

GUIDELINES *for* THE PREVENTION *of* TUBERCULOSIS



IN HEALTH CARE FACILITIES
IN RESOURCE-LIMITED SETTINGS



WORLD HEALTH ORGANIZATION

GUIDELINES FOR THE PREVENTION OF TUBERCULOSIS IN HEALTH CARE FACILITIES IN RESOURCE-LIMITED SETTINGS

Writing committee:

**REUBEN GRANICH, NANCY J. BINKIN,
WILLIAM R. JARVIS AND PATRICIA M. SIMONE**

*Centers for Disease Control and Prevention
Atlanta, United States of America*

HANS L. RIEDER

*International Union Against Tuberculosis
and Lung Disease
Paris, France*

MARCOS A. ESPINAL AND JACOB KUMARESAN

*Communicable Diseases Programme
World Health Organization
Geneva, Switzerland*



**World Health Organization
1999**

With Contribution from:

Paul A. Jensen, Denise Garrett, Renée Ridzon, Sidibe Kassim, Maria de Lourdes García,
Martin Okot Nwang, Thomas Frieden, Rajesh Gupta, and Mario Raviglione.

Acknowledgements

Jerome van Gorkom, Ian Smith, Afranio Kritski, Vladimir Babuš, DuanMu Hong-Jin, Alexander G. Khomenko, Edward Nardell, Domingo Palmero, Mohammad Reza Masjedi, Tessa L. Tan-Torres, Anthony D. Harries, Javaid A. Khan, Yuthichai Kasetjaroen, Pedro Suarez, Luigia Scudeller, Masashi Suchi, Dermot Maher, Paul Nunn, and Fabio Luelmo reviewed these guidelines and provided useful comments.

CONTENTS

Executive Summary	5
Glossary and Abbreviations	7
Introduction	11
1. Pathogenesis and Transmission of TB	13
1.1 Review of transmission and pathogenesis of <i>Mycobacterium tuberculosis</i>	13
1.2 Factors affecting the risk of <i>Mycobacterium tuberculosis</i> infection	13
1.3 Risk of disease following infection	15
2. Risk of Nosocomial Transmission of <i>Mycobacterium tuberculosis</i> to Health Care Workers in Resource-limited Countries	17
2.1 Documentation of nosocomial risk	17
2.2 Who is at risk?	17
2.3 Conclusion	18
3. An Introduction to Infection Control Strategies	21
3.1 Infection control strategies	21
3.2 Administrative (managerial) controls	21
3.3 Environmental control measures	21
3.4 Personal respiratory protection	22
4. Administrative Control Measures	23
4.1 Administrative (managerial) control measures	23
4.2 District level	23
4.3 Referral level	28
4.4 Special areas and topics	32
5. Environmental Control Measures	37
5.1 General comments	37
5.2 Environmental controls	37
5.3 Ventilation patterns	37
5.4 Methods to maximize natural ventilation	38
5.5 Mechanical ventilation	40
5.6 Monitoring of ventilation and ventilation systems	41
5.7 Special areas	41
5.8 Ultraviolet germicidal irradiation	42
5.9 HEPA filtration	43
6. Personal Respiratory Protection	45
6.1 The role of respiratory protection	45
6.2 The role of surgical masks and respirators	45

7. Laboratory Safety	49
7.1 Laboratory safety	49
7.2 AFB Smear preparation	49
7.3 Preparation of liquid suspensions of <i>Mycobacterium tuberculosis</i>	49
7.4 Biosafety Cabinets	49
7.5 Personal respiratory devices in the laboratory	50

EXECUTIVE SUMMARY

Presently, disease caused by *Mycobacterium tuberculosis* (*M. tuberculosis*) is the leading cause of mortality among adults in the world. Populations in resource-limited settings account for nearly 95% of *M. tuberculosis* infections, with the global burden due to infection of *M. tuberculosis* being approximately 1.1 billion people. In 1998, WHO reported an estimated two million deaths due to tuberculosis (TB).

The WHO strategy to control TB, Directly Observed Treatment, Short-Course Chemotherapy (DOTS), can cure nearly all cases of TB. One of the foundations of DOTS is the administration of standard short-course chemotherapy (SCC) under direct observation to TB patients via health care workers (HCWs). Recent studies performed in developing countries have shown that HCWs caring for infectious TB patients are at increased risk of *M. tuberculosis* infection and disease.

HCWs are essential in the fight against TB and they should be protected. Given the integral nature of HCWs in managing active cases and in preventing further transmission of *M. tuberculosis*, the World Health Organization (WHO) presents these guidelines to provide Member States with limited resources, with inexpensive and effective control strategies for prevention of *M. tuberculosis* transmission in HCWs. These guidelines serve not only to prevent patient-to-HCW transmission, but also to prevent patient-to-patient transmission.

These guidelines provide discussion and recommendations for the district and referral level (thus accounting for the wide variety of health care facilities) based upon three levels of infection control: administrative, environmental, and personal respiratory protection. The first priority in infection control is the use of administrative control measures to prevent the generation of infectious droplet nuclei, thereby reducing the exposure of the HCWs and patients to *M. tuberculosis*. Measures at the referral and district level include development of an Infection Control Plan, HCW training, patient education, sputum collection, triage and evaluation of suspect TB patients in outpatient settings, and reduction of exposure in the laboratory. Additional measures such as isolation of patients with multidrug-resistant TB (MDR-TB) and other isolation policies apply specifically to referral level facilities.

The second priority is environmental control methods that are used to reduce the concentration of droplet nuclei in the air in high-risk areas. Environmental control methods range from inexpensive methods such as maximising natural ventilation and mechanical ventilation, to more costly methods such as ultraviolet germicidal irradiation and HEPA filtration. Environmental control methods should not be used in absence of, or as a replacement for, administrative control measures.

The third priority is to protect HCWs, via personal respiratory protection, from inhaling infectious droplets. Surgical masks prevent the spread of microorganisms from the wearer but do not provide protection to the wearer. Respirators provide protection to the wearer from inhaling infectious droplet nuclei. Respirators are expensive and they should be reserved for high-risk referral hospital settings.

Personal respiratory protection alone will not provide adequate protection for the HCW from infection of *M. tuberculosis*.

HCWs are vital resources in the fight against TB. These guidelines provide cost-effective interventions that can be directly implemented (or modified) within a facility at the district or referral level in any resource-limited setting. Efforts should be made to execute such control strategies to prevent nosocomial transmission of *M. tuberculosis*. Such measures serve not only to conserve resources in terms of direct costs due to treatment of HCWs and indirect costs in terms of loss of HCWs specialising in the management of TB patients, but also in reducing the burden due to tuberculosis.

GLOSSARY AND ABBREVIATIONS

Administrative controls: defined as the managerial or administrative measures (e.g., early diagnosis, prompt isolation or separation of infectious TB patients, prompt initiation of appropriate anti-tuberculosis treatment) to reduce significantly the risk of TB transmission by preventing the generation of droplet nuclei.

Aerosol: a collection of droplet nuclei that are expelled by an infectious person upon coughing, sneezing, shouting.

Acid-fast bacilli (AFB): rod-shaped bacteria that do not lose their stain when exposed to acid-alcohol mixture after the staining process, i.e. *Mycobacterium tuberculosis* and all mycobacteria.

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

Biosafety Cabinets Class I (BSC I): cabinet that protects the worker and the work environment from exposure to an aerosol by drawing air into the cabinet. The air is either exhausted outside or filtered and recirculated into the room.

Biosafety Cabinets Class II (BSC II): cabinet that uses a laminar air flow in addition to exhaust to protect both the specimen /culture and the worker from contamination.

CDC: *Centers for Disease Control and Prevention*

District level health care facility: defined as aid posts, dispensaries, health centres, and hospitals.

DOTS: *Directly Observed Treatment, Short-course chemotherapy*. World Health Organization strategy for TB control.

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

已结束，完整报告链接和二维码如下：

[/www.yunbaogao.cn/report/index/report?reportId=5_30552](http://www.yunbaogao.cn/report/index/report?reportId=5_30552)



reas to

les

d of
es
ng