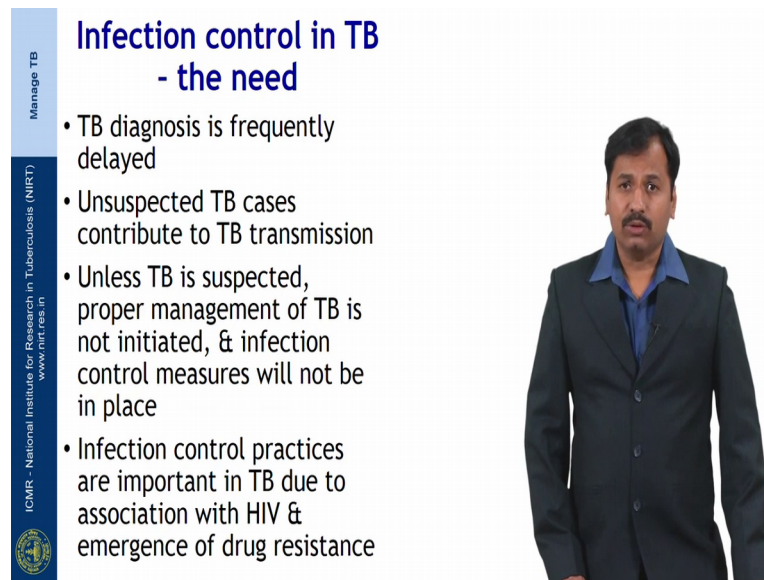


Manage TB
Dr. B.N. Sharath
ESIC Medical College and PGIMSIR Bengaluru, Karnataka
National Institute for Research in Tuberculosis

Lecture – 58
Airborne Infection Control in Tuberculosis Session 01

Good morning. I am Doctor B. N. Sharath faculty from ESIC medical college and PGIMSIR Bangalore, Karnataka. I will be talking on Infection Control in Tuberculosis which is based on the guidelines of airborne infection control for healthcare settings from central TB division.

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**Infection control in TB
- the need**

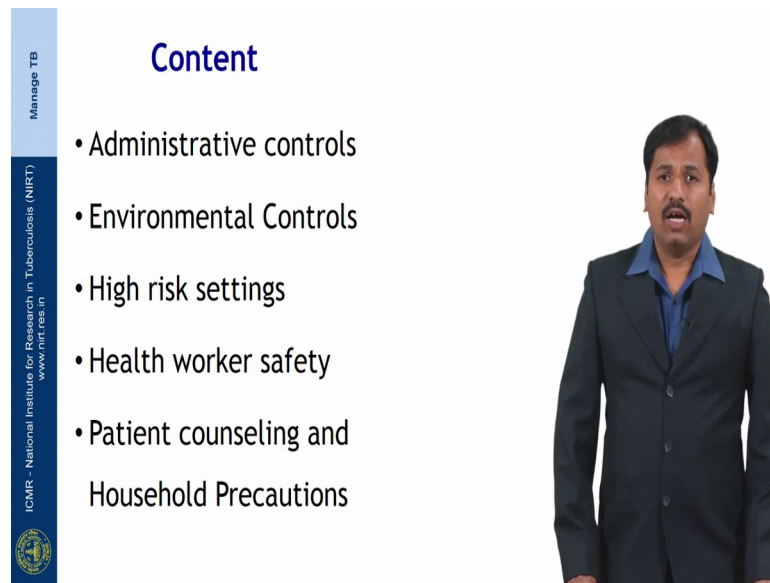
- TB diagnosis is frequently delayed
- Unsuspected TB cases contribute to TB transmission
- Unless TB is suspected, proper management of TB is not initiated, & infection control measures will not be in place
- Infection control practices are important in TB due to association with HIV & emergence of drug resistance

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Infection control; why do we need infection control? Basically we know TB diagnosis is frequently delayed and unsuspected TB cases contribute a lot for TB transmission and unless you suspect a TB case, initiate them on treatment infection control measures will not be in place and infection control practices are very important in TB due to its close association with HIV and drug resistance tuberculosis.


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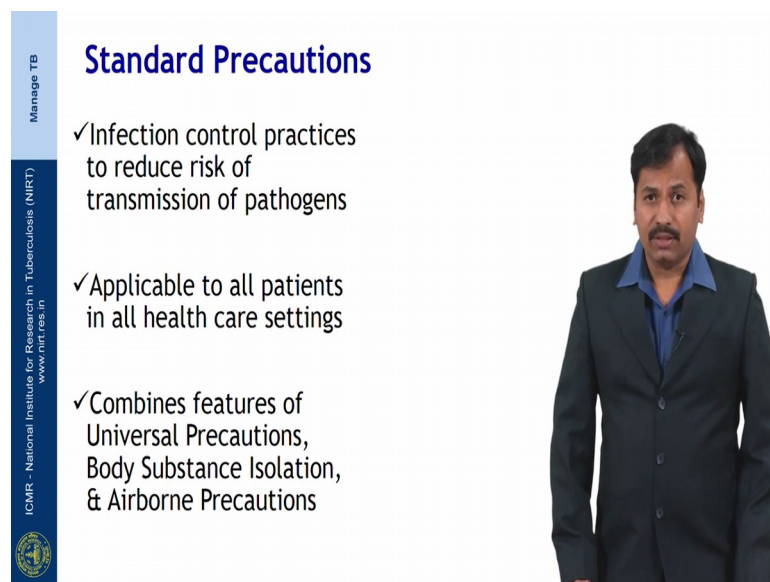
Content

- Administrative controls
- Environmental Controls
- High risk settings
- Health worker safety
- Patient counseling and Household Precautions



In this session I will be talking about administrative control, environmental control, higher settings and health worker safety and patient counseling and household precautions.


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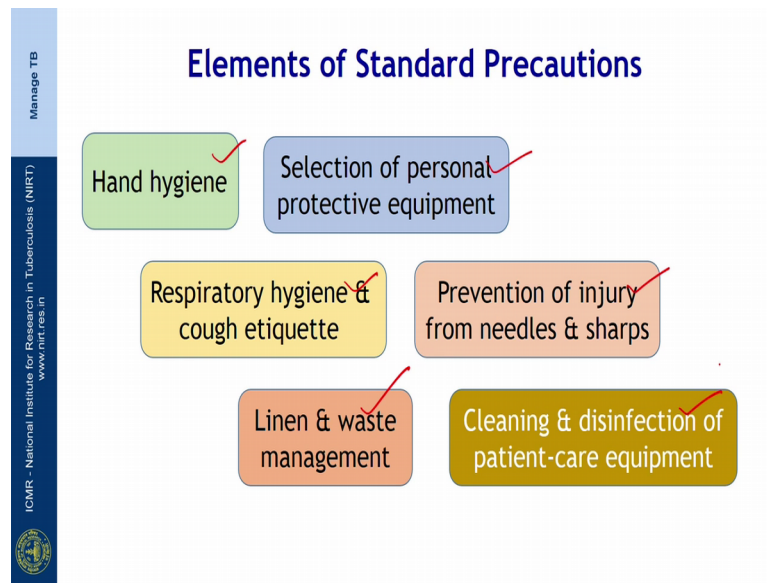
Standard Precautions

- ✓ Infection control practices to reduce risk of transmission of pathogens
- ✓ Applicable to all patients in all health care settings
- ✓ Combines features of Universal Precautions, Body Substance Isolation, & Airborne Precautions



Standard precautions; for any control of infections the infection control practices is to reduce the risk of transmission of pathogens applicable. It is applicable to all healthcare settings it combines the features of universal precautions, body surface isolation and airborne precautions.

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The elements of standard precautions includes; hand hygiene, selection of personal protective equipment especially for the healthcare workers and the patient to reduce the source of infection and educating the patients with respiratory hygiene and cough etiquette.

Prevention of injury from needles and sharps for the health care workers and disposal of infectious material which are accumulated in linen and waste management and cleaning and disinfection of patient care equipment frequently. These are the elements of standard precautions hierarchy of infection control any hierarchy I mean in any infection control the hierarchy is the first one is the administrative control the second is environment control and the third is personal protective equipment.


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Hierarchy of Infection controls

Infection Control

- Administrative controls**
Reduce risk of exposure, infection, & disease through policy & practice
- Environmental Controls**
Reduce concentration of infectious bacilli in air in areas where contamination of air is likely
- Personal protective equipment**
For HCW who must work in environments with contaminated air



In administrative control the aim is to reduce the risk of exposure among the patients and the healthcare workers.

Through proper policy and practice environmental controls it helps in reducing the concentration of the infectious bacilli in air in areas where contamination of air is likely to happen. Personal protective equipment for healthcare workers who work in such a contaminated area they are to be protected for that we use personal protective equipment.

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Administrative controls

- **Identify** persons with respiratory symptoms
- **Separate** them into appropriate environment
- **Fast-track** them through the health care facility to reduce exposure time to others
- **Diagnose & treat** them with minimal delay
- Hospitalization should be **reduced** or avoided to the greatest extent possible



Coming to administrative controls the first thing the administrative con in the measure of in administrative control is to identify the person with respiratory symptoms, separate them into appropriate environment, first track them through the health care facility to reduce exposure time to others, diagnose and treat them with minimal delay, hospitalization should be reduced or avoided to the greatest extent possible for this kind of patients.

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Administrative control strategies for health-care facilities

Outpatient Settings

- Screen - respiratory symptoms as early as possible
- Provide - education on cough hygiene & sputum disposal
- Segregate - patients with respiratory symptoms
- Fast-track- patients with respiratory symptoms

Inpatient settings

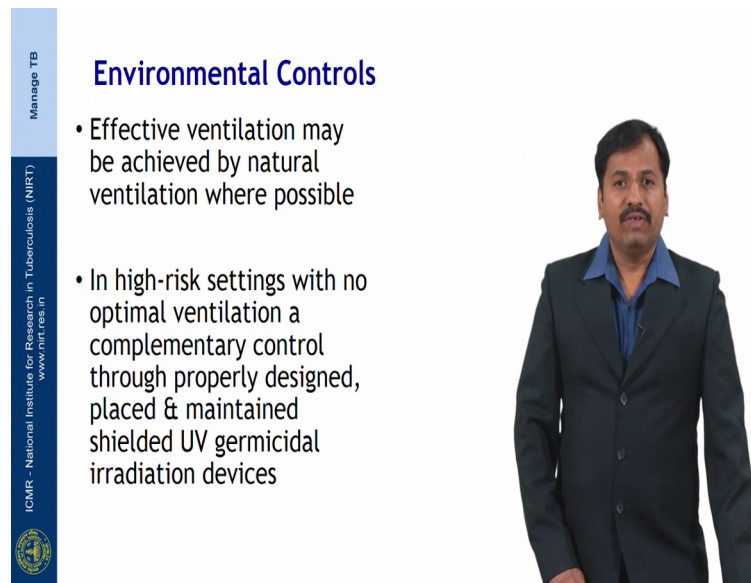
- Minimize - hospitalization
- Establish - separate rooms, wards, or areas within wards
- Educate - on cough hygiene & provide adequate sputum disposal
- Establish - safe radiology procedures

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Administrative control strategies for health care facilities; we have two stress two strategies one is for outpatient settings the other is for inpatient settings. In outpatient settings the first thing what we do is screen respiratory symptoms as early as possible, provide education on cough hygiene and sputum disposal at the place where the patient is there.

Segregate patients with respiratory symptoms as soon as possible and try to fast track these patients with respiratory symptoms for early diagnosis. Coming to the inpatient settings minimize hospitalization as for as possible and establish separate rooms or wards or area within wards for this highly infectious infectious diseases. Educate the patient in wards on cough hygiene and provide adequate sputum disposal facilities for the patients. Establish safe radiology processes.

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Environmental Controls

- Effective ventilation may be achieved by natural ventilation where possible
- In high-risk settings with no optimal ventilation a complementary control through properly designed, placed & maintained shielded UV germicidal irradiation devices

And coming to the environmental controls one important thing or one basic thing what we all need to know is the natural ventilation; effective ventilation may be achieved by natural ventilation wherever possible.

In high risk settings with no optimal ventilation a complimentary controlled through properly designed placed and maintained shielded UV germicidal irradiation devices can be used.

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Environmental controls recommendations

- Health-care facilities - minimum standards for air exchange
- High-risk settings -prioritized for immediate assessment & implementation of improved ventilation
- Natural ventilation - preferred method for ensuring adequate air exchange
- Ensure effective ventilation at all times & in all climatic conditions

And the recommendations for these environmental controls are in health care facility there should be a minimum standard for air exchange. High and high risk settings prioritized for immediate assessment and implementation of improved ventilation that the places, wherever there are high risk settings the area should be evaluated assessed and proper ventilation has to be in place. Natural ventilation; it is the preferred method for ensuring adequate air exchange. Ensure effective ventilation at all times and in all climatic conditions.

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The slide features a vertical blue bar on the left with the text 'Manage TB' at the top, 'ICMR - National Institute for Research in Tuberculosis (NIRT)' in the middle, and 'www.nirt.res.in' at the bottom. The main title is 'Environmental controls recommendations'. The content includes a list of recommendations and a photograph of a man in a dark suit and blue shirt.

Environmental controls recommendations

- In the absence of natural ventilation
 - A well designed, maintained & operated mechanical ventilation to be used
- In high-risk settings - use upper room or Shielded UV germicidal irradiation (UVGI) devices


In the absence of natural ventilation what we can do is; we should have a well designed maintained and operated mechanical ventilation in place or in high risk settings where it is not possible try to use the upper rooms or try to use shielded UV germicidal irradiation devices.

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Environmental controls recommendations

- Optimal arrangement of patients & staff in all OP departments, DOT centers, microscopy centers, & radiology
- Directional control of air flow recommended in specific high-risk settings i.e. airborne precaution rooms, MDR-TB wards & clinics, & bronchoscopy suites



One important aspect which can be easily done is optimal arrangement of patients and staff in all outpatient departments, directly observed treatment centers, microscopy centers and radiology departments. The directional control of air flow recommended in specific high risk settings, that is airborne precaution rooms or MDR-TB wards and clinics and bronchoscopy suits.

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<h3 style="color: #0056b3;">Ventilation</h3>			
	Mechanical Ventilation	Natural Ventilation	Hybrid (mixed mode) ventilation
Advantages	Suitable for all climates & weather ✓ More controlled & comfortable environment ✓ Occupants have limited control to affect ventilation ✓	Suitable for warm & temperate climates ✓ Lower capital, operational, maintenance costs for simple implementations ✓ Capable of achieving very high ventilation rates ✓	Suitable for most climates & weather ✓ Energy saving, relative to mechanical ventilation ✓ More flexible ✓
Disadvantages	Expensive to install & maintain ✓ Can fail to deliver required ventilation rates, through faulty design, maintenance, or operation ✓ Noise from equipment ✓	Easily affected by outdoor climate & occupants behavior ✓ May be difficult to plan, design, & predict performance ✓ Reduced comfort level of occupants in extreme weather ✓ Cannot achieve directional control of airflow, if required ✓	May be more costly or difficult to design

Among the ventilation we have three types of ventilation which we use; one is mechanical ventilation, natural ventilation and a hybrid or a mixed mode ventilation.

But each of this has certain advantages and certain disadvantages. Talking about mechanical and ventilation the advantages it is suitable for all climates and weathers and it is more controlled and comfort I mean and controlled a comfort environment. Occupants have limited control to affect ventilation, but the disadvantages are it is very expensive to install and maintain, it can fail to deliver a required ventilation rates through faulty design maintenance or operations and there will be a some kind of noise from the equipment.

Natural ventilation it is suitable for warm and temperate climates, it requires lower capital, no operational issues, maintenance cost for simple implementations, it is capable of achieving very high ventilation rates, but the disadvantages are easily it is easily affected by outdoor climate and occupants behavior, it might be difficult to plan design and predict the performance, reduced comfort level of occupants in extreme weather cannot achieve directional control of air flow if required.

We have a combination of both that is mixed mode ventilation or hybrid ventilation which is suitable for most climates and weathers it is energy saving relative to mechanical ventilation and more flexible, but the disadvantages is it may be more costly or difficult to design.

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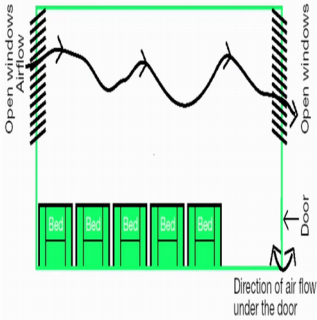
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National standards for minimum ventilation in health-care settings

Should maintain

- a minimum amount of ventilation during all climactic conditions
- the minimum ventilation rate estimated to reduce the probability of infection in an enclosed room to less than 5% with an hour of exposure to an infectious source case

Room with natural ventilation



The diagram illustrates a room with natural ventilation. It shows a rectangular room with a door at the bottom center and two open windows on the top wall. A wavy line represents the air flow path, starting from the left window, moving across the room, and then down towards the door. A label 'Open windows Air flow' is on the left, and 'Open windows' is on the right. A label 'Door' is at the bottom right, and 'Direction of air flow under the door' is at the bottom center. The room contains several green rectangular objects representing beds or desks.

National standards for minimum ventilation in healthcare settings any healthcare setting should maintain a minimum amount of ventilation during all climatic conditions. The

minimum ventilation rate estimated to reduce the probability of infection in an enclosed room to less than 5 percent with an hour of exposure to an infectious source case.

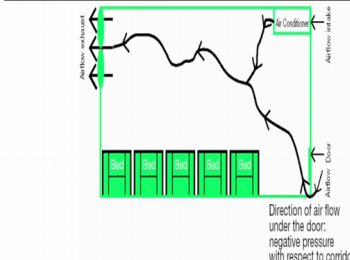
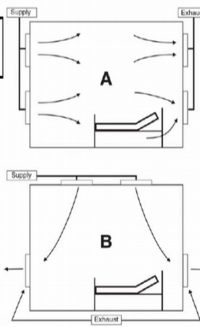
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Mechanical Ventilation

- Use fans to drive the air flow through a building
- Can be fully-controlled & combined with air conditioning & filtration systems
- Includes "Mixed Mode ventilation"- exhaust and/or supply fans used in combination with natural ventilation

Adequate air exchange in a room with air-conditioning/heating

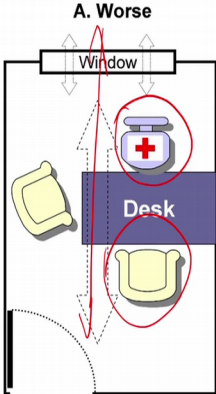
Mechanical ventilation; we usually use fans to drive the airflow through a building and these fans can be fully controlled and combined with air conditioning and filtration systems as I said earlier it includes mixed mode ventilation exhaust and our supply fans used in combination with natural ventilation.

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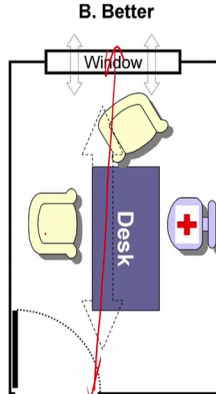
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Optimal seating arrangement for patient & health care worker

A. Worse



B. Better



In this figure we can see the optimal seating arrangement for patient and healthcare worker. In figure A what you can see is you have a window and a doctor is sitting just in front of the window whereas, the patient is also sitting in front of the window, but the airflow is in this direction there is all possibility that the healthcare worker may get infected with the infectious materials of the patient. So, the best way that is the figure B which shows is you have to place the doctor and the patient in such a way that a stream of air separates them; this is the window and this is the stream of air which separates the doctor or the healthcare worker and the patient.

So, in this session have talked about the administrative control and environmental control, in this session I talked about the administrative control measures and the environmental control measures that are key for control of infection control in healthcare settings. I will be ending this session now in the next session I will be talking about infection control in higher settings households and for healthcare workers.