



REPUBLIC OF NAMIBIA

MINISTRY OF HEALTH AND SOCIAL SERVICES

Tuberculosis Infection Control Guidelines

MINISTRY OF HEALTH AND SOCIAL SERVICES

Tuberculosis Infection Control Guidelines

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PREFACE

According to the World Health Organisation (WHO), Namibia had the second highest case notification rate of TB in the world in 2006, after Swaziland. Although results from recent antenatal seroprevalence surveys suggest that there is a decline in the prevalence of HIV in Namibia, the country remains one of the worst affected countries with a prevalence rate of 17.8% in 2008. The dual epidemic poses a major challenge since HIV is the major risk factor for the development and TB is a leading cause of morbidity and mortality among HIV infected individuals. Namibia has made huge strides in providing anti-retroviral therapy to eligible patients, which has resulted in reduced mortality and death from HIV related opportunistic infections.

Patients attend health facilities for various ailments ranging from minor illnesses to life-threatening conditions, as well as for routine services such as immunization, antenatal care, and medical examinations and as guardians accompanying children. A number of patients attending these facilities may also have airborne diseases such as tuberculosis, which can be spread to other patients and staff if appropriate precautions are not taken. Due to the various afflictions often associated with HIV infection, PLHIV tend to attend health facilities more frequently than other patients. This factor, plus the fact that these patients are more susceptible to develop TB disease if they become infected necessitates the establishment of measures to protect these patients from infection with TB.

These guidelines address the TB component of infection control and are meant to assist in the establishment of a framework for TB infection control with particular emphasis on health facilities. These measures are however also applicable to other settings where the potential for transmission of TB is likely to be high, such as prisons and holding cells. While they are based on internationally accepted infection control practices, the guidelines have been formulated to try and address the unique Namibian situation. Due to the varying climatic conditions across the country, the different measures included in the guidelines will be tailored to different facilities and institutions in the country.

I would like to express my sincere gratitude to all those from the MoHSS and our development partners (KNCV Tuberculosis Foundation, CDC Namibia and Global Fund) who contributed in the development of these guidelines.

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Mr. K. Kahuure

Permanent Secretary

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LIST OF ABBREVIATIONS

AFB	Acid Fast Bacilli
ART	Antiretroviral therapy
AIDS	Acquired Immunodeficiency Syndrome
ARV	Antiretroviral medicine
BCG	Bacille Calmette-Guerin
BSC I	Biosafety Cabinet Class 1
BSC II	Biosafety Cabinet Class 2
BSL	Biosafety Level
CDC	Centres for Disease Control and Prevention(USA)
CPT	Co-trimoxazole therapy
CNR	Case Notification Rate
DCC	District Coordinating Committee
DOT	Directly Observed Treatment
DOTS	Directly Observed Treatment, Short Course
DST	Drug susceptibility testing
DTC	District Tuberculosis Coordinator
DR-TB	Drug- resistant tuberculosis
HAART	Highly Active Anti Retroviral Therapy
HCWs	Health care workers
HIV	Human immunodeficiency virus
HEPA	High Efficiency Particulate Air filter
IPT	Isoniazid Preventive Therapy
IUATLD	International Union Against Tuberculosis and Lung Diseases
MDR-TB	Multi-Drug Resistant Tuberculosis
<i>M. tuberculosis</i>	<i>Mycobacterium tuberculosis</i>
PLHIV	People Living With HIV
PTB	Pulmonary Tuberculosis
EPTB	Extra-pulmonary tuberculosis
PPD	Purified Protein Derivative
TB/HIV	Tuberculosis and Human Immunodeficiency virus
TBIC	Tuberculosis Infection Control
TST	Tuberculin Skin Testing
VCT	Voluntary HIV Counseling and testing
WHO	World Health Organization

CHAPTER 1: INTRODUCTION

Namibia reports one of the world's highest incidence rates of tuberculosis (TB) and has a case notification rate (CNR) of 722 per 100,000 in 2007. Like the rest of Southern Africa the country is also faced with a generalized HIV epidemic, with an antenatal seroprevalence rate of 17.8% in 2008. First and second line TB medicines have been used extensively without well functioning control mechanisms in place and by HCWs who may not have been well equipped to handle TB patients. Namibian hospitals admit TB patients during the intensive phase of treatment yet infection prevention and control measures are not stringent, hence the risk of nosocomial transmission is real. The transmission of TB to both patients and HCWs is therefore a serious risk in Namibian healthcare settings.

The risk of TB infection is well acknowledged since the identification of the *M. tuberculosis* bacillus as the cause of TB. In the pre-antibiotic era TB patients used to be isolated for long periods in sanatoria until they were cured or died. With the introduction of antibiotic therapy this practice gradually changed to a much shorter isolation in hospital, often until the completion of the intensive phase of treatment or until sputum smear conversion.

The introduction of rifampicin reduced treatment regimens from 18 and 12 months to 6 or 8 months, and was so effective in killing *M. tuberculosis* that infectious patients became non-infectious much faster than in the pre-rifampicin era. Due to these advances, isolation of infectious TB patients was no longer a key priority, because the short period of infectiousness after initiation of short-course treatment was considered irrelevant compared to the period before diagnosis, when most of the TB infection transmission would have taken place.

The priority of TB control shifted to scaling-up early diagnosis and short-course chemotherapy under DOTS, with TB Infection Control (TB-IC) receiving low priority in low-income high TB burden countries. The occupational risk of health care workers (HCWs) acquiring TB infection at the workplace (nosocomial infection) was considered relatively low and acceptable when they were dealing with patients with drug susceptible TB patients who were on treatment. The only exception remained for laboratory workers handling TB cultures for who specific biosafety measures continued to be implemented. Namibia is no exception in this general trend regarding TB-IC except that most hospitals still have what are often incorrectly referred to as "TB isolation wards".

This lack of prioritisation of TB-IC needs to change urgently and drastically because of the threat posed by HIV infection and the emergence of multidrug-resistant and extensively drug-resistant TB (X/MDR-TB). HIV infected persons have a 30-50 times higher risk of developing TB disease after being infected with *M. tuberculosis*, and X/MDR-TB is associated with very high mortality

rates in HIV infected persons partly due to delays in diagnosis. Diagnosis of MDR-TB in Namibia can take up to two months using conventional culture methods, with that of XDR-TB taking even longer. This situation is compounded by the fact that HIV infected TB patients may test sputum-smear negative and are more likely to have extra-pulmonary TB. In both cases they can continue to harbor DR-TB that goes untreated because drug sensitivity testing is not routinely done in these patients. Emerging evidence suggests that in the absence of effective TB-IC, outbreaks of HIV associated X/MDR-TB will arise, leading to high morbidity and mortality among both HIV-positive patients and HCWs. This has been documented in Tugella Ferry in South Africa in 2006.

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. Up to half of these may be infectious TB cases. 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, HCWs, and staff at their HIV care clinics and in community programs. Persons with HIV-associated immunosuppression progress rapidly from TB infection to disease – over a period of weeks/months rather than a period of years as is common for persons with a normal immune system. This explains why X/MDR-TB, when spread in hospital settings, particularly affects HIV positive immune-compromised patients. PLHIV in a high burden TB setting may become easily re-infected and quickly develop a second episode of TB disease.

It is the obligation of the MoHSS to protect both HCWs and patients from acquiring TB infection in the course of their professional practice and when seeking care in health facilities respectively. The implementation of TB-IC measures in health facilities should thus be a priority.

The purpose of these guidelines is to guide efforts aimed at reducing the risk of TB infection in health facilities, households and the community through the implementation of rational, affordable and cost-effective TB-IC measures. Most of the infection control measures outlined in this document also apply to airborne infection control in general. An essential element in TB-IC is a reliable and efficient laboratory system for the timely diagnosis of infectious TB to enable the implementation of appropriate separation and isolation practices along with the more expensive engineering controls where necessary.

1.1. Process of Developing the Tuberculosis Infection Control Guidelines

The process of producing these guidelines started with the NTCP drafting the initial draft document which was circulated to all programme staff at national, regional and district level as well as among local partners. Input obtained from this process was consolidated to produce the second draft document which was also widely distributed for input. After some internal reviews the third draft was produced in collaboration with the Quality Assurance Division in the MOHSS. This third draft was forwarded for review by the Directorate of Special Programmes. The final version of the guidelines was submitted to the Permanent Secretary for endorsement.

Tuberculosis Infection Control Guidelines is part of the overall infection control document for the MoHSS, thus the information contained herein will also be included in the overall infection control document. Due to the critical and urgent need for the implementation of TB infection control; the TB infection control section was extracted and produced separately to aid with training and implementation of TB infection control measures.

CHAPTER 2: DETERMINANTS OF TRANSMISSION

Tuberculosis is caused by *M. tuberculosis*. Invisible *M. tuberculosis* droplets are formed when a person with TB in the lung or larynx coughs, sneezes, laughs or speaks. Droplet formation can also occur in laboratories, autopsy rooms or during procedures like bronchoscopy. Small droplets (aerosols) laden with bacilli can be suspended in air for a long time while bigger droplets drop to the floor quite quickly. Infection occurs when a susceptible person inhales one or more droplets containing mycobacteria, which then lodge in the alveoli of the lungs. Once in the lungs the bacilli may then spread all over the body. TB disease may develop soon after infection with TB bacilli. In most persons however, an immune response generated within 2-10 weeks after infection limits further multiplication and spread of the TB bacilli. More often than not, the bacilli remain dormant and viable, a condition called latent tuberculosis infection (LTBI). Persons with LTBI do not have symptoms of active TB and are not infectious.

A TB suspect (a patient who has symptoms and signs suggestive of TB but in whom the diagnosis is yet to be made) should be considered infectious until a diagnostic investigation is completed, while a person with TB disease of the lungs or larynx should be considered infectious until the person has completed at least two weeks of directly observed standard anti-TB therapy and has improvement in symptoms. It should be noted, however that some patients may have DR-TB which may initially improve on standard first line medicines, therefore general infection control precautions need to be taken throughout TB treatment.

The probability of nosocomial transmission of TB depends on the following factors:

2.1 The number of infected patients

Large numbers of TB patients cared for in a health facility; particularly those not yet diagnosed and not receiving treatment, are associated with an increased risk of nosocomial transmission. These numbers vary from facility to facility, and depend on the prevalence of TB as well as the population density in the facility's catchment area. In Namibia these patients are commonly found in outpatient departments and HIV care clinics, although they may also be found in other areas of the health facility. This is the most important determinant of risk of transmission.

2.2 Infectiousness of each patient

The infectiousness of a patient is determined by the number of viable bacilli in the sputum. Thus a patient who is sputum smear positive for AFB will infect many more close contacts than a patient with culture positive but smear negative TB. The following characteristics of a patient with TB disease increase the risk for infectiousness:

- Presence of cough; patients who cough persistently are more infectious because they expel more infectious droplets;

- Cough inducing procedures;
- Not covering mouth or nose while coughing;
- Extensive lung destruction with pulmonary cavitations on chest x-ray, often a feature of patients presenting with a delayed diagnosis;
- Positive AFB sputum smear results;
- Respiratory tract disease with involvement of the lung or pleura though exclusively pleural involvement is less infectious;
- Laryngeal TB;
- Sputum-smear and culture positive patients with undiagnosed DR-TB; these patients may be on treatment, though inadequate to treat their drug resistant TB;
- Incorrect anti-TB treatment regimens.

2.3 Duration of exposure

The risk of transmission increases with close and prolonged contact with an infectious TB patient. An untreated case of infectious TB remains infectious for longer periods than a patient who is promptly diagnosed and started on appropriate treatment. Early intervention with appropriate chemotherapy reduces the time of infectiousness; conversely prolonged transmission occurs where chemotherapy is inadequate due to improper drug combinations, poor adherence, lower dosages, malabsorption, drug interactions or TB strains resistant to the prescribed drugs.

2.4 Environmental factors

The risk of transmission of TB increases as a result of various environmental factors, which include:

- Exposure to TB in small, enclosed spaces;
- Inadequate ventilation that results in insufficient dilution or removal of infectious droplet nuclei;
- Recirculation of air containing infectious droplet nuclei;
- Inadequate cleaning and disinfection of medical equipment;
- Improper procedures in handling specimens.

2.5 Host characteristics

The probability that a person who is exposed to TB bacilli will become infected depends primarily on the concentration of infectious droplet nuclei in the air and the duration of exposure to a person with infectious TB disease. The following persons are at particularly high risk:

- HCWs who serve high-risk patients or undertake high-risk activities which include cough-inducing procedures (sputum induction, bronchoscopy), autopsy, morbid anatomy and pathology examination, and laboratory procedures such as handling of cultures of *M. tuberculosis*.

- HCWs with unprotected exposure to a patient with TB disease before identification of the patient as a TB suspect and implementation of correct airborne precautions
- HCWs whose work entails regular, direct patient contact (such as nurses, nursing assistants, social workers, physiotherapists and volunteers) in units where patients with active TB are admitted;
- Persons with no prior exposure to *M. tuberculosis* are at high risk of becoming infected when exposed. Prior infection, especially if it led to TB disease, provides a measure of protection against re-infection in immune-competent persons;

Risk of disease following infection

The following categories of persons are at high risk for progressing from LTBI to TB disease:

- People living with HIV (PLHIV): HIV infection is the highest risk factor for progression from LTBI to TB disease. PLHIV may become infected or re-infected with *M. tuberculosis* when exposed to someone with infectious TB. They can progress rapidly from TB infection to disease (over a period of weeks/months rather than years as is common with immunocompetent individuals). Persons with TB/HIV co-infection have approximately 10% risk per year of developing active TB;
- Other medical conditions which lead to increased risk of developing TB disease from LTBI include silicosis, diabetes mellitus, malignancies, chronic renal failure, and all other diseases which compromise the immune system.

The difference between latent TB infection and TB disease

Latent TB infection (LTBI)

- LTBI is the state of having a small number of live TB bacilli in the body which are unable to grow due to control by the immune system. The bacteria are inactive, but can become active later.
- LTBI does not cause a person to feel sick; there are no signs or symptoms of TB disease;
- Tuberculin skin test (TST) is one of the methods used to diagnose LTBI. A positive result usually means that TB infection is present, but persons with HIV associated immunosuppression can have a false negative TST even with TB infection. Conversely, persons who have received BCG vaccination may have a false positive skin test;
- Only one in ten people with TB infection and normal immune system will develop TB disease in their *lifetime*. On the contrary one in ten PLHIV infected with TB will develop active TB disease *every year*;
- Treatment for LTBI with isoniazid reduces the risk of TB disease though the protective benefit only lasts for two years in HIV infected persons;

TB disease

- Approximately 80% of TB disease occurs in the lungs. In PLHIV, up to half of the TB patients have disease in other parts of the body;
- A person with TB disease of the lungs usually has cough, which is often productive and may have some blood in the sputum;
- General symptoms of TB disease include fever, sweating at night, and loss of appetite, weight loss and fatigue;
- With standard treatment TB disease is curable in over 95% of cases, even in PLHIV, provided there is no drug resistance;
- Untreated TB is often fatal, especially in persons with HIV.

Table 1: Latent TB infection versus TB disease

	TB INFECTION	PULMONARY TB DISEASE
Bacteria	<i>M. tuberculosis</i> in the body	
Tuberculin Skin Test	Skin test reaction is usually positive	
Symptoms	No symptoms	Cough, fever, weight loss
Chest X-ray	Normal	Abnormal
Sputum Smears & cultures	Negative	Usually positive*
Infectious?	Not infectious	Often infectious before treatment
Classification	Not a case of TB	A case of TB

*Sputum smears more often negative in HIV infected TB patients

Nosocomial transmission in health care settings

Several published studies show that HCWs and medical and nursing students in contact with patients with TB are at an increased risk for acquisition of TB infection and disease. While it is well known that HCWs are at increased risk, implementing a well functioning TB surveillance (infection and disease) among health workers is challenging because:

- TB disease is associated with HIV/AIDS, and HCWs may be reluctant to disclose that they have TB disease for fear of stigmatization;
- Few countries have occupational health systems which actively follow-up and monitor TB infection and disease in all HCWs;
- The widespread BCG vaccination which may complicate interpretation of TST for the monitoring of skin test conversion.

At the macro level a number of factors are responsible for the nosocomial transmission of TB in facilities. Poverty can cause delays in patients seeking treatment or affect the health system's ability to provide timely and appropriate diagnosis and treatment. In addition, patients may be hospitalized and cared for in overcrowded clinics and wards thus increasing risk of transmission to both patients and HCWs. Other contributing factors are absence of national guidelines and lack of training and communication on TB-IC.

CHAPTER 3: TB-IC MEASURES

Types of intervention

All health facilities are visited by patients with TB in their often protracted process of seeking diagnosis and cure. Health facilities should therefore have an infection control plan to ensure prompt identification of TB suspects and institution of airborne precautions, as well as to expedite the diagnosis and start of treatment for those found to have TB. Measures should be put in place to minimize the risk of airborne infection.

TB-IC is based on a four level hierarchy of controls, namely organisational activities, administrative and environmental controls and respiratory protection. Organisational activities are essentially policy-level activities and they need to be in place to facilitate the implementation of all the other levels of TB-IC. Administrative controls have the potential to have the greatest impact on preventing transmission of TB in health facilities and should be prioritized in all facilities as these are considered the most effective. These measures prevent droplet nuclei containing *M. tuberculosis* from being spread in the facility thus reducing exposure of staff and patients to TB infection. Ideally elimination of droplet generation means that exposure is no longer possible, thereby requiring no further controls. In reality however it is not possible to completely eliminate exposure, therefore environmental measures are required to reduce the concentration of droplet nuclei in the air. Unfortunately even the combination of administrative and environmental controls can never provide 100% safety; respiratory protection is therefore needed in specific areas and during the performance of specific tasks to create the desired level of safety. It is important to note that environmental and personal respiratory controls will not work in the absence of solid administrative control measures.

Each level operates at a different point in the transmission process;

- Organisational controls provide an enabling environment for the implementation of all the other levels of control
- Work practice and administrative controls reduce HCW and patient exposure;
- Environmental controls reduce the concentration of infectious droplet nuclei in the air;
- Personal respiratory protection protects HCWs in areas where the concentration of droplet nuclei cannot be adequately reduced by administrative and environmental controls.

Table 2: Package of interventions for TB-IC in health-care settings

Organisational activities
1. Identify and strengthen coordinating bodies for planning, development of national guidelines and implementation plan
2. Conduct surveillance and assessment of TB infection risk at all levels of the health system
3. Engage civil society and address advocacy communication and social mobilization
4. Conduct monitoring and evaluation
5. Enable and conduct operational research
Administrative controls
1. Develop strategies to promptly identify potentially infectious cases (triage), separate them, control the spread of pathogens (cough etiquette) and minimize time in health care settings.
Environmental controls
1. Natural ventilation
2. Mechanical ventilation
3. Ultraviolet germicidal irradiation (UVGI) units
4. Health facility design and renovation
Personal protective interventions
1. Respirators
2. Package of prevention and care for HCWs

3.1 Organisational activities

The organisational activities may include planning and budgeting, assessing the problem, developing policy, setting up surveillance activities, establishing coordinating bodies at all levels of the health system, conducting research, building human resource capacity, monitoring and evaluation. Organisational activities are based on public health principles and represent the foundation of any public health program. They are mainly conducted by national level staff and include the development and periodic review of infection control policies and guidelines and ensuring the availability of the necessary resources. Monitoring and evaluation of infection control activities is covered in chapter 5 of these guidelines. Other organisational activities include training of staff, promoting operational research in infection control, increasing community awareness and enhancing communication between HIV and TB programmes.

3.1.1. Training of Staff

Infection control is effective only if each HCW working in a facility understands the importance of IC practices and the role they play in implementing them. Each HCW should receive instructions appropriate to their job category. Training should be received before initial assignment (pre-service) and each HCW should undergo annual continuing education (in-service). National trainings should be conducted initially targeting infection control focal persons, and these should be complemented by regional trainings for all levels of staff. Training should include the following components;

1. **Clinical Information:** basic concepts of *M. tuberculosis* transmission, pathogenesis, diagnosis and the risk of transmission to HCWs, including the TB/HIV interaction;
2. **Epidemiology of TB:** Epidemiology of TB in the local community and district and the risk factors for TB disease;
3. **Infection control plan:** All HCWs should be oriented on the facility's infection control plan, including all the measures which should be implemented to make the plan a success;
4. **TB and Public Health:** HCWs should also be made aware of the overall TB control strategy, including the role of the local as well as national TB control programmes. This should also include the availability of information for social mobilization and behavioural change.

3.1.2. Education of patients and increasing community awareness

Educating communities and patients to recognize symptoms of TB and to seek health care and further investigations should be routine in Namibia where there is a high co-infection rate of TB and HIV. In addition, patients should understand how to protect themselves, and others, from exposure to TB by simple cough hygiene measures. Information, education and communication materials such as posters and pamphlets emphasizing cough etiquette should be placed in HIV care clinics, waiting areas of outpatient departments, TB clinics, TB wards, consultation rooms and all the other strategic areas. TB-IC messages should also be included in both TB and HIV communication activities.

3.1.3. Coordination and communication with the TB and HIV Programs

National TB and HIV/AIDS programs should ensure that each facility caring for persons with HIV strengthens well coordinated and integrated service delivery for HIV and TB care depending on the local setting and staff complement existing at their local level, and have a TB-IC plan. TB-IC in HIV care settings and voluntary counselling and testing (VCT) centres should be prioritized.

3.2 Administrative controls

Administrative control measures serve as the first line of defense against spread of TB in health facilities. These measures include practices and procedures to promptly identify potential and known infectious cases of TB, and separate and treat them with the minimal delay. Administrative controls aimed at reducing TB transmission in health care and congregate settings include triaging, physical separation or isolation of patients or TB suspects, cough etiquette and minimising time spent in health care settings. The work practice and administrative control measures comprise of:

- Facility infection control plan for the different sections and activities in the health facility;
- Administrative support for procedures in the plan, including quality assurance and local training of staff;
- Education of patients;
- Monitoring and enforcement of adherence to standard operating procedures.

3.2.1. Infection Control Plan

Every health facility and setting should have a written infection control plan that outlines a protocol for the prompt recognition, separation, investigation and referral of patients with suspected or confirmed TB disease. Areas which should be prioritised in the health facilities include where diagnosed or undiagnosed TB patients are found; namely out-patient screening areas, waiting areas in medical outpatient departments, HIV care clinics, medical wards, TB clinics and TB wards. While the latter have generally been regarded as relatively safe since the patients are on treatment and therefore not infectious, the rising problem of drug resistant TB demands that high levels of airborne precautions continue to be taken even for patients on treatment.

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 for patients with cough of more than 2 weeks duration immediately after they arrive at the facility. These patients should be allowed to enter and register without standing in line with other patients and must be given advice on **respiratory hygiene/cough etiquette**, and provided with a 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. Their investigation should be expedited in order to minimize their stay in the health facility as well as the need to come back for investigations. After ensuring cough hygiene, identified TB suspects who may have attended the clinic for another reason should preferably promptly **receive the services** they were originally accessing (e.g. VCT, medication refills) before being investigated for TB.

TB suspects should promptly be **investigated** for TB following the Namibian diagnostic protocol. Sputum collection should always be done in a well ventilated area outdoors and away from other people, not in toilets or other enclosed areas.

The facility IC plan should include the following measures:

- Prompt screening of all patients after arrival at the facility to identify persons with symptoms of TB or those who are being investigated or treated for TB disease;
- Instructing the TB suspects and patients in **respiratory hygiene/cough etiquette**. This includes instructing them to cover their nose and mouth when coughing or sneezing, and 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. Paper tissues are less likely to be used effectively but are less costly and less likely to identify people as TB suspects with the attendant risk of stigma. Tissues and face masks should be disposed of in waste receptacles. Clients and 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 such as the flu virus can;
- Placing TB suspects and cases in a separate well-ventilated waiting area such as a sheltered open-air space is ideal in warm climates;
- Speeding up management of these persons so that they spend as little time as possible at the facility;
- Ensuring rapid diagnostic investigation of TB suspects and ensuring that persons reporting TB treatment are adhering with their treatment;
- Using and providing regular maintenance of appropriate environmental control measures;
- Training and educating all staff on TB and the TB-IC plan (should include special risks for TB for HIV positive HCWs and patients, and need for diagnostic investigation for those with signs or symptoms of TB).
- Providing voluntary, confidential HIV counseling and testing for staff with adequate access to treatment;
- Monitoring the TB-IC plan's implementation and correcting any inappropriate practices and enforcing adherence to institutional policies.

Table 3: Five steps to prevent transmission of TB in health care settings.

STEP	ACTION	DESCRIPTION
1	Screen	Early recognition of patients with suspected or confirmed TB disease is the first step in the plan. A staff member should be assigned to screen for patients with cough of more than 2 weeks or who are under investigation or on treatment for TB. These patients should be attended to without delay.
2	Educate	Persons identified in 1 above should be instructed on cough hygiene without delay. This should include covering their mouth and noses on coughing, sneezing and where possible be provided with face masks or tissues for use in this regard.
3	Separate	Separate patients identified in 1 above from other patients promptly. They should wait in a separate, well ventilated waiting area, and instructed in cough hygiene as in 2 above.
4	Provide HIV Services	Symptomatic patients should be triaged to the front of the line while seeking services (e.g. HIV counseling and testing, medication refills etc) for prompt attention and reduce time to expose other persons to <i>M. tuberculosis</i> .
5	Investigate for TB	TB diagnostic investigations should be done promptly according to the <i>National Guidelines for the Management of Tuberculosis</i> .

3.2.2. Administrative support for the plan

The TB-IC plan must be supported by the Chief and Principal Medical Officers in the regions and districts and should be coordinated by the facility infection control officer. Referral and district hospitals should additionally have an infection control committee. The Medical Superintendent (for referral hospitals) or the Principal Medical Officer (for district hospitals), is responsible for overseeing the infection control committee and development of a written infection control plan, monitoring its implementation, and providing effective training for HCWs and other staff. For health centres and clinics the Principal Registered Nurse is responsible for overseeing infection control activities, with the infection control officer (environmental health technician or officer) being responsible for the day to day implementation of the TB infection control plan.

3.2.3. TB/HIV collaboration

Facilities without an integrated system providing care for both TB and HIV should develop an agreement between the local care providers which establishes:

- Strict identification of patients with cough in the waiting rooms of HIV/AIDS care facilities, their separation away from other patients in a well ventilated area (cohorting), cough hygiene, and use of face mask when moving into rooms for individual consultation and medical care;
- A (referral) mechanism for patients suspected of having TB disease to be investigated expediently for TB and started on treatment, if indicated;
- 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.

3.2.4. Other areas to be addressed by the IC Plan

3.2.4.1. *Outpatient management*

One of the most effective means of reducing the risk of nosocomial transmission in the health facility is to avoid hospitalisation where possible and manage ambulatory TB patients on an outpatient basis. If patients are hospitalised, frequent evaluation should be carried out for possible discharge with continuation of therapy as out-patients. Outpatient treatment should **not** be provided in the same rooms where TB suspects are evaluated. Treatment schedules should be convenient to the patient to avoid defaulting and falling ill again. Outpatient treatment should strictly be DOT and provided by an individual who is available and acceptable to the patient.

The DR-TB and the infection control committees should work closely together to ensure that patients who are discharged for ambulatory treatment are well informed about infection control measures while at home. This is particularly important for patients with DR-TB who may continue to be infectious for prolonged periods of time. It should always be remembered that some patients on first line TB treatment might be harboring undiagnosed DR-TB therefore it is still important to emphasize infection control practices to all TB patients on treatment.

3.2.4.2. *Inpatient Management*

Ideally all infectious TB patients should be isolated from non-TB patients as well as from other TB patients. Where this is not possible, separation should be practiced till the patients are non-infectious. Always 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 should be located away from other wards with non-TB patients (especially pediatric wards, medical wards with immune compromised patients) preferably in separate buildings;
- Where only a single ward is available, separate the area within the ward and keep TB patients in a well ventilated area and try to maintain physical separation as much as possible. The direction of the airflow in such settings should always be away from patients without TB;
- Introduce and enforce that infectious TB patients are limited/restricted in their movements within the hospital, or otherwise wear a face mask when this cannot be avoided;
- Patients with suspected or confirmed DR-TB should be strictly isolated from patients without DR-TB. This is important because DR-TB patients may be able to transmit their infection to other TB patients (cross infection) who may eventually develop active TB disease from DR-TB after their drug sensitive TB bacilli were effectively killed.

3.2.4.3. Drug Resistant TB (MDR/PDR/XDR-TB) patients

Patients with DR-TB require specialized management at a referral centre for some period of time. These patients are infectious for a long period with resultant increased risk for nosocomial transmission. Patients with suspected or confirmed DR-TB should be placed in a separate area or building in a facility, preferably in ventilated individual patient rooms where the possibility of contact with other patients without TB, or with presumed drug sensitive TB is not possible. Where this is not possible, and a large number of patients are suspected or have confirmed DR-TB cases, then a separate ward or a section of the existing ward should be designated for these patients.

Isolation for MDR-TB/XDR-TB/PDRTB patients

- While DR-TB patients are encouraged to spend as much time as possible outdoors, it is important to ensure that strict isolation (or separation where isolation is not possible) policies are enforced whenever patients are indoors.
- Patients should wear a disposable or surgical face mask whenever they venture out of their room or isolation areas;
- Visitors should be received in designated area outdoors. Minimize persons entering the isolation area. Those entering the area should put on respiratory protection;
- Provide incentives for patients in isolation, like TVs and indoor games to facilitate adherence to isolation. Address problems and habits which are likely to interfere with isolation such as alcohol dependence;
- Educate the isolated patients on the mechanism of *M. tuberculosis* transmission and the reasons for them being isolated. They should be taught to cover the mouth and nose whenever they cough even while in isolation to minimize spread of infectious aerosols into the air.

Discontinuing Isolation

Patients in isolation should be evaluated frequently to determine if isolation is still required. In general DR-TB patients can only be released from isolation when they have received appropriate anti-TB treatment without fail and both sputum smear for AFB and culture for *M. tuberculosis* are negative for two consecutive months. The facility's DR-TB Committee can in exceptional circumstances allow ambulatory treatment before culture conversion depending on individual cases and local circumstances. In these cases ensuring adherence to TB-IC practices in the household is of paramount importance. Isolation throughout the entire treatment could be considered for MDR-TB/XDR-TB patients if patients do not become smear and culture negative, and if it socially and legally possible and acceptable to do so.

3.2.4.4. Protection of health care workers and staff working in congregate settings

Any staff, including volunteers, who have contact with persons with TB are at risk of infection with TB. This could include porters and cleaners, as well as peer educators, adherence supporters, and volunteers working as counselors or in support groups. PLHIV 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. Staff working in correctional institutions and drug rehabilitation centres, also have been documented to have higher rates of TB infection and disease than the general population.

The infection control measures recommended in these guidelines 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. Staff training and re-training programmes should also encourage all staff members who are at risk to know their HIV status so that they can take additional precautions and benefit from IPT if they are HIV infected.

Reminders that HCWs and other staff can develop TB, regardless of previous infection status or BCG vaccination should occur with annual re-training on infection control. Staff should be investigated for TB if they have a cough for 2 weeks or more and the infection control plan should list designated staff members who should be contacted to initiate TB investigations, and reinforce that all services are confidential.

3.3 Environmental controls

Environmental control measures are of secondary importance *after* administrative controls in prevention of nosocomial airborne transmission. In facilities with inadequate administrative measures, environmental measures alone will not eliminate the risk of TB transmission. Environmental controls include measures to reduce the concentration of infectious respiratory aerosols (i.e. droplet nuclei) in the air, such as mechanical ventilation, enhancing natural ventilation, filtration and ultraviolet germicidal irradiation (UVGI) units. For environmental

controls to be implemented, organisational activities and administrative controls should also be in place to ensure availability of resources and proper use and maintenance of equipment, training of staff, etc. The environmental measures include:

Ventilation: This is the simplest and least expensive technique which basically removes and dilutes the air from areas with TB patients' channeling it away from other patients and HCWs without TB. Ventilation measures can be natural or mechanical.

- **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. 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;
- **Mechanical ventilation** should be considered in those facilities where natural ventilation is inadequate, because open windows are far too small, or the climate does not allow having the windows open (too hot or too cold). Mechanical ventilation measures include fans which may assist to distribute the air (this allowing better dilution of air from "dead" corners), evacuate the air (fans pushing air into or pulling air out of a room), air conditioning and negative pressure rooms (air sucked from the corridor into the room and evacuated through a HEPA filter on the roof). When mechanical ventilation systems are used, management must ensure that the system is regularly maintained. Filtration involves removing infectious particles from the air. Machines suck in air and pass it through a HEPA filter. Their efficiency is controversial, when compared to other measures, and they are expensive to buy and maintain.

Ultraviolet Germicidal Irradiation (UVGI): This blue light kills *M. tuberculosis* organisms when adequately exposed to the light (long enough and close enough). It can be considered for facilities managing DR-TB particularly in areas where climate conditions preclude the utilization of natural and mechanical ventilation and on wards with high patient numbers. If this modality is used responsibility should be assigned to ensure the lamps are cleaned, maintained (replaced) and monitored (measure UV intensity), and adverse exposure is avoided. They work better in clean air without much dust or humidity. Natural sunlight is not very effective in killing *M. tuberculosis* bacilli and should not be relied upon in TB-IC measures. Sunlight passing through windows does not kill *M. tuberculosis*.

3.4 Personal protective interventions

Personal protective interventions aim to prevent the inhalation of infectious respiratory aerosols while assuming that they are in the air. They should be used together with administrative and environmental controls in situations where there is an increased risk of pathogen transmission. Personal protective interventions include use of personal respirators.

Face masks or surgical masks

There are important differences between a face mask and a respirator. Face masks, such as surgical masks (cloth or paper) prevent the spread of micro organisms from the wearer (e.g., surgeon, TB patient) to others by capturing the large wet particles near the nose and mouth but they **do not** provide protection to the wearer (e.g., HCW, patient, family member) from inhaling infectious droplet nuclei in the air. Although not the highest priority intervention, disposable masks can be used to reduce aerosols generated from potentially infectious TB patients.

Respirators

Respirators are the last line of defence for HCWs against nosocomial *M. tuberculosis* infection. They are made of a material that filters out very small particles in the air (including the infectious particles in aerosols). They are also called High Efficiency Particulate Air (HEPA) filters. Respirators 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. Respirators manufactured with at least 95% filter efficiency (N95 respirators) for particles of 0.3 micron in diameter are usually recommended for use by HCWs. They are disposable but can be re-used repeatedly for several weeks up to a month if they are properly taken care of.

Without appropriate administrative and environmental controls, respirators will **NOT** adequately protect the HCW from infection. However, respirators may serve as a valuable complement to administrative and environmental infection measures. Since personal respiratory protection devices are also quite costly they are most appropriate for use in high risk areas in the referral hospital setting, namely:

- isolation rooms for patients with TB or MDR-TB;
- during sputum induction or other cough-inducing procedures;
- bronchoscopy suites;
- autopsy areas;
- spirometry rooms;
- during emergency surgery on potentially infectious TB patients (elective surgery should be always postponed).

The main factors responsible for the deterioration of respirators are humidity, dirt, and crushing. They should be stored in a clean dry location. One method is to fold a light towel around the

respirator (being careful not to crush it). Plastic bags should never be used since they retain humidity.

Respirator fitting

Respirators are available in different sizes, because different people need different sizes. It is recommended that HCWs be “fit tested” to ensure selection of the appropriate respirator. Fit testing of respirators should be performed 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 respirator must be adjusted (i.e., the nose clip) and retested. If the HCW fails the test a second time, a different size or brand respirator should be tested. Beard and facial hair do not allow proper sealing of respirators to the face. Any leak between the face and the mask is a potential entry point for infectious droplet nuclei.

Where possible a respirator fit testing program should be incorporated into the infection control plan of each health facility. The NTCP should make fit testing equipment available, and ensure sufficient staff are well trained in its use. Fit testing should be conducted prior to the use of a respirator and annually thereafter. District environmental health technicians or officers shall be responsible for conducting respirator fit testing.

3.5 TB infection control package

The set of interventions recommended in these guidelines are strongly interrelated and should therefore be implemented as a package. Organisational activities should be prioritized at national level. In facilities, however, administrative controls must be given the highest priority, so that they can support and facilitate the implementation of the other interventions. In addition to the interventions given in this chapter, all health-care facilities caring for patients with respiratory diseases should also implement the standard precautions and precautions for airborne infection control.

CHAPTER 4: SPECIAL AREAS

Special consideration should be given in reducing nosocomial TB transmission in the settings outlined below, especially so if PLHIV are either working or admitted in these settings.

4.1. Laboratory

AFB Smear preparation

Many laboratories which process infectious sputum in Namibia perform only direct smear microscopy, which has not been documented to result in transmission of *M. tuberculosis* (assuming centrifugation is not being used). Direct smear microscopy can therefore be safely performed on the open bench in the absence of BSC. Neither environmental controls nor personal respiratory protection are necessary during the preparation of smears. Administrative controls should be used to limit exposure of laboratory personnel to coughing patients. For general hygienic measures simple use of lab coat and hand washing procedures are adequate for sputum-smear examination. However, if a BSC is available it should be used for sputa smearing and drying.

Preparation of liquid suspensions of *M. tuberculosis*

Laboratories which process liquid preparations of suspended *M. tuberculosis* (e.g. centrifugation, cultures, and DST) should be considered at higher risk for nosocomial *M. tuberculosis* transmission. In Namibia this is currently only done in the reference laboratory in Windhoek, although plans are under way to avail TB culture and DST in Walvis Bay and Oshakati. Safety can be improved by enhancing ventilation in areas where culture and DST of *M. tuberculosis* isolates is performed, using the appropriate biosafety cabinets (BSC I or BSC II) and allowing only experienced staff to work with liquid suspensions of *M. tuberculosis*.

Biosafety Cabinets (BSCs)

BSCs are relatively expensive and are designed to contain airborne microorganisms in laboratories working with liquid suspensions of *M. tuberculosis*. When used with appropriate laboratory practices, the spread of aerosolized microorganisms to the air can be minimized through the use of a BSC. There are two general types of BSCs. **BSC Class I** protects the worker and the work environment from exposure to an aerosol by drawing air into the cabinet. It does not protect the specimen from contamination. Air is exhausted outside or filtered and recirculated into the room. Since the filters require maintenance, the most practical and safest cabinets simply exhaust air outside, away from windows, people, or areas where the air may be brought back into the building. Exhausting air to the outside produces negative pressure in the laboratory relative to the surroundings. The BSC should be designed such that the velocity into the cabinet is 0.35-0.45 m/sec. Excessive velocity will induce turbulence and the potential for contaminated air to flow out of the BSC. Too little velocity may not be sufficient to carry out of

the cabinet the aerosolized microorganisms. A simple technique to monitor airflow and rate is to hold a thin strip of tissue paper at various positions around the opening of the cabinet. In a well-functioning cabinet, the strip should float gently inward when placed anywhere around the opening. Ideally, air velocity should be measured periodically using a velometer, also known as hotwire anemometer. One can also use smoke tubes, or the smoke from mosquito coils to visualize the flow of air. This is the type of BSC needed in most laboratories.

A **BSC II** is more expensive, since it uses laminar air flow in addition to exhaust. This type of cabinet protects both the specimen/culture and the HCW from contamination. However, without proper maintenance, the laminar air flow in Class II cabinets may actually increase the risk to HCWs by pushing contaminated air from the BSC into the breathing zone of the HCW.

Personal respiratory devices in the laboratory

In laboratories where only smear microscopy is performed, personal respiratory protection (HEPA masks/respirators) is in general not needed. Laboratories working with liquid suspensions of *M. tuberculosis* should be equipped with a BSCII. Personal respiratory protection is not recommended if the BSC is functioning appropriately and all work with liquid suspensions is carried out in the cabinet. Due to the time lag that can occur between the malfunction of a BSC and the detection of the malfunction, it is advisable for laboratory staff working with liquid suspensions to adopt N95 respirators as standard practice.

4.2. Radiology

Radiology departments provide services for many patients with various ailments who might be at particular high risk of TB (children and PLHIV). Precautions to reduce nosocomial transmission should be put in place including;

- Schedule inpatient chest radiography on infectious and suspected TB patients for non busy times, such as the end of the afternoon;
- Provide coughing patients with surgical face masks to wear;
- Expedite service for infectious TB patients to minimize the length of time spent in the department;
- Restrict access to radiology suite during operation hours to patients and essential personnel only;
- Use the room with best ventilation for infectious TB patients only.

4.3. Sputum induction and cough-inducing procedures

Procedures like bronchoscopy and sputum induction lead to coughing and aerosol production which increases the risk of transmission of *M. tuberculosis*. These procedures should only be done as a last resort after less risky diagnostic measures have been taken. Avoid bronchoscopy

on patients with an established TB diagnosis. The rooms for these procedures should have proper ventilation coupled with respiratory protection with N95 masks.

4.4. Surgical and autopsy suites

These settings require special TB-IC consideration for preventing *M. tuberculosis* transmission. Poorly ventilated surgical and autopsy rooms pose considerable risk of *M. tuberculosis* transmission and subsequent infection to HCWs whenever surgical or dissection procedures are done on infectious TB patients or cadavers. In general, elective surgery on infectious TB patients should be postponed until effective sterilization using adequate chemotherapy has been achieved. Efforts should be made to establish adequate environmental controls coupled with N95 respirators for all HCWs involved in the procedures. Potentially contaminated equipment such as endoscopes should be cleaned and sterilized appropriately

5: MONITORING AND EVALUATION

The effectiveness and impact of the national TB-IC programme and implementation plan should be monitored and evaluated. This is to provide the data needed to guide the planning, coordination, and implementation of TB-IC efforts, assess its effectiveness; and identify areas for program improvement. Monitoring the results of the infection control program will allow health facilities to determine if the techniques already in effect are working well or if changes (internal and external) are required.

5.1. Objectives of M&E in TB-IC

The following are some of the objectives of conducting M & E of TB-IC strategies:

- To facilitate the most effective and efficient use of human and financial resources to achieve maximum health benefit for the population served;
- To provide information on programme management. In this regard M & E of TB-IC can help to:
 - measure programme performance in TB-IC
 - ensure quality and effectiveness in service provision
 - measure progress towards the achievement of specific objectives
 - identify problems and possible solutions;
- To help promote a learning culture focused on service improvement;
- To improve accountability; and
- To attract resources for TB-IC.

5.2. M & E Framework for TB-IC

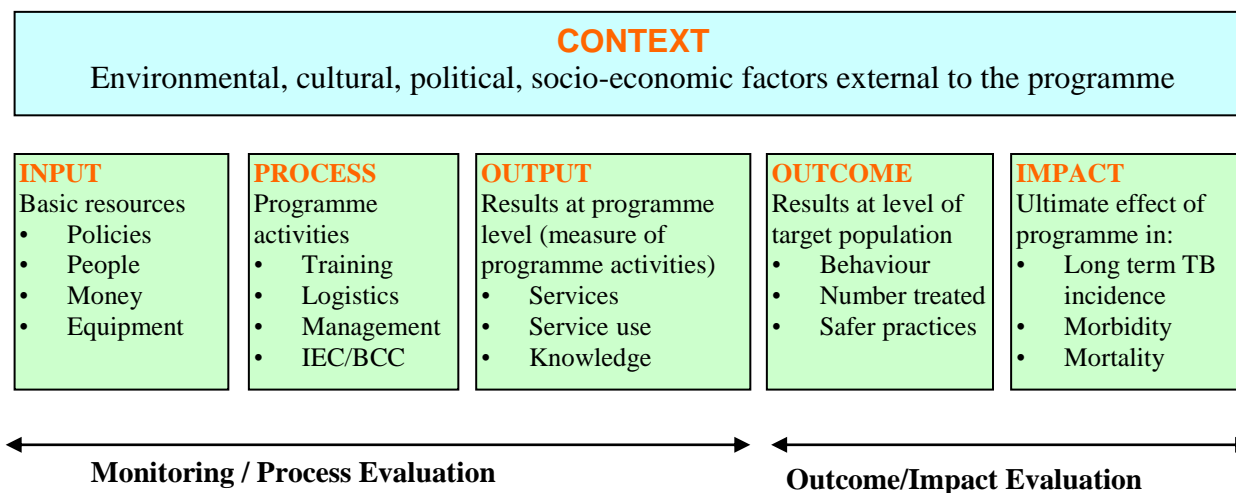
To achieve the above objectives, the NTCP will be guided by a strategic framework for national and sub-national level programmatic implementation of TB-IC. This will clearly outline and visually conceptualize the project inputs, processes, outputs as well as desired outcomes and impact.

Strategic Framework for TB Infection control

Aim: Minimal transmission of *M. Tuberculosis* infection in high risk settings, including high HIV prevalence settings like Namibia

Objective: Appropriate TB-IC controls implemented in all health facilities, congregate settings and households

Fig 1: M&E framework for Infection Control



5.3. Indicators for TB-IC

M&E activities in the context of TB-IC relate to administrative and environmental control measures as well as personal respiratory protection. These activities should be identified and tracked using the indicators outlined in Table 4 below.

5.4. Monitoring

Infection control and performance improvement will be linked through information gathering and clinical analysis. There will be continuous collection and/or screening of data to identify potential infection outbreaks. Comprehensive periodic surveillance data on patients and HCWs for development of TB will be reviewed; including the identification and analysis of infection problems or undesirable trends.

The tools that will be used for TB-IC are the Facility Review Checklist, Health Facility Supervision Checklist as well as the Facility Cough Register. Frequency of measurement with the checklists will be on a baseline and periodic (6 months) periods. The checklist will be completed by the DTC in collaboration with the DCC and forwarded to the national office. However data from the cough register needs to be monitored and reported on a monthly basis by the DTC.

5.5. Reporting

Routine monitoring and surveillance data as well as results of special studies will be gathered, aggregated and analyzed and shared with the TB-IC committee comparing current statistical information and historical data and findings of surveys and internal and external inspections.

Table 4: Indicator Matrix for TB infection control in health care and congregate settings

No.	Indicator	Definition	Indicator Type
Administrative Controls			
IF1	Infection Control Plan developed and available	# of health care facilities and/or congregate settings with a written infection control plan, expressed as a proportion of the total number of health care facilities and congregate settings evaluated	Process
IF2	Functional Infection Control Committees	# / % of districts with functional Infection Control Committees	Process
IF3	Infection Control Committee meetings	# of meetings held by district Infection Control Committees	Process
IF4	Active Screening and Case Detection	# / % of health facilities and congregate settings with system for active cough screening and case detection in place (cough registers available)	Process
IF5	Risk of TB infection among HCW's	#/% of HCWs in health facilities and congregate settings diagnosed with TB	Impact
IF6	CNR of TB disease	# of TB cases detected per 100,000 in general population vs. notification rate in HCW's	Impact
IF7	Health workers trained in Infection Control	# / % of HCWs trained in Infection Control	Process
IF8	Health facilities with trained staff in Infection Control	# / % of health facilities and congregate settings with health care workers trained in infection control	Process
Environmental (Engineering) Controls			
IF9	AFB Isolation Facilities	# / % of health facilities and congregate settings with AFB isolation or separation facilities (adequate ventilation) for admitted suspected or confirmed TB cases	Process + Outcome
Personal Protection Controls			
IF10	Availability of Respiratory Protection	# / % of health facilities and congregate settings with N-95 masks available all the time with no stock outs reported	Process

GLOSSARY

Acid-fast bacilli	Rod-shaped bacteria that do not lose their stain when exposed to acid or acid–alcohol mixture after the staining process, i.e. bacteria of the <i>Mycobacterium tuberculosis</i> complex and all non-tuberculous mycobacteria.
Administrative controls	Strategies implemented in a facility to promptly identify potentially infectious (TB) cases, separate them, control the spread of pathogens through cough etiquette and minimize time in health care settings.
Air-borne infection	The dissemination of microbial aerosols to a suitable portal of entry, usually the respiratory tract.
Air-borne precautions	Measures taken to prevent the spread of infection through the air from one person to another.
Active TB	Tuberculosis disease associated with symptoms or signs.
Aerosol	A cloud of solid or liquid particles in the air, usually produced by coughing, sneezing, talking or laughing.
Biosafety cabinets class 1	A hood (or cabinet) under which some special laboratory procedures are performed. It protects the worker and the work environment from exposure to an aerosol by drawing air into the cabinet, but does not protect the specimen from contamination.
Biosafety cabinets class 2	A hood (or cabinet) under which some special laboratory procedures are performed. This type of cabinet uses laminar air flow in addition to exhaust, and protects both the specimen and the HCW from contamination.
Bronchoscopy	A procedure whereby an instrument (bronchoscope) is introduced into the respiratory tract in order to see inside the airways.
Close contact	A person who has been in close proximity in an enclosed environment for a prolonged period (i.e. 8 hours or longer) with a person with infectious or potentially infectious TB and who is therefore considered to be at risk of infection with <i>M. tuberculosis</i> .
Cohorting	The process of separating patients who are potentially infectious from those who are not so that appropriate precautions can be instituted
Contact tracing	The process of identification, assessment and follow-up of close contacts of index

cases.

Cough hygiene/etiquette	Measures taken by a potentially infectious coughing patient to prevent the generation of aerosols (eg covering the mouth when coughing)
Cough inducing procedures	Procedures that can stimulate the patient to cough, or can aggravate cough in a coughing patient, such as bronchoscopy
Congregate settings	Institutions where large groups of people can be found in one place. Airborne infections can therefore spread to many people within a short time
Directly observed therapy (DOT)	A trained and supervised person observes the patient swallowing the medication.
Droplet nuclei	Microscopic particles (1-5 microns in size) that can become airborne when a person coughs, sneezes, shouts, sings, breathes, or talks.
Drug-resistant TB (DR-TB)	TB disease caused by <i>M. tuberculosis</i> strains which are resistant to at least one TB medicine
Drug resistant TB committee	A committee established within hospitals managing drug-resistant TB to address issues related to treatment, adherence, discharge and social needs of patients with drug-resistant TB
Extensively drug resistant TB (XDR-TB)	TB caused by strains of <i>M. tuberculosis</i> that are resistant to isoniazid <i>and</i> rifampicin <i>and</i> to any of the fluoroquinolones <i>and</i> to at least one of the injectable second-line anti-TB medicines.
Extra-pulmonary tuberculosis (EPTB)	TB of organs other than the lungs: e.g. pleura, lymph nodes, abdomen, genito-urinary tract, skin, joints and bones, meninges etc.
Surgical masks	A device worn over the mouth and nose by operating room personnel during surgical procedures to protect both surgical patients and operating room personnel from transfer of microorganisms and body fluids. Surgical masks also are used to protect healthcare personnel from contact with large infectious droplets (>5 µm in size). They do not protect against inhalation of small particles or droplet nuclei and should not be confused with particulate respirators that are recommended for protection against selected airborne infectious agents, (e.g. <i>M. tuberculosis</i>).
Fit testing	Evaluation of how a respirator fits conducted by trained personnel. Includes the use of scented solution and the determination of whether the employee can detect the odour.
High-Efficiency	This is a filter that is capable of removing 99.97% of particles 0.3 micron in

Particulate Air (HEPA) filter	diameter or greater. HEPA filters remove all particles in the size range of TB droplet nuclei.
Infection control committee	A committee set up in all hospitals and that is tasked with addressing all infection control issues in the facility, and should be chaired by the medical superintendent or principal medical officer of the facility.
Infection control plan	A plan to ensure prompt identification of TB suspects and institution of airborne precautions, as well as expediting the diagnosis and start of treatment for those found to have TB.
Infectious TB patient	A patient who has TB (diagnosed or undiagnosed) of the lungs or larynx and is capable of transmitting TB infection to others. These patients are usually sputum smear positive.
Isoniazid preventive therapy	The treatment of subclinical latent TB infection to prevent progression to active TB disease usually based on 6 months of oral isoniazid.
First line TB medicines	Anti-TB medicines used for the treatment of TB in a patient who has not been treated for TB before and who has no evidence of resistance to these medicines (e.g. rifampicin, streptomycin, ethambutol). Some of these first line medicines can be incorporated into regimens for drug resistant TB if there is evidence of susceptibility to them
Isolation	The process whereby a patient needing airborne precautions is assigned to a private room with special ventilation requirements. If a patient must move from the isolation room to another area of the hospital, the patient should be wearing a mask during the transport. Anyone entering the isolation room to provide care to the patient must wear a respirator.
Latent tuberculosis infection (LTBI)	Infection with mycobacteria of the <i>M. tuberculosis</i> complex, usually diagnosed by a positive TST, without clinical evidence of disease.
Mechanical ventilation	Use of artificial devices to enhance movement of air into and/or out of a room/area/building.
Multidrug-resistant TB (MDR-TB)	TB caused by strains of mycobacteria of the <i>M. tuberculosis</i> complex that are resistant to at least isoniazid <i>and</i> rifampicin.
Mycobacterium tuberculosis	The namesake bacterium of the <i>M. tuberculosis</i> complex and the most common causative agent of TB in humans. The <i>M. tuberculosis</i> complex also includes <i>M. bovis</i> and five other related species.
Natural ventilation	Use of wind to facilitate movement of air into and/or out of an area/room/building

by keeping wind and doors open.

N95 respirators/masks	Respirators/masks designed to provide respiratory protection for the wearer. They have filter efficiency levels of 95% or greater against particulate aerosols free of oil when tested against a 0.3 micron particle. It is fluid resistant and may be worn in surgery.
Nosocomial infection	Infections which are a result of treatment in a hospital or hospital-like setting, but secondary to the patient's original condition.
Occupational exposure	Reasonably anticipated skin, eye, mucous membrane, or parenteral exposure to blood or other potentially infectious materials that may result from performance of your duties, despite the appropriate use of protective attire or equipment.
Organisational activities	Infection control activities mainly conducted at national level, and include the development and periodic review of infection control policies and guidelines and ensuring the availability of resources.
Personal respiratory protection	Measures taken to prevent inhalation of infectious particles, assuming that these particles are present in the air.
Polydrug-resistant TB	Resistance to more than one anti-tuberculosis medicine, other than both isoniazid <i>and</i> rifampicin.
Respirator	A special type of mask that is designed to prevent the breathing in of poisonous fumes and/or infectious particles.
Second line TB medicines	Anti-TB medicines used when the first-line medicines cannot be used (e.g. for DR-TB or because of adverse reactions to the first-line drugs). Examples are cycloserine, ethionamide, and capreomycin.
Separation	An infection control practice whereby patients are placed in different sections of the facility based on defined criteria (eg. Separating culture positive patients from culture negative patients in a ward for drug-resistant TB patients).
Spirometry	A test of the air capacity of the lung which utilises a machine called a spirometer to measure the volume of air inspired and expired by the lungs, and involves forceful expiration which can generate aerosols.
Sputum smear examination	A laboratory technique in which sputum is smeared on glass slides, stained (e.g. carbol-fuchsin or auramine – Ziehl- Neelsen method), and washed with an acid. Slides are subsequently examined by microscopy for the presence of stained acid-

fast bacilli (AFB).

Sputum smear conversion	The process where a patient's sputum samples change from having enough bacilli to be detectable under the microscope, to having no detectable TB bacilli in follow-up sputum samples.
Sputum induction	A procedure used to obtain sputum for diagnostic purposes when patients are unable to spontaneously expectorate a specimen. The procedure uses sterile water or hypertonic saline to irritate the airway, increase secretions, promote coughing, and produce a specimen.
TB suspect	Any person who presents with symptoms or signs suggestive of TB, in particular cough of long duration.
Triage	The process of identifying patients who are potentially infectious (coughing, on anti-TB treatment or being investigated for TB) so that airborne precautions can be instituted.
Ultraviolet germicidal irradiation (UVGI)	The use of ultraviolet radiation to kill or inactivate microorganisms.
Ventilation	The process of supplying and removing air.

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ANNEXES

Annex 1. Sample IC Plan

- A. The IC plan should include but not be limited to the following policy areas;
1. Screening patients to identify TB symptomatic patients or those being investigated for TB;
 2. Provide face masks, tissues and waste containers to persons with TB symptoms, or under investigation or treatment for TB;
 3. Placing TB suspects in a separate waiting area;
 4. Triage TB suspects and cases for prompt attention;
 5. Referral of TB suspects to diagnostic services;
 6. Confirming that TB patients are adhering to treatment;
 7. Usage and maintenance of environmental measures;
 8. Training HCWs on TB, with emphasis on pathogenesis, presentation, TBHIV and need for prompt diagnostic investigation and treatment;
 9. Training HCWs on TB control and IC plan;
 10. Monitoring implementation of the IC plan.

B The facility will implement each policy by following the standard operating procedures that accompany it.

Policy and Procedures

Purpose: Early identification, separation, provision of services and referral of patients with TB disease is essential in preventing nosocomial transmission.

Lead: _____ is responsible for implementing the policies and procedures and report to the DCC.

Policy 1. Screening For TB Symptoms.

Procedures:

1. The designated HCW asks all persons coming to the facility and before entering enclosed areas on symptoms of TB-affirmative answer leads to prompt attention
2. Use 3 simple screening questions;
 - a. “Are you coughing? If answer is yes
 - b. For how long?
 - c. Are you being investigated or treated for TB

3. Repeat the same questions when identified patients enter the examination room. HCWs in the examination rooms should then take prompt action including reporting the identified patients to the IC officer.

Policy 2. Instructions on Cough Hygiene

Procedures:

1. Give cough hygiene instruction to all identified TB suspects. Also provide them with masks, tissues and containers if available or else they should cover mouth with hand on coughing or sneezing.
2. Avail no touch receptacles for disposal of used tissues in waiting areas

Policy 3. Separate TB suspects/patients from other patients

Procedures:

1. Staff should direct patient to the separate waiting area. The area should have natural ventilation as much as possible.

Policy 4. Triaging TB suspects and patients for prompt attention

Procedures:

1. Move TB patients ahead of the queue for prompt services

Policy 5. Referral of TB suspects to TB diagnostic services.

Procedures:

1. _____ will counsel TB suspects about TB diagnostic services
2. TB suspects and patients will be referred to _____ (Facility providing services from previously negotiation)
3. Provide patient with an appointment card(indicating name of patient , referring facility, facility referred to, date etc)

Policy 6: Usage and maintenance of environmental control measures.

Procedures:

1. _____ will check on environmental control measures and maintain a written log of monitoring and maintenance.
2. Check on windows and doors daily to ensure are in a proper position (Open or closed depending on the plan). All windows and doors should be open when using natural ventilation and closed when using mechanical ventilation.
3. Check the fans every month to ensure cleanliness, are pooling or pushing correct amount of air in the correct direction.

Policy 7: Provision of TB and HIV services to HCWs

Procedures:

1. Educate all HCWs on the symptoms/signs of TB and encourage to seek prompt attention on developing this signs/symptoms;
2. Inform HCWs on special risks for TB in PLHIV;
3. Encourage HCWs to know their HIV status, and therefore access relevant HIV care and services;
4. Staff training should pay attention on stigma reduction for TB and PLHIV;
5. _____ is responsible for determining when HCWs with TB should return to work;
6. HCWs should return to work when they are no longer infectious. This is after having:
 - a. Clinically improved
 - b. 3 negative sputum smear examination results from 3 consecutive early morning sputum specimens
7. All HCWs on TB treatment should have a DOT supporter ensuring they adhere to the treatment until declared cured.

Policy 8: Training HCWs on all aspects of TB, TBHIV IC plan.

Procedures:

1. _____ will train HCWs, including newly hired staff and maintain training records.
2. _____ will conduct annual training to all HCWs and maintain training records.

Policy 9: Monitoring the implementation of the TB IC Plan

Procedures:

1. Determine the frequency of IC plan
 - a. During initiation of procedures, monitoring and evaluation should be done frequently, perhaps every month or after every 2 months.
 - b. Annually when procedures are running well
2. Evaluate the screening process
 - a. Determine whether patients with cough were missed when entering the facility and only detected later (Examination room or later)
 - b. What correctional factors were associated with these potential exposures?
3. Evaluate the success of referrals to the TB diagnostic center
 - a. Did the referred TB suspects indeed go to the centre and were they investigated?
 - b. Did those with a diagnosis of TB started on TB treatment and registered?
 - c. What changes in screening or referral process should be made, if any?
4. Evaluate the training process

- a.** Were all new HCWs trained on TB IC during their induction?
 - b.** Did all HCWs receive an annual re-training on TB IC?
- 5. Revise the IC plan to reflect changes in staff responsibilities, policies, and procedures.
- 6. Develop a plan for correcting inappropriate practices or failure to adhere to policies and procedures.
 - a.** Identify incentives to participate fully and adhere to policies and procedures;
 - b.** Identify corrective actions if policies are not followed.

Annex 2: Monitoring tools

_____ is responsible for overseeing or evaluating the TB IC policies and its procedures and reports to the DCC.

_____ will fill out the “TB case and suspect register” daily See register below.

_____ will follow up all patients referred for TB diagnostic investigations and record the results in the register.

_____ Will report the results of the screening process to relevant management and staff every quarter.

TB Cases and Suspect Log

Date	Patients’ Full Names	Cases or Suspect (C/S)	Missed at Intake ¹ Y/N	Referred to (Name of facility)	Outcome ² (TB, Not TB or NS)

1. Missed at intake: When symptoms detected after patient enters the examination room
2. Outcomes: TB diagnosed or confirmed
 - a. TB: Confirmed to have TB
 - b. Not TB: TB ruled out after investigations
 - c. NS (Not seen): Did not present to referral facility for investigation.

Annex 3: Staff (HCWs) IC Training register

Staff Name	Start date	Date of 1st IC training	Date of annual training	Date annual training	Date annual training	Date annual training