **referred.** Also, each facility should have a linkage with a TB treatment center to which those who are diagnosed with TB can be **referred.**

*Although TB patients on adequate treatment are no longer infectious, it may be difficult for the facility to determine if anyone reporting being on treatment for TB has indeed received adequate treatment. The most cautious procedure is to manage those who are on treatment in the manner described.

ADMINISTRATIVE SUPPORT

Each facility should appoint one person to serve as the infection control officer. Larger facilities may also have a committee. The officer is responsible for overseeing the infection control committee and developing a written infection control plan, monitoring its implementation, and providing effective training for health care workers and other staff. (See *Annex A.2. Sample monitoring tools*)

TRAINING OF STAFF

Infection control is effective only if all staff working in a facility understands the importance of the infection 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 seven issues below:

- Basic concepts of *M. tuberculosis* transmission and pathogenesis (i.e., the difference between infection and disease);
- 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 control plan and the responsibility that each staff member has to implement and maintain infection control practices;
- Specific infection control measures and work practices that reduce the likelihood of transmitting TB; and
- Measures staff can take to protect themselves from TB.

(See *Annex A.3. Training materials for staff*)

EDUCATION OF PATIENTS AND COMMUNITY AWARENESS

As noted in the introduction, up to one-third or more of HIV-infected persons living in areas with widespread TB will develop TB disease during their lifetime. Educating communities and patients to recognize symptoms of TB and to seek health care and further investigations should be routine in settings providing care for HIV-infected persons. In addition, patients should understand how to protect themselves, and others, from exposure to TB by simple cough hygiene measures. (See *Annex A.4. Patient education materials*)

COORDINATION AND COMMUNICATION BETWEEN TB AND HIV/AIDS CARE PROGRAMS

Coordination and communication between HIV/AIDS and TB programs is one aspect of a major initiative of STOP TB Department of the World Health Organization to prevent TB in persons with HIV. In most countries, national TB/HIV coordinating bodies are being established with a goal of having similar committees at every level of health care service. Each facility caring for persons with HIV should determine what coordinating mechanisms already exist at their local level. Each facility without an integrated system providing care for both TB and HIV should develop an agreement with the local TB program which establishes:

- A referral mechanism for patients suspected of having TB disease to be investigated in the TB diagnostic center and started on treatment, if indicated; and

- A monitoring mechanism which provides feedback to the referring facility to evaluate both the linkage with TB diagnostic services and the appropriateness of referrals as indicated by the proportion of suspects actually confirmed as having TB disease. (See *Annex A.2 Sample monitoring tools*)

PERSONAL RESPIRATORY PROTECTION

Personal respiratory protection (i.e., the selection, training, and use of respirators) is not a priority intervention in the HIV care settings addressed in this addendum. Respirators can protect health care workers from inhaling *M. tuberculosis* only if standard work practice and environmental controls are in place. In addition, they are expensive to purchase and require specialized equipment to determine proper fit. Frequently, they are unavailable in resource-limited settings. Their use should be restricted to specific high risk areas in hospitals and referral centers, such as rooms where spirometry or bronchoscopy are performed or specialized treatment centers for persons with MDRTB.

If a respirator is needed, a U.S.-certified N95 (or greater) or EU-certified FFP2 (or greater) respirator should be used. Respirators are different from face masks, such as surgical masks made of cloth or paper. Use of a face mask does not protect health care workers, other staff, patients, or visitors against TB. Therefore, it is NOT recommended that health care workers and other staff or visitors in HIV care settings wear them.

For more detailed information, please refer to pages 45-48 of the *Guidelines for the prevention of tuberculosis in health care facilities in resource-limited settings*.[1]

Respirator – has only tiny pores which block droplet nuclei and relies on an air tight seal around the entire edge

Face mask – has large pores and lacks air tight seal around edges

ENVIRONMENTAL CONTROL MEASURES

Environmental controls are the second line of defense for preventing the spread of TB in HIV care settings. It is important to recognize that if work practice or administrative controls are inadequate, environmental controls **will not eliminate the risk.**

Environmental controls include:

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

Many environmental control measures are technologically complex and expensive, and therefore only practical for referral hospitals. However, controlled natural ventilation can reduce the risk of spreading *M. tuberculosis*.

Ventilation is the movement of air in a building and replacement of air in a building with air from outside. Natural ventilation relies on open doors and windows to bring in air from the outside; ”controlled” implies that checks are in place to make sure that doors and windows are maintained in an open position that enhances ventilation. Fans may also assist to distribute the air. When fresh air enters a room it dilutes the concentration of particles in room air, such as droplet nuclei containing *M. tuberculosis*. Designing waiting areas and examination rooms so that they maximize natural ventilation can help reduce the spread of TB. In warm climates, this means open-air shelters with a roof to protect patients from sun and rain (See *Annex B. Information on Ventilation and Fans*).

If patients are asked to **provide sputum specimens for TB diagnosis** onsite, they should always do so in an adequately ventilated booth or **outside** in the

open air and away from other people, not in small rooms such as toilets or other enclosed areas. (See *Additional Resources* for more information on sputum collection booths.)

Studies show that *M. tuberculosis* is killed if the organisms are exposed to sufficient ultraviolet germicidal irradiation (UVGI). The major concerns about UVGI have been adverse reactions, such as acute and chronic skin and eye changes from overexposure if the UVGI is not installed and maintained properly. Information on installation, cleaning, maintenance, and ongoing monitoring is available from Additional Resources.

PROTECTION OF HEALTH CARE WORKERS AND STAFF

INCREASING AWARENESS OF TB IN HEALTH CARE WORKERS AND STAFF

Investigations in countries in Africa, Asia, and South America have documented increased risk of TB disease or infection in health care workers compared with the general population[1]. Those at risk include not just health care providers, but any staff, including volunteers, who have contact with persons with TB who have not yet been diagnosed and started on treatment. This could include porters and cleaners, as well as peer educators, adherence supporters, and volunteers working as counselors or in support groups. PLWHA in these roles are at particular risk of rapid progression to TB disease if they become infected or re-infected due to exposure to *M. tuberculosis* in the facility. They should be included in all training programs. A third group, staff in correctional institutions and drug rehabilitation centers, also has been documented to have higher rates of TB infection and disease than the general population.

The infection control measures recommended in this addendum should reduce the time persons with undiagnosed TB spend in HIV care settings and should improve ventilation and thus dilution of any *M. tuberculosis* particles in the environment. Nevertheless, the risk to staff will never be zero, and an additional aspect of protecting staff is promoting early recognition of TB disease and standard treatment.

Annual screening programs for TB disease, such as annual chest radiography, have not been shown to effectively reduce the amount of time between developing symptoms and diagnosis, as only a fraction of those who develop TB do so around the time of screening. Instead, reminders that health care workers and other staff can develop TB, regardless of previous infection status or BCG vaccination, should occur with annual re-training on infection control. It is recommended that staff be investigated for TB free of charge if they have a cough for two weeks or more. The infection control plan should list designated staff members who should be contacted to initiate TB investigations, and reinforce that all services are confidential.

Tuberculin skin testing can diagnose persons with TB infection who are most likely to develop TB disease, and who could potentially benefit from preventive treatment for TB infection. However, TB preventive therapy programs are not yet widely implemented in resource-limited settings.[9] In the new era of expanding access to care for persons living with HIV, TB preventive therapy for HIV-infected health care workers should be considered.

INCREASING ACCESS TO VOLUNTARY HIV COUNSELING AND TESTING

Encouraging and enabling health care workers and all staff to know their HIV status should be a priority of all health care services, and HIV care programs, in particular. The rate of HIV infection among health care workers and staff may be similar to that of the broader community. In the past, stigma, lack of confidentiality, and lack of treatment options have contributed to failure of health care workers to know their HIV status. The expansion of the types of facilities addressed in this addendum is a sign that conditions are changing.

Encouraging and enabling health care workers and all staff to know their HIV status can be facilitated by providing accessible, acceptable, confidential VCT, including periodic retesting, to staff. Policies which prioritize ART for health care workers who need it can motivate them to know their HIV status. Health care workers are a valuable resource, and they must receive adequate care and treatment to remain healthy and in the workforce. Furthermore, HIV-infected health care workers and other staff are at increased risk of developing TB disease if exposed in the workplace, and additional precautions should be taken to protect them. Immunocompromised health care workers should be given opportunities to work in areas with a lower risk of exposure to TB.

Leadership and advocacy at the national level, from health care worker unions, and from medical and nursing associations will encourage health care workers to know their HIV status. Locally, programs can consider confidential testing options such as use of rapid test kits at home; travel to another setting where one could be tested truly confidentially; bringing in a mobile counseling team (not from the community), who will not personally know any of the staff they test.

There is no role for mandatory HIV testing of health care workers.

Health care workers have the same rights as all individuals to confidential HIV testing with counseling and conducted only with an informed consent.

Education directed to health care workers concerning HIV testing can also be linked to their role in educating patients and communities about the benefits of testing and knowing one's HIV status and may further reduce stigma.

MULTI-DRUG RESISTANT TB (MDRTB)

TB disease that is caused by organisms susceptible to the first-line anti-TB drugs can generally be treated effectively without side effects from treatment, even in persons with HIV infection. TB disease caused by organisms resistant to at least the two most potent first-line drugs (isoniazid and rifampicin) is called multi-drug resistant TB (MDRTB). Treating MDRTB takes longer and requires drugs that are more toxic, more expensive, often of limited availability in resource-limited settings, and generally less effective particularly in persons with HIV infection.

Because of the risk of severe morbidity and mortality to HIV-infected persons from MDRTB, persons with known MDRTB should receive routine care outside of normal HIV care settings.

HIV care facilities can obtain estimates of the prevalence of MDRTB in their community from the local TB program. Through joint coordination and communication, the TB and HIV programs can plan for how to care for these patients. In areas where MDRTB is rare, special arrangements can be made to provide HIV care for an MDRTB patient. In areas where MDRTB is more prevalent, specialized clinics can be established (See *Annex D. FAQ on MDRTB*).

DRUG REHABILITATION CENTERS AND CORRECTIONAL INSTITUTIONS

In many areas the proportion of persons with HIV infection in drug rehabilitation centers and correctional institutions (e.g., jails and prisons) is much higher than in the general population. This is in part due to the high prevalence of HIV infection among injection drug users and sex workers, who in turn represent a large proportion of those incarcerated or in rehabilitation in some parts of the world. Additionally, 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. WHO has published guidelines for TB control in correctional institutions.[10] These guidelines emphasize effective administrative and environmental controls, including screening detainees upon entry into the facility, and on a regular basis during times of prolonged detention.

Because the same TB infection control policies will protect HIV-infected and uninfected detained persons as well as staff, it is not necessary to know who in the population at the institution is HIV-infected to conduct effective TB infection control. However, voluntary, confidential HIV counseling and testing with consent can identify persons in need of HIV treatment with antiretroviral drugs, and prevention services such as preventive therapy for latent TB infection, which may contribute to TB control.

OPERATIONAL RESEARCH PRIORITIES

The recommendations in this addendum are based on current state of the art knowledge about TB infection control in resource-limited settings. However, 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 immunocompromised health care workers; and
- Interventions with health care workers that reduce stigma towards HIV and TB/HIV patients.

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7. Centers for Disease Control and Prevention. Multi-drug resistant Tuberculosis outbreak on an HIV ward – Madrid, Spain, 1991-1993. *Morbidity and Mortality Report*, 1996, 44:330.
8. Harries AD et al. Practical and affordable measures for protection of health care workers from tuberculosis in low-income countries. *Bulletin of the World Health Organization*, 1997, 75:477-489.
9. World Health Organization. Preventive therapy against tuberculosis in people living with HIV. *Weekly Epidemiological Record*, 1999, 46:385-397.
10. Tuberculosis Control in Prisons: A Manual for Program Managers, Geneva, World Health Organization, 2000

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

Additional Resources

TB Infection Control and TB/HIV Collaborative Activities

Guidelines for the prevention of tuberculosis in health care facilities in resource-limited settings, Geneva, World Health Organization, 1999
http://www.who.int/docstore/gtb/publications/healthcare/PDF/WHO99-269.pdf

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

Guidelines for Preventing the Transmission of Mycobacterium tuberculosis in Health-Care Facilities, Morbidity and Mortality Weekly, Centers for Disease Control and Prevention, 1994
http://www.cdc.gov/mmwr/preview/mmwrhtml/00035909.htm

Interim policy on collaborative TB/HIV activities, WHO 2004
http://whqlibdoc.who.int/hq/2004/WHO_HTM_TB_2004.336.pdf

Strategic framework to decrease the burden of TB/HIV, Geneva, World Health Organization, 2002
http://www.who.int/docstore/gtb/publications/tb_hiv/2002_296/pdf/tb_hiv_2002_296_en.pdf

A Guide to Monitoring and Evaluation for Collaborative TB/HIV activities, Geneva, World Health Organization, 2004
http://whqlibdoc.who.int/hq/2004/WHO_HTM_TB_2004.342.pdf

TB/HIV: A Clinical Manual, Geneva, World Health Organization, 2nd edition, 2004
http://whqlibdoc.who.int/publications/2004/9241546344.pdf

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

Francis J. Curry National Tuberculosis Center, Institutional Consultation Services. A guideline for establishing effective practices: Identifying persons with infectious TB in the emergency department. 1998
http://www.nationaltbcenter.edu/catalogue/downloads/emergencyRoomGuidelines.pdf

Francis J. Curry National Tuberculosis Center, Institutional Consultation Services, and California Department of Health Services. TB in Homeless Shelters: Reducing the Risk through Ventilation, Filters, and UV. 2000.
http://www.nationaltbcenter.edu/catalogue/downloads/tbhomelessshelters.pdf

Isoniazid Preventive Therapy

Policy Statement on Preventive Therapy Against Tuberculosis in People Living with HIV: Report of a meeting held in Geneva 18-20 February 1998, Geneva, World Health Organization, 1998
http://www.who.int/docstore/gtb/publications/TB_HIV_polstmnt/PDF/tbhivpolicy.pdf

MDRTB

DOTS-Plus for Standardized Management of Multi-drug resistant Tuberculosis in South Africa – Policy Guidelines, South African Medical Research Council/National Department of Health, 2004

The Management of Multi-drug resistant Tuberculosis in South Africa, South African Medical Research Council/National Department of Health, 2nd Edition, 1999.

Anti-tuberculosis Drug Resistance in the World. Report No. 3. The WHO/IUATLD Global Project on Anti-tuberculosis Drug Resistance Surveillance, Geneva, World Health Organization, 2004
http://www.who.int/tb/publications/who_htm_tb_2004_343/en/index.html

Correctional Institutions

Tuberculosis Control in Prisons: A Manual for Program Managers, Geneva, World Health Organization, 2000
http://www.who.int/docstore/gtb/publications/prisonsNTP/PDF/tbprisonsntp.pdf

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

Francis J. Curry National Tuberculosis Center and California Department of Health Services, 2002: Tuberculosis Infection Control Plan Template for Jails
http://www.nationaltbcenter.edu/jailtemplate/docs/tb_section1.pdf

Laboratory Issues

World Health Organization. Communicable Diseases Prevention and Control. Laboratory Services in Tuberculosis Control. Edition 1. Geneva, World Health Organization, 1998.

Glossary and Abbreviations

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

Droplet nuclei: microscopic particles which are estimated at 1-5 microns in diameter and are produced when a person coughs, sneezes, shouts or sings. 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.

Face mask: 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 through.

Health care workers: group of people that includes nurses, physicians, nursing and medical students, laboratory workers, counselors, 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 subclinical, latent infection with the organisms that cause TB, manifested by a positive tuberculin skin test, but without clinical evidence of disease.

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

Isolation room: 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, exhaust ventilation systems).

Multidrug-resistant tuberculosis (MDRTB): TB caused by strains of *M. tuberculosis* which 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

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

Smoke tubes: devices used to monitor proper airflow direction and to determine the correct function of ventilation systems.

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

Tuberculosis (TB): a clinically active, symptomatic disease caused by bacteria belonging to the M. tuberculosis complex (*M. tuberculosis, M. bovis, M. africanum*).

Ultraviolet germicidal irradiation (UVGI): an environmental control measure to kill or inactivate micro-organisms like *M. tuberculosis* through exposure to UVGI.

VCT: voluntary counseling and testing for HIV infection

Work practice and administrative controls: defined as managerial or administrative measures which 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.

ANNEX A.1. SAMPLE INFECTION 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 control plan.

9. Monitoring the TB infection 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:

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. 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. 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 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 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 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 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. Triaging TB suspects and cases to the head of the line to receive services in the facility

Procedures

1. 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

1. _____ is the designated staff person to counsel patients about obtaining TB diagnostic services.

2. Patients will be referred to _____ (TB diagnostic center the HIV care facility has a previously negotiated agreement, see section __).

3. Patients should be given a card with the name, location, and operating hours of the TB diagnostic center. 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 center and used as an anonymous check on number of referrals who 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

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. 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 confidential TB and HIV services to health care workers and staff

Procedures

1. 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.

2. Health care workers and other staff should be informed about the special specific risks for TB for HIV-infected persons (see section on Training of staff).

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

4. Staff training should include reduction of stigma of TB and HIV.

5. _____ is responsible for determining when staff who develop TB disease may return to work.

6. 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; and
    b. Exhibiting clinical improvement; and
    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 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 TB infection control training.

(See *Annex A.3 for Sample Training Materials*)

Policy 9. Monitoring the TB infection control plan's implementation

Procedures

1. Determine the frequency of the infection 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.

2. 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?

3. Evaluate the success of referrals to the TB diagnostic center
    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?

4. Evaluate the training process
    a. Did all new staff receive training on TB infection control during their induction?
    b. Did all staff receive annual re-training on TB infection control?

5. Revise the infection control plan to reflect changes in staff responsibilities, policies, and procedures

6. 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 A.2. 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

Date	**Patient Name**	**Case or Suspect** (c/s)	**Missed at intake?*** (y/n)	**Referred to** (name of facility)	**Outcome**** (TB, not TB, NS)

*Missed at intake = symptoms or history detected only after patient enters private room with clinician or counselor 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

Staff Name	**Start Date**	**Date first IC training**	**Date annual training**	**Date annual training**	**Date annual training**	

Annex A.3. Training materials for staff

The following is a set of overheads with a script that can be used by a training facilitator or lecturer. Alternatively the staff person can read through the materials. Users may modify as needed to meet local needs.

(Insert PowerPoint presentation)

Annex A.4 Education materials about TB for patients

Health care workers can use this guide to remind them of what to ask and say about TB during an initial information session with any patient. Questions they can ask to find out how much the patient knows about TB are in bold on the left; and messages related to the questions are on the right. They can emphasize different messages with different patients depending on the patient's current knowledge about TB.

What is TB?	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 the 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.
What kind of symptoms do you think people with TB have?	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.
Have you ever known anyone with TB? What happened to that person?	*(just listen to their response)*
Do you know that TB can be completely cured?	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.
How do you think that TB spreads?	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.
How can someone with TB avoid spreading it?	There are several ways that a person with TB can prevent infecting others. An important step it to take regular treatment to become cured. Another measure to prevent infecting others is for infected persons to cover to their noses and moths when coughing or sneezing. Finally, infected persons should open windows and doors to allow fresh air into their homes.
Is TB a problem for people with HIV infection?	People living with HIV/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/AIDS.

Source: Stop TB Department, WHO: Management of Tuberculosis Training for Health Facility Staff, Geneva, 2003

Annex B. Information on Ventilation and Fans

Controlled natural ventilation

Natural ventilation refers to fresh dilution air that enters and leaves a room or other area though openings such as windows or doors. Natural ventilation is controlled when openings are deliberately secured open to maintain air flow. Unrestricted openings (that cannot be closed) on opposite sides of a room provide the most effective natural ventilation.

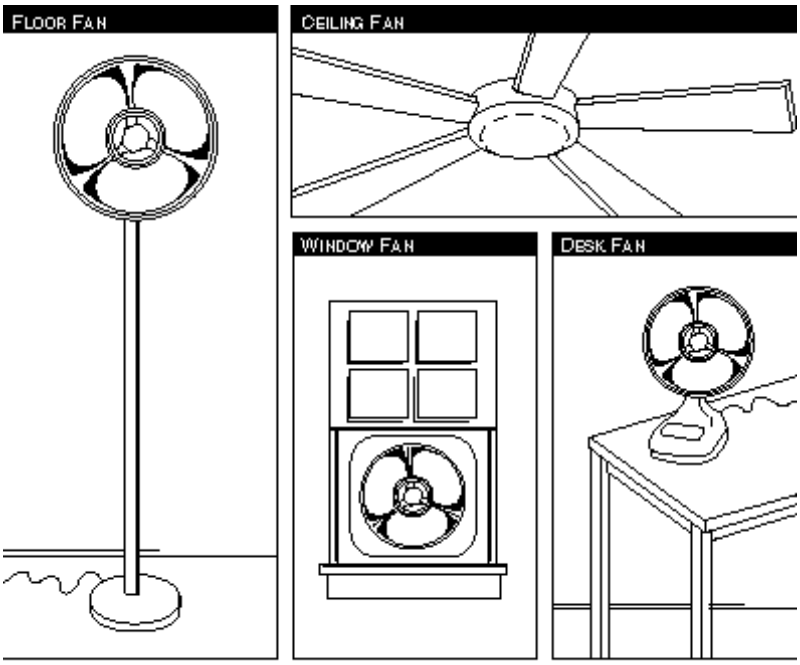
Propeller fans

Propeller fans may be an inexpensive way to increase the effectiveness of natural ventilation, by increasing the mixing of airborne TB as well as assisting in the direction of air movement by pushing or pulling of the air.

Types of propeller fans

Propeller fans include:

- Ceiling fans,
- Small fans that sit on a desk or other surface,
- Fans that stand on the floor, and
- Fans mounted in a window opening.



Air mixing and removal

A propeller fan helps mix air in a room. Mixing of air will reduce pockets of high concentrations, such as in the corners of a room or in the vicinity of patients where natural ventilation alone is not enough. 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.

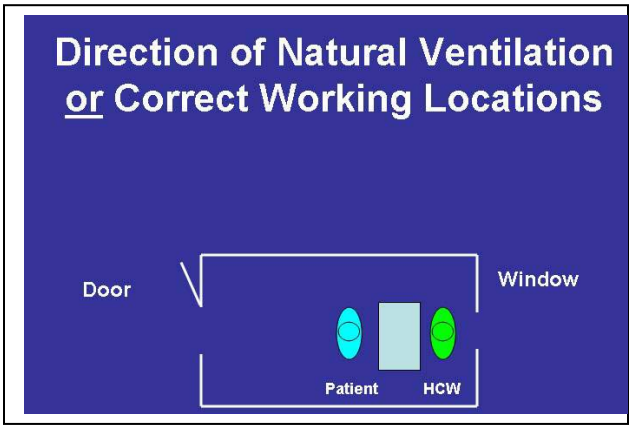
If this dilution effect is combined with a way to replace room air with fresh air, such as by opening windows and doors, the result will be fewer infectious particles in the room.

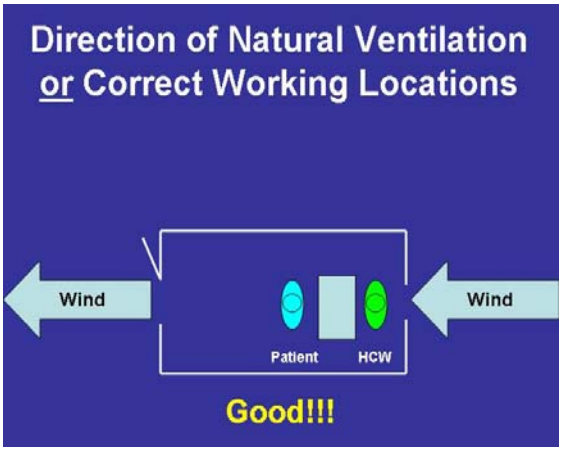
A room with an open window, open door, and a fan will have less risk than an enclosed room with no fan, an enclosed room with a fan, or a room with an open window but no fan. In addition, mixing may increase the effectiveness of other environmental controls.

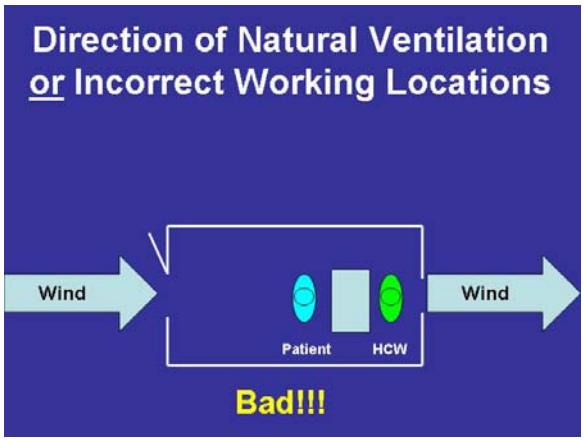
Directional airflow

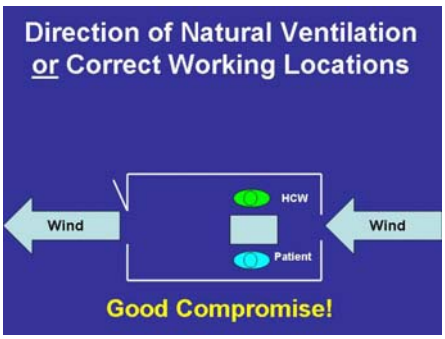
If placed in or near a wall opening, propeller fans can also be used to enhance air movement into and out of a room.

Consider fans installed in the windows or through wall openings on the back wall of a building. The fans exhaust air outside, away from people or areas where air may come back into the building. If doors and windows in the front of the building are kept open, the overall effect should be to draw in fresh air through the front of the building and exhaust air through the rear. Health care staff should be mindful of the direction of airflow to ensure the patient is closest to the exhaust fans and the staff are closest to the clean air source.









With this arrangement, the risk that TB will be spread is greater near the back of the building; however, once the contaminated air is exhausted, dilution into the environment will be fast.

Exhaust fans

There are a wide variety of exhaust fan systems. A system can be as simple as a propeller fan installed in the wall, or it could include a ceiling grille, a fan, and a duct leading to discharge on an outside wall or on the roof.

Over time, dust and lint accumulate on exhaust fan blades. The fans, motors, blades, and ducts become dirty and less air is exhausted. For this reason, these systems should be cleaned regularly.

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 odors will linger. Use the following checklist to assess natural ventilation in your waiting areas and examination rooms:

- 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.
  1. Hold two incense sticks together and light them.
  2. As soon as the incense starts to burn, blow out the flame. Now the incense should produce a continuous stream of smoke.
  3. Observe the direction of the smoke.
  4. Observe how quickly the smoke dissipates. This is a subjective test that may require some practice (see box below). It does not give a definite result but is useful for comparing one room or area to another.
  5. Check natural ventilation once a year after the prevailing wind patterns have been determined. Recheck if any changes in the physical

environment are made and confirm procedures for ensuring free movement of air are followed.

6. Keep records of all routine activities and dates.

Checking fans

- Check that all room fans are working and cleaned once a month. Use cloth or vacuum cleaner to remove dust and lint from fans, grilles, and ducts.
- Check that exhaust fans are working and cleaned once a month. Use cloth or vacuum cleaner to remove dust and lint from fans, grilles, and ducts. Clean ducts behind grilles as far back as can be reached.
- To check 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.
- Flow rates through exhaust fans and grilles can be measured using a simple velocity meter and a means to measure that velocity over a known cross-sectional area. The air flow rates can be calculated from simple velocity measurements (see Boxes 1 and 2).
- 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.
- Keep records of all routine activities and dates.

Box 1. Estimating air velocity.

Measure 0.5 meter distance and mark it on a tabletop. Move your hand from one end to the other (0.5 meters) in one second. This is equivalent to 0.5 m/s! In order to have directional control of contaminants in air, one should have air moving at least 0.5 m/s.

Example air flow calculation:

Fan, duct, or box opening: 0..5 m high, 0.5 m wide
Area = 0.5 m x 0.5 m = 0.25 m^2
Average air velocity through fan, duct, or box opening: 2.5 m/s

Average flow rate = Area times average air velocity
0.25 m^2 x 2.5 m/s x 3600 s/hour = 2 250 m^3/hour

Box 2. Example air exchange rate calculation

Window opening: 0..5 m high, 0.5 m wide
Window area = 0.5 m x 0.5 m = 0.25 m^2
Average air velocity through window: 0.5 m/s
Room dimensions: 3 m wide, 5 m deep, and 3 m high
Room volume = 3 m x 5 m x 3 m = 45 m^3

Average flow rate = Area of window times average air velocity
0.25 m^2 x 0.5 m/s x 3600 s/hour = 450 m^3/hour

Air exchange rate = Average flow rate divided by room volume
450 m^3/hour ÷ 45 m^3 = 10 air exchanges per hour

Annex C. Inpatient settings

Although the information in this addendum is directed primarily toward outpatient facilities, many of the recommendations also apply to inpatient facilities. Specifically, measures regarding the infection control plan, health care worker and staff training, patient education, sputum collection, and triage and evaluation of suspect TB patients are similar. Prevention of TB in hospitals requires a combined effort of infection control practices; more information on prevention of transmission of *M. tuberculosis* in hospital settings is available in *Additional Resources.*

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 pediatric or immunocompromised 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 [8]. 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 immunocompromised 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.

Annex D. FAQ – 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 those 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 MDR-TB, 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 nonresistant 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 Program 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?
The diagnosis of MDRTB can only be made in a laboratory that can test sputum specimens for the presence of *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 from persons with HIV infection until their condition is evaluated.

Is there MDRTB is my community?

The District Medical Officer and national TB program can provide information on rates of MDRTB in specific communities.