THE NATIONAL GUIDELINES FOR TB INFECTION CONTROL
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<th>Description</th>
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<tr>
<td>AFB</td>
<td>Acid Fast Bacillus</td>
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<tr>
<td>AIDS</td>
<td>Acquired Immune Deficiency Syndrome</td>
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<td>ART</td>
<td>Anti-Retroviral Therapy</td>
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<td>BCG</td>
<td>Bacille Calmette-Guerin</td>
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<td>BSCs</td>
<td>Basic Safety Cabinets</td>
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<td>DOTS</td>
<td>Directly Observed Treatment Short-course</td>
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<tr>
<td>FCT</td>
<td>Federal Capital Territory</td>
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<td>FGN</td>
<td>Federal Government of Nigeria</td>
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<td>FMOH</td>
<td>Federal Ministry of Health</td>
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<td>GFATM</td>
<td>Global Fund to Fight AIDS, Tuberculosis and Malaria</td>
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<td>GHWs</td>
<td>General Health Workers</td>
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<td>HIV</td>
<td>Human Immunodeficiency Virus</td>
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<td>LGA</td>
<td>Local Government Area</td>
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<td>LTBI</td>
<td>Latent TB Infection</td>
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<td>MDGs</td>
<td>Millennium Development Goals</td>
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<td>MDR-TB</td>
<td>Multi-Drug Resistant Tuberculosis</td>
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<td>XDR-TB</td>
<td>Extreme Drug Resistant -TB</td>
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<td>NASCP</td>
<td>National HIV/AIDS and Sexually transmitted infections Control Programme</td>
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<td>NRL</td>
<td>National Reference Laboratory</td>
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<td>NTBLCP</td>
<td>National Tuberculosis and Leprosy Control Programme</td>
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<td>PHC</td>
<td>Primary Health Care</td>
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<td>PLWA</td>
<td>People Living with HIV and AIDS</td>
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<td>PMTCT</td>
<td>Prevention of Mother To Child Transmission</td>
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<td>TB</td>
<td>Tuberculosis</td>
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<td>TB-IC</td>
<td>TB Infection Control</td>
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<td>TBL</td>
<td>Tuberculosis and Leprosy</td>
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<td>ZRL</td>
<td>Zonal Reference Laboratories</td>
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**FOREWORD**

Tuberculosis (TB) is a major public health problem in Nigeria with country ranked 5th among the 22 high TB burden countries in the world and 2nd in Africa (2008 TB Global report). The TB burden in the country is further compounded by the high HIV/AIDS prevalence.

Tuberculosis is an infectious disease which spreads from person-to-person through the air by droplet nuclei. The transmission of TB is higher in health care settings providing care for people affected by TB and HIV/AIDS. In such settings, the risk is higher in areas such as the out-patient department, wards, consulting rooms, counseling rooms, laboratories and waiting areas. The transmission can be from suspects or patients with infectious TB to other clients, staff and visitors.

TB is the leading cause of morbidity and mortality among People Living with HIV/AIDS, therefore as the country scales up, TB, HIV TB/HIV and MDR-TB services, the need arises for the control programmes and all implementers to pay special attention to TB- infection control particularly in high risk settings such as HIV service delivery centres. These involve administrative, control strategies/workplace policy and personal protective measures.

This document was developed with input from all stakeholders to provide the guidelines for TB Infection control in health care settings.

I hereby enjoin all stakeholders in the control of TB and HIV/AIDS to be guided by the principle as spelt out in this document in our joint efforts at ensuring provision of quality services to the generality of the population.

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ACKNOWLEDGEMENT

This guideline for TB infection control in Nigeria provides the necessary framework for preventing transmission of Tuberculosis in health care settings.

The development of the Guidelines would not have been possible without the commitment of the staff of the Federal Ministry of Health, the National TB/HIV Working Group and our numerous partners mentioned in the list of contributors. We are immensely grateful to them for their invaluable support and contribution in the development of the Guidelines.

We wish to express our appreciation to all the development partners, the World Health Organization (WHO), the USG and members of the International Federation of Anti-Leprosy Association (ILEP) for their support and active participation in the whole process of developing the Guidelines.

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EXECUTIVE SUMMARY

Tuberculosis is a major public health problem in Nigeria, the country ranked 5th among the 22 countries of the world with an estimated 380,000 cases occurring annually of which more than 50% are smear positive (WHO Global TB report 2008 – Annex 1). The TB burden is further compounded by the high HIV prevalence of 4.4% (National seroprevalence survey 2005) and the emergence of MDR TB in the country. TB is the most important (airborne) opportunistic infection that affects the HIV positive patient.

The WHO recommended DOTS strategy was adopted by the country in 1993 to control the spread of TB through prompt detection of infectious cases and providing effective therapy with quality-assured anti-TB drugs under standard case management conditions. The new Stop TB Strategy was adopted in 2006.

There were about 261 health facilities in the country providing ART services at the end of 2007. Some of these facilities have poor infrastructure, are under-staffed and have a very high number of clients; thus creating longer waiting time during clinic days. Patients and clients mix freely during the waiting period, including those with untreated and potentially contagious TB. The waiting areas in some of these clinics are not well ventilated and are often shared with other category of patients including those with TB thus increasing the risk of TB transmission among clients receiving care and portending danger to health care workers.

In high TB burden settings like Nigeria, surveys have shown that up to 10% of persons with HIV infection may have previously undiagnosed TB at the time of HIV Counseling and Testing (HCT), half of which may be infectious TB cases. Between 40% to 50% 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.

Therefore as the country scales up, TB, HIV TB/HIV and MDR-TB services, the need arises for the control programmes and all implementers to pay special attention to TB- infection control particularly in high risk settings. These involve administrative, control strategies/workplace policy and personal protective measures.

Health care workers and staff may be immunosuppressed due to HIV infection and be at higher risk of developing TB disease once infected. Patients with MDR TB accessing care in facilities providing MDR-TB services (diagnosis and treatment) are of great danger to others due to possible transmission of resistant strains of TB.
BACKGROUND INFORMATION:

TB and HIV Burden in Nigeria.

TB was declared a national emergency in June 2006 after which an emergency plan for the control of TB in Nigeria was developed. The country is currently ranked 5th among the 22 high TB burden countries in the world and second in African region. With an estimated incidence of 283 all forms of TB per 100,000 population per year out of which 123/100,000 population are smear positive and prevalence of 536/100,000 population. Statistics from NTBLCP revealed that Case notification rate of new smear positive has increased by about two fold from less than 25/100,000 population in 2004 to 31/100,000 population in 2006. In absolute number, TB case detection rate of all forms has also increased from 15% in 2002 to 30.3% in 2006 (73,854 TB cases out of which 39,903 (54%) were smear positive).

The generalized TB epidemic that the country is experiencing is affecting mostly the young economically productive age groups (15-44 year old) who account for more than 50% of cases and therefore impacting significantly on the socio-economic development of the country. The proportion of women and children affected are on a steady rise over the past three years.

The increasing association between HIV and TB observed over the past five years poses a significant challenge. The HIV sero-prevalence rate among TB patients increased over the years from 2.2% in 1991 to 19.1% in 2001 (Sentinel survey among high risk group NASCP 2001), and now estimated to be 27% (WHO 2006 TB Report). On the other hand, an estimated 30% - 50% of PLWHA have TB which indicates that the TB situation in the country will continue to be HIV-driven.

National statistics revealed that 1.45 million Nigerians have so far died from HIV/AIDS, an estimated 30% - 40% of this death is attributable to TB which is a curable disease even among PLWHAs. The difficulty in diagnosing TB among PLWHAs especially at primary and secondary health facilities in the country contributed greatly to this mortality rate among PLWHAs.

There is paucity of data on the level of MDR-TB in the country however; Cat 2 treatment failure patients have been reported. WHO estimates that 1.7% of all new TB cases may be resistant to first line anti-TB drugs. This poses another challenge to the TB programme in the country.
1. **INTRODUCTION:**

1.1 **TB Infection**
TB infection is the state of having a small number of *M. tuberculosis* 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.

1.2 **Mode of Transmission**
Tuberculosis is an infectious disease which spreads from person-to-person through the air by droplet nuclei. Droplet nuclei are produced when persons with pulmonary or laryngeal tuberculosis cough, sneeze, spit talk or sing. They may also be produced by aerosol-producing investigations or processing of tissue or secretions in the laboratory. The size of the droplet nuclei is estimated to be about 1-5 um, and normal air currents can keep them airborne for a long time and spread them throughout a room or building 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. Nosocomial infection of TB occurs in settings like out-patient department, wards, consulting rooms, counseling rooms, laboratories and waiting areas.

In general HIV negative persons who become infected with *M. tuberculosis* have approximately a 10% risk for developing active TB during their lifetimes. This risk is greatest during the first 2 years after infection. HIV positive and other immunocompromised persons have a greater risk for the progression of latent TB infection to active TB disease; HIV infection is the strongest known risk factor for this progression. Persons with latent TB infection who become co-infected with HIV have approximately 5%-10% risk per year and 50% lifetime risk for developing active TB.

1.2.1 *Factors which determine the likelihood of transmission of M. tuberculosis*:
- The number of organisms being 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; and
- The immune status of the exposed individual.

1.2.2 *Features of TB patients that may enhance their ability to infect others include*:
- Presence of the disease in the lungs (Pulmonary TB), airways or larynx.
- Presence of cough or other forceful expiratory measures
- Presence of acid-fast bacilli (AFB) in the sputum
- Failure of the patient to cover the mouth and nose when coughing or sneezing(Poor cough etiquette)
- Patient who received inappropriate or short duration of chemotherapy not in line with the national protocol.
- Undertaking procedures that can induce coughing or cause aerosolization of M. tuberculosis (e.g., sputum induction).
1.2.3 Environmental factors that enhance the likelihood of transmission include:
- Exposure in relatively small, poorly lit and poorly ventilated spaces
- Re-circulation of air containing infectious droplet nuclei.

| Any patient with history of cough for three weeks or more should be considered a TB suspect. |

1.3 When is a TB patient 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 is no more coughing;
- has had two consecutive negative sputum smears on two different days, with at least one morning specimen, and
- has improvement in symptoms.
Note: However, HIV positive or immunocompromised patients may still be at risk.

| A TB suspect should be considered infectious until a diagnostic investigation is completed and treatment started in line with National protocol for at least 2 weeks and is no more coughing. |

Note: BCG is given to children at birth. It does not prevent TB infection but reduces the development of the severe form of the disease.

2. **TB INFECTION TRANSMISSION IN HEALTH CARE SETTINGS.**

Transmission of M. tuberculosis is a recognized risk in health-care facilities. The transmission could be to:
- Patients/clients.
- Visitors/patient’s relative (especially in case of admission)
- GHWs
- Other staff of the health care facility.

The magnitude of the risk varies considerably according to the following:
- Type of health care facility
- The patient population served
- The prevalence of TB in the community
- The HCW's occupational group
- The area of the health care facility in which the HCW works
- Availability of effective TB infection control interventions.

The risk may be higher in areas where patients with TB are provided care before diagnosis and initiation of TB treatment (e.g., in clinic waiting areas, laboratories and OPD) or where diagnostic or treatment procedures that stimulate coughing are performed. Nosocomial transmission of M. tuberculosis has been associated with close contact with persons who have
infectious TB and with the performance of certain procedures (e.g., bronchoscopy, endotracheal intubation and suctioning). Sputum induction and aerosol treatments that induce coughing may also increase the potential for transmission of M. tuberculosis.

The risk of transmission to the above listed group of people is higher in the following settings:
- DOTS treatment unit.
- ART and HIV service delivery sites.
- Sites where TB and HIV services are co-located.
- AFB microscopy sites.
- Congregate settings such as prison.
- TB culture laboratories
- MDR-TB treatment unit.

Personnel of the above listed health care facilities should be particularly alert to the need for preventing transmission of M. tuberculosis

The Following factors enhance transmission in these settings.
- Absence of TB infection control plan in the facility.
- Poorly ventilated waiting areas
- Sitting of both HIV and TB services in such a way that allow TB patients and HIV clients to mix freely either at waiting areas, OPD, clinic and wards
- Long waiting time of patients: This may be as a result of limited number of health workers especially in facility with high case load, this allow the patients to stay longer than necessary and this gives opportunity for further transmission.
- The setting in the consulting room - Poorly ventilated consulting room may put the health workers at risk or the sitting arrangement vis a vis wind direction may also expose the health workers to infection.
- Admission protocol– This becomes a risk in places where TB patients and HIV/AIDS clients are admitted together in the same ward.
- Space – Limited and poorly ventilated space increase the rate on infection transmission.
- Poorly ventilated sputum collection area.
- Poor staining procedure which allow generation of aerosol
- Poorly ventilated laboratory space.
- Poor arrangement of the work benches which allow air flow to get to the infectious first before getting to the lab staff.
- The fitting of windows in the wards in such a way that prevent sunlight to penetrate the wards.

3. HOW TO REDUCE THE RISK OF SPREADING M. TUBERCULOSIS IN HEALTH CARE SETTINGS.

3.1 Infection control strategies

There are three levels of TB infection control:
- Administrative (managerial) control measures/ work place policy,
- Environmental control measures, and
- Personal protective equipment (respiratory protection).
Administrative control measures are the most important since environmental control measures and personal protective equipment (respiratory protection) will not work in the absence of solid administrative control measures. Each level operates at a different point in the transmission process:

- Administrative control measures reduce HCW and patient exposure
- Environmental control measures reduce the concentration of infectious droplet nuclei
- Personal protective devices (respiratory protection) protect HCWs in areas where the concentration of droplet nuclei cannot be adequately reduced by administrative and environmental control measures.

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<tr>
<th>Priority</th>
<th>Measures</th>
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<tr>
<td>1st</td>
<td>Administrative Control Measures /work place policy</td>
</tr>
<tr>
<td>2nd</td>
<td>Environmental Control Measures</td>
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<tr>
<td>3rd</td>
<td>Personal Protective devices (Respiratory Protection)</td>
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3.2 Administrative Control Measures /work place policy

Health care facilities most especially HIV service delivery sites and other congregate settings should institute good work practice and administrative control by:

- Developing a written TB infection prevention and control plan.
- Put in place administrative support for procedures in the plan, including quality assurance
- Training of staff to implement plan;
- Education of patients and increasing community awareness; and
- Coordination and communication with the TB program
- Co-location of DOTS and ART services should be facility rather than clinic based (Both services located proximal to each other within the same facility and not just within the same clinic space).
- New TB and HIV centers should take into account TB infection control measures before setting up services.

3.2.1. Infection Control Program

The development of administrative TB infection control measures should take priority over all other interventions to reduce nosocomial *M. tuberculosis* transmission. Without effective administrative control measures, environmental control measures and personal protective equipment (respiratory protection) are of limited value.

An Infection Control Program consists of two major components: managerial aspects and implementation of activities.

- Managerial aspects include the TB infection control assessment, facility risk assessment, assignment of roles and responsibilities, monitoring and evaluation.
Implementation of activities as expressed in the TB infection control plan including trainings, documentation, quality assurance, supervision and coordination.

3.2.2 The first step is to perform a TB infection control assessment. This process will determine the type and mix of administrative, environmental and respiratory protection measures. The specific interventions will be expressed through the development of an infection control plan. At facility-level, the TB IC assessment entails an initial and ongoing evaluation of the risk of TB transmission.

The initial and periodic IC assessment should cover the following activities:

- Collection and review of statistical reports on TB in the community or LGA, such as data on the profile of notified cases, TB/HIV co-infection rate, and drug resistance. The LGA TB program is a valuable source of these data (five years data suggested).
- Collection and review of data on reported TB cases in the facility for the past several years (five years data suggested), such as collected for the LGA assessment (as above). These data are found in annual reports, TB patient card archives or, in some instances, facility TB registers and/or electronic TB recording and reporting databases.
- Identifying services within the facility that are most likely to encounter persons with unrecognized TB (e.g. ART clinics, OPD, wards, radiology unit, lab etc). Efforts should be made to expedite recognition, diagnosis and treatment of TB cases.
- In facilities with TB/HIV services, identify appropriate sites for ART and DOTS clinics
- In-patient settings should provide facility-level TB data and describe current patterns of isolation and separation of TB suspects and cases.
- Identifying categories of HCWs that need to be included in a TB screening program.
- Identifying mechanisms for prompt recognition and reporting of suspected episodes of TB transmission in the facility.
- Identifying most-at-risk settings within the facility and prioritize them for initial efforts to improve TB infection control.
- Careful record-keeping should be instituted.

3.2.3 The next step is to use the data in the TB infection control assessment to develop a TB Infection Control Plan. A diverse group of stakeholders including facility management, LGA TB and HIV supervisors, and occupational health practitioners should be involved in reviewing the plan. Once approved by the appropriate management authorities, funding for the prioritized activities needs to be obtained. The TB Infection Control Plan should then be implemented and adherence with its recommendations should be monitored. Together, the LGA TB supervisor and the HCW in the primary health facility/ facility head should assume the responsibility for writing, as well as implementing and monitoring the TB infection control
plan in line with the national guidelines. For larger facilities (secondary and tertiary health institutions), a small committee can be set up for this purpose. In certain settings, having a TB infection control plan for TB alone might not be feasible. If the facility already has an infection control committee, infection control measures appropriate for the control of TB could also be part of the more general infection control plan.

In general, the TB infection control plan should include:

- Description of TB and TB/HIV incidence in the facility
- Assessment of HCW training needs and training plan
- Administrative policies with regards to triage and screening, referral and diagnosis, separation and isolation
- Using and maintaining environmental control measures
- Policy on the training and use of respiratory protection
- Area-specific infection control recommendations
- Description of roles and responsibilities for implementation and monitoring the infection control plan.
- Time-line and budget (e.g., material and personnel costs)

3.2.4 Evaluating infection control interventions

At facility level, it may be difficult to detect a change in TB rates among HCWs after the implementation of TB infection control measures because of 1) the long time intervals that often occur between TB infection and disease and 2) the small number of HCWs working at the facility. However, it is usually possible to monitor the implementation of the interventions through periodic supervision of the measures outlined in the TB Infection Control Plan. Establishing surveillance of active TB rates among HCWs in the LGA may nonetheless provide a useful means of evaluation, although the complex relationship between infection and development of disease, as well as other factors such as high HIV rates may complicate the interpretation of trends.

One means to evaluate TB infection control measures is by reviewing the medical records of a sample of TB patients seen in the facility. The evaluation of outcome measures can then be used to identify the areas where improvement may be needed.

The process of developing and implementing the TB infection control plan is not static, but should be continually monitored and adapted, with ongoing education integrated at all steps.
3.3 Client Management

3.3.1 Screening

Early recognition of patients with suspected or confirmed TB disease, through screening, is the first step in patient management. It can be achieved by assigning a staff member to screen patients immediately they arrive at the facility. Patients with cough of more than three weeks duration, those being investigated or on treatment for TB should be managed using the six steps outlined below.

3.3.2 Education

Education of the above mentioned persons identified through screening, in cough etiquette and respiratory hygiene. Cough etiquette includes instructing them to cover their noses and mouths when coughing or sneezing, using handkerchief or tissue papers. Respiratory hygiene includes proper disposal of used tissues and sputum. Patients and their families should also be educated on the signs and symptoms of TB disease, that it is a treatable disease, the risks of not completing treatment, the public health implications of not being treated, and increased risk of TB disease to PLWHAs. Public health awareness messages could be as simple as posters on the walls and presentations by health educators to as complex as electronic media (videos, DVDs, CDs, etc.).
3.3.3 Separation

Triaging symptomatic patients to the front of the line for the services they are seeking (e.g. HIV counselling and testing, medication refills), to quickly provide care and reduce the amount of time that others are exposed to them is recommended. 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 or patient ward.

How could one separate patient?

First, one has to prioritize the healthcare needs of the patients and the ability of the health staff to provide appropriate health care. Next, one has to prioritize who should be separated from whom. Finally, the optimal spatial separation scheme (separation into appropriate spaces) should be developed and modified as the patient population changes.

3.3.4 Provide needed inpatient and outpatient services

In an integrated service delivery setting, if possible, the patient should receive the necessary healthcare services they are accessing before the TB investigation.

3.3.5 Provide TB diagnostic services or refer

TB diagnostic tests (minimum clinical evaluation and smear microscopy within 24 hours) should be done onsite or, if not available onsite, the facility should have an established link with a TB diagnostic centre to which symptomatic patients can be referred. Also, each facility

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### How can stigma affect TB infection control programs?

Social stigma is a recognized barrier to effective TB care.
- In the community, stigma can discourage health-seeking behaviour thereby delaying TB diagnosis and treatment.
- Among HCWs, fear and uncertainty can negatively impact on services and patient-centred care.

Additionally, TB infection control interventions such as the wearing of masks by patients, respirators by HCWs and separation may be perceived as stigmatizing or as an impediment to patient-provider communication.

TB infection control programs need to address and mitigate the impact of stigma:
- At patient-level, education programs - both via individual and group sessions - should include content aimed at stigma-reduction. IEC materials need to be visible in facilities and include messages about cough hygiene and use of masks. Messages should attempt to normalize separation of coughing clients, use of masks, respirators, etc within the context of promoting patient safety and provision of quality care.
- At the institution level, training programs and policies aimed to promote patient-centred care are important.
should have a linkage with a TB treatment centre to which those who are diagnosed with TB can be referred.

### Suspect TB!!

- Maintain a high index of suspicion at every patient encounter
- Screen (ask questions) for TB on patient intake and routinely at HIV services
- Think TB
- Know the signs and symptoms of TB
- Suspicion of TB should be high in persons with any of the following:
  - Cough >3 weeks
  - Fever >3 weeks
  - Night sweats
  - Unexplained weight loss
  - Haemoptysis (coughing up blood or blood-tinged sputum)
  - Enlarged lymph nodes (>2 cm)
  - History of TB
  - Contact with a person with TB disease

If yes to any of the above, send sputum for AFB sputum smear microscopy to the lab. Further evaluation should be in accordance with the National TB program policy.

Literature suggests that HIV-infected persons may have TB disease even in the absence of cough.

For sample TB screening questions for patients see National Integrated Management of Adult Illness (IMAI) TB/HIV Co-Management Guidelines.

### 3.3.6 Treatment

**Appropriate TB treatment** should be initiated in accordance with the National TB guidelines at the earliest possible time.

- Use directly observed therapy (DOT) to ensure adherence to treatment
- Follow-up and monitor patients in accordance with the National TB guidelines.
- Conduct additional diagnostic procedures to ensure that appropriate treatment is being given (both for TB as well as potential interactions with other medications such as ARVs).
- Document completion of treatment program.

### 3.3.7 Discharge plan

For inpatient and outpatient settings, coordinate a discharge plan with the patient (including a patient who is a HCW with TB disease) and the TB control program of the LGA health department, the family and community. If applicable, co-management of patients with HIV or other diseases should be coordinated with the applicable LGA health department. Global efforts are increasingly expanding access to treatment of drug-resistant TB. Identification of
expertise and referral sites that manage drug-resistance is generally described in national plans for management of drug-resistant TB. Networks can facilitate access to appropriate expertise including isolation, initiation and monitoring of treatment. While M(X)DR TB treatment often involves long periods of care in hospital, coordination with the national and local TB programs is important in order to manage care provision, follow-up of contacts and outpatient treatment (when indicated).

**Seven Steps for Patient Management to Prevent Transmission of TB**

1. Screening
2. Education*
3. Separation*
4. Provide needed services
5. Provide TB diagnostic services or refer
6. Treatment
7. Discharge Plan

*The sequence of education and separation may be interchanged

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A staff member should be designated to be the infection control officer who will be responsible for ensuring that the infection control procedures are implemented.

### 3.4 Example of the TB Infection control plan

The plan should be facility specific and the content could vary from facility to facility. The plan should at least include, but not be limited to, the following policy areas:

1. Screening all patients as soon as possible on 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 or sneezing, using tissue papers (provided by the program) or handkerchief.

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 onsite; and ensuring that persons on TB treatment are adhering to their treatment.

6. **Using** and maintaining environmental control measures (see *Environmental Control Measures*).
7. Training and educating all facility staff (health and non-health) on TB and the TB infection control plan. Training should include increased risk of TB in HIV-infected persons, and the need for diagnostic investigations for those with signs or symptoms of TB.

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

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

10. In situation where there is the need to admit a smear-positive patient in the hospital, the plan should include policy on separation until they have received 2 – 3 weeks medications after which they are likely to be non-infectious.

In addition to the above, facility providing MDR services should also include the following policy areas in their plan.

- Laboratory biosafety measures.
- The use of N95 respirator by staff in such facilities.
- The use of disposable surgical mask by relatives/visitors and patients during visiting hours.
- The respiration fit testing.
- Adherence to standard operating procedures (SOP).
- Maintenance of equipment such as Biological safety cabinets.
- Set up a facility based infection control committee.

Each health care facility especially the large ones should establish multidisciplinary infection control committee where appropriate. The composition of membership of this committee can vary from facility to facility depending on the available human resources. This committee should comprise of representatives of various units within the facility that have roles to play, membership of this committee should include at least the head of clinical services of the facility, officer in charge of infection control, occupational health staff, head of nursing services, AFB microsocpist/head of lab, maintenance officer, head of DOTS and ART or HIV service delivery units, hospital secretary or administrator.

In facilities where the availability of medical staff does not permit, there should at least be an identifiable clinician designated to provide medical input and direction to the infection control committee in the hospital.

The infection control committee provides a forum for multidisciplinary input, cooperation, collaboration and information sharing.

The TOR of the infection control committee will be to:

- Develop a written infection control plan.
- Assess and promote improved practice at all levels of the health facility.
- Ensure appropriate staff training in infection control and safety management.
- Conduct periodic review of the infection control plan.

This committee should at least meet once a month and record of such meeting should be kept at the facility and shared with the control programme at LGA and state levels.
3.4.2 TRAINING OF STAFF

Infection control is effective only if all staff working in a facility understand 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 worker, should receive job category-specific instructions. Training should be conducted before initial assignment and continuing education should be provided to all employees.

Training should include the following:

- 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 PLWHAs;
- 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.

3.4.3 EDUCATION OF PATIENTS AND COMMUNITY AWARENESS

Members of the community have a great role to play in successful implementation of this health intervention. About one-third or more of HIV-infected persons living in areas with widespread TB will develop TB disease during their lifetime. To reduce TB infection in the community, patients and community members must be provided with routine education on:

- Cause of TB.
- Symptoms of TB and how to recognize them.
- Availability of treatment for TB and the fact that TB is curable and treatment is free.
- Where to seek health care if one has symptoms of TB.
- How TB patients can protect themselves, and others, from exposure to TB by simple cough hygiene measures.

Home-based care for PLWHAs and Community TB Care for TB patients is already an integral part of programme implementation in the country, thereby providing an avenue for the implementation of this activity. Patient education and community awareness will help reduce stigma about TB in the community, in addition to reducing the risk of TB infection in the community.

3.4.4 COORDINATION AND COMMUNICATION BETWEEN TB AND HIV/AIDS CARE SERVICES IN HEALTH FACILITY.

Coordination and communication between HIV/AIDS and TB programs is key to a successful implementation of TB infection control measures. A scenario in which there is no functional collaboration between TB and HIV service units despite being co-located within the same facility is not acceptable to the control programmes. The other possible scenario where TB services are not available in an HIV service delivery site and vice versa should be urgently addressed.
Each facility in both scenario described above should develop an agreement/working relationship with the local/nearest DOTS/HIV site as applicable. This agreement should establish:

- A two way referral mechanism for patients suspected of having TB disease to be investigated in the TB diagnostic centre and started on treatment if indicated, and for HIV as well.
- A monitoring mechanism which provides feedback to the referring facility to evaluate both the linkage with TB/HIV diagnostic services and the appropriateness of referrals as indicated by the proportion of suspects actually confirmed as having the diseases.

**Work practice and administrative measures**

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H/Facility Management

Appoints a TB IC Officer

Form a TB IC Committee

Develop facility TB IC Plan

Train staff to implement plan

Monitor implementation

Regular meetings of the committee to review implementation

Community mobilization

MD

Head of DOTS and HIV units

Maintenance officer

TB IC Officer and Others
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### 3.5 ENVIRONMENTAL CONTROL MEASURES

Work practice and administrative measures alone are not enough to eliminate the risk of exposure to M. TB infection by clients and GHCWs in health care settings, therefore environmental control measures must be added to reduce the concentration of droplet nuclei in the air. This is also an important aspect of the infection control plan described above. Environmental control measures serve as the second line of defence after work practice or administrative control for preventing the spread of TB and reducing the concentration of infectious droplet nuclei in the air. It is important to recognize that if work practice or administrative controls are inadequate, environmental control measures will **not eliminate the risk**.

A variety of simple to complex environmental control measures can be used to reduce the number of infectious droplet nuclei in the work environment.

These include:
- Maximizing natural ventilation through open window—this is the simplest, extremely effective, and least expensive technique.
- Ultraviolet germicidal irradiation (UVGI) to inactivate *M. tuberculosis* organisms—using natural sunlight or UVGI lamps.
- Mechanical ventilation (e.g., window fans, exhaust ventilation systems, supply and exhaust ventilation systems, etc.)—these are more complex and costly methods.
- Room air cleaners with air filtration—these are also complex and costly methods used to remove and dilute infectious particles.

Some of these measures are technologically complex and expensive, and may not be feasible in some settings. However, a cheaper measure like controlled natural ventilation which reduces the risk of spreading *M. tuberculosis* may be feasible at all levels of health care delivery (primary, secondary and tertiary).

The design of the facility, climate of the area, type of patient population served, number of TB patients cared for in the facility, and resources available will dictate the type of environmental control measures for each facility. To maximize benefit, efforts to improve ventilation should involve consultation with an expert in environmental control measures and infection control.

Whatever environmental control measures are in place, their adequate operation and maintenance should be included in the TB infection control plan, and their proper function should be evaluated regularly. Other administrative control measures to ensure optimal operation of environmental control measures may include (but not limited to):
- assignment of a person to oversee environmental controls,
- to open and close windows, as appropriate,
- change filters,
- test environmental control measures periodically,
- clean UVGI lamps,
- perform preventive maintenance, etc.

### 3.5.1 Ventilation:
Ventilation is the exchange of air between an enclosed space and the 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 positions that enhance ventilation.

**Waiting areas and consulting rooms where TB suspects are likely to seek medical care e.g. ART Clinics and other congregate settings should be designed in such a way that they maximize natural ventilation.**

When the weather permits, open-air shelters with a roof to protect patients from sun and rain could be used as waiting areas.
Airflow direction is controlled in health care settings to contain contaminated air and prevent its spread to uncontaminated areas. The general ventilation system should be designed and balanced so that air flows from less contaminated (more clean) to more contaminated (less clean) areas.

3.5.2 Controlled natural ventilation

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

To provide controlled ventilation, the air supply (the opening through which the air comes in) and the exit (the opening through which the air goes out) should be located so that clean airflow first to parts of the room where GHWs work and then across the infectious source and into the exit. This recommended working location is illustrated in the diagram below.

In the diagram above, GHW is not positioned between the infectious source and the exist. If the direction of the airflow is controlled, this option may be recommended.

The configuration illustrated above may not always be possible but should be used whenever feasible. However, a good compromise when the above is not feasible is illustrated with the diagram below.
2. Direction of Natural ventilation or Correct working location

Good compromise when the position illustrated above is not feasible

GHW in the consulting room should not position him/herself between the infectious source and the exit. This type of position illustrated with the diagram below put the GHW at higher risk of being infected with Mycobacterium Tuberculosis and is therefore not recommended.

Note: GHW should not sit face to face with the patient.

3. Direction of Natural ventilation or Correct working location

GHW should be mindful of the flow of air to ensure that they do not position themselves between the infectious source and the exit. The flow of air should also be considered when setting up a work bench.
3.5.3 How to increase the effectiveness of natural ventilation:
This can be achieved through the correct use of propeller fans. These fans provide affordable means of increasing the effectiveness of natural ventilation by increasing the mixing of airborne TB droplets, as well as assisting in the direction of air movement by pushing or pulling of the air.

Types of propeller fans include:
- Ceiling fans.
- Table fans.
- Standing fans.
- Fans mounted in a window opening (exhaust fan)

3.5.4 Air mixing and removal
A propeller fan helps mix air in a room thereby reducing areas with pockets of high concentrations of the droplet nuclei 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 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
- enclosed room with a fan
- enclosed room with air conditioner
- a room with an open window but no fan

In addition, mixing may increase the effectiveness of other environmental controls.

3.5.5 Control of airflow direction in a health care setting.
Propeller fans can also be used to enhance air movement into and out of a room, if placed in or near a wall opening.

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 re-enter 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 fan and the HCW is 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.

3.5.6 Exhaust fans
There are wide varieties 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 and directed upwards.
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.

3.5.7 Checking natural ventilation

Natural ventilation of the consulting rooms and the waiting areas should be checked once a year and rechecked if any changes in the physical environment are made. The record of these checks should be kept at the facility.

The following should be assessed when checking natural ventilation:
- Direction of Air movement
- The extent of Air mixing.

One way to visualize air movement and the extent of mixing is to use incense sticks as described in the steps below.
- 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 (direction of air movement/flow)
- Observe how quickly the smoke dissipates (air mixing).
- Keep records of all routine activities and date in the facility based ventilation register. This register is an adapted booklet with the following columns:

<table>
<thead>
<tr>
<th>Date</th>
<th>Description of Activities</th>
<th>Findings</th>
<th>Action taken</th>
<th>Name</th>
<th>Signature</th>
</tr>
</thead>
</table>

The test is a subjective test and may require some practice.

People can usually feel the existence or lack of air movement in a space. A ventilated space has a slight draught. In the absence of ventilation, air will feel stuffy and stale and odours will linger.

3.5.8 Checking fans

The use of fans to increase the effectiveness of natural ventilation will fail if they are not properly operated and maintained. It is therefore important that routine checks are conducted monthly on the installed fans.

Check monthly for the following:
- If the room fans are working and clean.
- If the exhaust fans are working and clean.
- Record your findings in the facility based ventilation register illustrated above.

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.
Use cloth or vacuum cleaner to remove dust and lint from fans, grilles, and ducts regularly. Clean ducts behind grilles as far back as can be reached.

In addition, where feasible the staff must also check for the followings during the monthly checking of the fans:

- Flow rates through exhaust fans and grilles: This 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 (ACH)) 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. Recommended general ventilation rates for health-care facilities are usually expressed in number of ACH. This number is the ratio of the volume of air entering the room per hour to the room volume and is equal to the exhaust airflow \( Q \) \{cubic feet per minute\} divided by the room volume \( V \) \{cubic feet\} multiplied by 60 (i.e., \( ACH = \frac{Q}{V} \times 60 \)).

Keep records of all routine activities and dates.

**Box 2. Example air exchange rate calculation**

Window opening: 0.5m high(length), 0.5m wide(breath)
Window area = Length x breath = 0.5m X 0.5m = 0.25m²
Average air velocity through the window = 0.5m/s
Room dimension: 3m wide, 5m deep and 3m high
Room volume = 3m x 5m x 3m = 45m³
Average flow rate = Area of window X Average air velocity
\[ = 0.25m² \times 0.5m/s \times 3600s/hour = 450 \text{ m}³/\text{hour} \]
Air exchange rate = Average flow rate divided by room volume
\[ = \frac{450 \text{ m}³/\text{hour}}{45m³} = 10 \text{ air exchanges per hour} \]

**3.6 FILTRATION.**

Air filtration is the removal of unwanted material from the airstreams; the unwanted material in this case is mycobacterium tuberculosis droplet nuclei. This air cleaning method is used to supplement other recommended ventilation measures and it is particularly used in the TB culture laboratories. High Efficiency Particulate Air (HEPA) filter is considered an adjunct to other ventilation measures. HEPA filters can be used to clean air before it is:
- exhausted to the outside.
- re-circulated to other areas in the health care settings.

To ensure adequate functioning, install HEPA filters carefully and maintain them according to the instructions of the manufacturer. Maintain written records of all pre-filter and HEPA maintenance and monitoring.
All HEPA filters must be carefully installed and meticulously maintained to ensure adequate function.

3.7 ULTRAVIOLET GERMICIDAL IRRADIATION (UVGI)
This is an environmental control measure used to kill or inactivate micro-organisms like M. tuberculosis through exposure to UVGI. Because exposure to ultraviolet light can be harmful to the skin and eyes, the lamps must be installed in the upper part of rooms or corridors or placed in exhaust vents. The effectiveness of UVGI in preventing the transmission of TB is not known.

3.8 NEW HEALTH FACILITIES
All newly constructed health facilities should take into consideration the environmental strategies in TB infection control in their construction.

4. PERSONAL PROTECTION MEASURES

Personal Protective Device (Respiratory Protection)

4.1 The role of respiratory protection
Respiratory protection (respirators) is generally the third line of defence for HCWs against nosocomial M. tuberculosis infection. Without appropriate administrative and environmental control measures, respirators will NOT adequately protect the HCWs from infection. However, respirators may serve as a valuable complement to administrative and environmental control measures.

Since respiratory protection is expensive, it is most appropriate for use in high risk areas in the referral hospital setting (e.g.
  ◆ during sputum induction or other cough-inducing procedures
  ◆ rooms where spirometry or bronchoscopy is carried out
  ◆ TB culture lab
  ◆ autopsy areas
  ◆ during surgery on potentially infectious TB patients;
  ◆ Specialized treatment centres for persons with MDR TB).

A valveless respirator must be used

4.2 The role of surgical or procedure masks and respirators in respiratory protection
4.2.1 Surgical or procedure masks
There are important differences between a surgical or procedure mask and a respirator. Surgical or procedure masks (cloth or paper):

- do prevent the spread of micro-organisms from the wearer (e.g., surgeon, TB patient, etc.) to others by capturing the large wet particles near the nose and mouth and limiting the distance aerosols are expelled when coughing, sneezing, and talking.

- may provide a limited level of protection to the wearer (e.g., HCW, patient, family member) from inhaling infectious droplet nuclei in the air. However, they are not designed to be of high filtration efficiency or with a tight face seal.

### 4.2.1.1 Use of surgical or procedure masks for patients

In many settings the resources for disposable/cloth surgical or procedure masks for potentially infectious TB patients may not be available. In this case, cough etiquette (i.e., covering mouth, using tissues or clothes) and respiratory hygiene (i.e., not spitting on floor, disposing of soiled tissues properly) should be enforced.

Although not the highest priority intervention, disposable/cloth surgical or procedure masks may be used to reduce aerosols generated from potentially infectious TB patients:

- Disposable surgical or procedure masks should be considered for suspect and known infectious TB patients leaving isolation rooms for medically-essential procedures

Because surgical or procedure masks may also serve to identify TB patients the risk of stigma also needs to be considered. Patient and HCW education regarding the importance and appropriate use of surgical or procedure masks should accompany their distribution. **It is important to remember that a surgical or procedure mask worn by HCWs may not adequately protect them from inhalation of air contaminated with M. tuberculosis. Respirators are the preferred device to reduce the concentration of M. tuberculosis bacilli inhaled.** Surgical or procedure masks usually have limited filtration capacity and are loosely fitted over the nose and mouth, allowing free entrance of aerosolized M. tuberculosis. Other devices, such as respirators do provide respiratory protection. Cloth/gauze surgical or procedure masks can be sterilized and reused.

### 4.2.2 Respirators

To protect HCWs from M. tuberculosis airborne droplet nuclei, a respiratory protective device with the capacity to filter 0.3-0.4 micrometer particles is needed. Respirators are a special type of device that provide such a level of filtration and are closely fitted to the face to prevent leakage around the edges. If the respirator is not fitted correctly, infectious droplet nuclei can easily enter a person’s airways, potentially resulting in infection (see photo):

- respirators manufactured with at least 94-95% filter efficiency for particles of 0.3-0.4 micrometers in diameter are usually recommended for use by HCWs
filtering face-piece respirators are disposable but can be re-used repeatedly for several weeks for TB, if they are properly stored.

 CDC/NIOSH-certified N95 (or greater) and CEN-certified FFP2 (or greater) filtering face piece respirators meet these criteria.
The main factors responsible for the deterioration of respirators are humidity, dirt, and filter damage. Respirators should be stored in a clean dry location. One method is to fold a light towel around the respirator (being careful not to crush the respirator). Plastic bags should never be used since they retain humidity.

**Photo: Wearing and fitting a respirator properly**

**Surgical Mask**

**N95 Respirator**

- Surgical masks do not filter out infectious droplet nuclei
- Not for laboratory personnel
- Respirators fit over the mouth and nose and filter out infectious TB particles

Respirator – has only tiny pores
relies on an air tight seal around the entire edge

Surgical or procedure mask – has large pores
and lacks air tight seal around edges
4.2.3 Respirator fitting

Respirators are available in different sizes. It is recommended that “fit testing” of respirators should be performed on HCWs to ensure that the appropriate respirator (size and shape) for each HCW is used. Qualitative fit testing involves the use of an aerosol which may be “tasted” If the HCW “tastes” the aerosol (usually saccharin or a bitter-tasting material), the nose clip should be adjusted and the respirator re-tested. If the HCW fails the test a second time, a different size or brand respirator should be tested. Beards and facial hair do not allow proper sealing of respirators to the face. Any leak between the face and the respirator is a potential entry point for infectious droplet nuclei. Should time and resources (financial and staff) permit, a respirator testing program should be incorporated into the TB infection control plan.