

Editorial

Infection control in Tuberculosis-High time to implement the basics

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"It may seem a strange principle to enunciate as the very first requirement of a hospital that it do the sick no harm" (Florence Nightingale, Notes on Hospitals, 1863).

Tuberculosis is a major public health problem in India. The incidence of new cases of pulmonary tuberculosis was about 1.5 per 1000 population in 2000 in India¹. The global TB scenario in 2006 showed² that the number of New TB cases was 9.2 million {139/100,000}, HIV co-infected cases were 0.7 million. New sputum smear positive cases were 4.1 million {62/100,000} and the prevalence of TB was 14.4 million{219/100,000}. Annually, nine million new cases of active TB were reported around the world, with about 1.7 million deaths in 2009. With an estimated annual incidence of over nine million cases, tuberculosis is believed to be responsible for more adult deaths each year than any other single infectious agent³.

India has more TB patients than any other country and accounts for one fifth of the world's incident TB cases⁴. Every year, 2 million new cases of TB are reported in India and nearly 1 million cases are smear positive; an estimated 40% of the Indian population is latently infected with *M. tuberculosis*⁵.

When a patient with pulmonary tuberculosis coughs, sneezes or talks, bacilli get disseminated into the environment in the form of droplet nuclei. A patient with smear positive pulmonary tuberculosis can infect 10-15 persons in a year⁴. Hence it is important to educate Pulmonary Tuberculosis patients to practice proper cough hygiene⁵. Cough hygiene is one among the five steps in "Preventing TB transmission through good patient management"⁶ as recommended by WHO. An annual decline in the newly occurring TB infection to the extent of 14% could halve the problem in five years.

Control of TB in high burden countries including India relies on the detection and treatment of infectious cases, mostly by testing patients attending a health clinic with chest symptoms. World Health Organization estimates suggest that in 2006 there were 4 million individuals with undiagnosed tuberculosis.

In India RNTCP emphasizes mainly on case detection and treatment. Not much

importance is given for infection control from a source of TB. Unhealthy practice of coughing and sneezing without covering mouth and nose is a high risk behavior causing transmission of respiratory pathogens. So also coughing and spitting sputum in public places should be discouraged as it may cause transmission of TB. A patient with TB is infectious before diagnosis and at least for two weeks after initiation of Anti TB treatment. Strangely enough, no cough hygiene is taught to these patients with TB when they are initiated on treatment.

Undiagnosed TB patients are a potential source of infection. In India, where most of the public places are overcrowded, it is natural that an innocent person would get infected from a source who sadly does not practise cough etiquette. Patients with suspected TB who attend health care facilities, wait for a long time and may infect others around them. In India there is no strict implementation of guidelines by RNTCP or Government regarding prevention of TB transmission.

Mycobacterium tuberculosis is usually transmitted through air, not by surface contact. *M. tuberculosis*, the causative agent of TB, spreads from person to person via infected aerosols created by patients with predominant lung involvement. *Mycobacterium tuberculosis* is carried in airborne particles called droplet nuclei that are generated when persons with pulmonary or laryngeal TB cough, sneeze, shout, or sing^{7, 8}.

Coughing causes both mucus aerosolization and droplet generation. When the layer of mucus lining the airways interact with the high-speed airflow of the expulsive phase (up to 100 km/h) droplets of different sizes are formed and forced up the airway tree. The particles are approximately 1-5 µm; normal air currents can keep them airborne for prolonged periods and spread them throughout a room or building. These droplet nuclei are invisible to the naked eye. Droplet nuclei can remain airborne in room air for a long period of time, until they are removed by natural or mechanical ventilation.

For TB to spread, there must be a source (a patient who has infectious TB disease) and a susceptible host (a person to inhale droplet nuclei containing *M. tuberculosis*). Anyone who shares air space with a person with infectious TB disease of the lungs or larynx is at risk. Studies of TB transmission indicate that the size of the infected aerosol is critical in its ability to reach and infiltrate the lung¹⁰.

An association between cough frequency and tuberculous aerosol production and increased transmission among household contacts has been found¹¹. Retrospective study of TB contacts suggests that most transmission within households occur prior to diagnosis and initiation of treatment. Advanced cavitary disease and the presence of high numbers of *M. tuberculosis* in expectorated sputum is associated with transmission.¹² But it is not known how early in the course of infection that these patients pose a significant risk of infecting others.

Mycobacterium tuberculosis can be transmitted even by brief contact with an infectious case¹³. Close contacts are persons who share the same air space in a household or other enclosed environment for a prolonged period (days or weeks, not minutes or hours) with a person with pulmonary TB disease.

Persons who use tobacco or alcohol, illegal drugs, including IV drug abuse and crack cocaine are also at increased risk for infection and disease. Health care workers (HCW) should be particularly aware of the need for preventing transmission of *M. tuberculosis* in

settings in which persons infected with HIV might be encountered. Transmission of *M. tuberculosis* is a risk in health care settings. Health care associated transmission of *M. tuberculosis* has been linked to contact with persons with TB during aerosol-generating procedures including bronchoscopy, endotracheal intubation, suctioning, other respiratory procedures, open abscess irrigation, autopsy, sputum induction and aerosol treatments that induce coughing. Of the reported TB outbreaks in health care settings, multiple outbreaks involved transmission of MDR TB strains to both patients and health care workers. The majority of the patients and certain HCWs were HIV-infected, and progression to TB and MDR TB disease was rapid¹⁴. Factors contributing to these outbreaks included delayed diagnosis of TB disease, delay in initiation of treatment and inadequate airborne precautions, lapses in practices and precautions for cough-inducing and aerosol-generating procedures, and lack of adequate respiratory protection. One of the most important source for transmission of *M. tuberculosis* in health care settings is from patients with unrecognized TB disease who are not promptly handled with appropriate airborne precautions¹⁴.

The first and most important level of TB control is the use of administrative measures to reduce the risk of transmission from TB suspects using appropriate signage advising respiratory hygiene and cough etiquette.

Cough hygiene refers to measures like 1) Covering the mouth/ nose when coughing or sneezing 2) Using tissues to contain respiratory secretions and dispose them in the nearest waste receptacle after use 3) To practice hand hygiene (e.g., hand washing with antimicrobial soap and water, alcohol-based hand rub, or antiseptic hand wash) after having contact with respiratory secretions and contaminated objects/materials. 4) Stand /sit at least 3 feet from patients¹⁵.

If we have to control TB, we need to focus on infection control along with case detection and treatment. The general population should be made aware about the symptoms of TB. Everyone should practice strict cough hygiene so that transmission of respiratory infection is minimized. Patients diagnosed with pulmonary TB should strictly be advised isolation till he/she becomes non infectious¹⁵. Anti tussives may help to reduce the cough and hence may help to decrease the chances of spread of the disease. Infection control measures should be implemented in all health care settings. Legislation enforcing cough hygiene among the public and infection control measures in health care facilities with strict adherence to the legislation will definitely help to decrease the burden of TB in India.

Implementation of infection control measures will decrease the incidence of both nosocomial TB as well as drug resistant TB in the high risk and vulnerable population.

References:

1. WHO(2000), Joint Tuberculosis Programme Review, India, February 2000, Regional office for South-East Asia, New Delhi.
2. Dye C. Global epidemiology of tuberculosis. *Lancet*, 2006;367:938-40.
3. World Health Organisation: Global tuberculosis control: surveillance, planning, financing. Geneva: WHO; 2009
4. Central TB. Division, Directorate General of Health Services. TB India 2005. RNTCP Status report. New Delhi, India: Ministry of Health and Family Welfare; 2005

5. Wells WF: On air-borne infection study II. Droplets and droplet nuclei. *Am J Hygiene*, 1934;20. 611-18.
6. Participant's Manual for integrated management of adolescent and adult illness(imai) TB Infection Control Training at Health Facilities. In WHO,July 2008: 9.
7. American Thoracic Society, CDC, Infectious Disease Society of America. Diagnostic standards and classification of tuberculosis in adults and children. *Am J RespirCrit Care Med* 2000;161:1376-95.
8. American Thoracic Society, CDC, and Infectious Disease Society of America. Treatment of tuberculosis. *MMWR* 2003; 52(No.RR-11).
9. Wells WF. Aerodynamics of droplet nuclei [Chapter 3]. In: Airborne contagion and air hygiene. Cambridge, MA: Harvard University Press; 1955:13-9.
10. HatchTF : distribution and deposition of inhaled particles in respiratory tract. *Bacteriol rev* 1961,25:237-240
11. Loudon RG, Spohn SK. Cough frequency and infectivity in patients with pulmonary tuberculosis. *Am Rev Respir Dis* 1969;99:109-111
12. Marks SM, Taylor Z, Qualls NL, Shrestha-Kuwahara RJ, Wilce MA, Nguyen CH: Outcomes of contact investigations of infectious tuberculosis patients. *Am J RespirCrit Care Med* 2000, 162(6):2033-2038.
13. Bauer J, Kok-Jensen A, Faurschou P, Thuesen J, Taudorf E, Andersen AB. A prospective evaluation of the clinical value of nation-wide DNA fingerprinting of tuberculosis isolates in Denmark. *Int J Tuberc Lung Dis* 2000;4:295-299
14. Koppaka VR, Ridzon R. Prevention and control of the nosocomial transmission of Mycobacterium tuberculosis. In: Wenzel RP, ed. Prevention and control of nosocomial infections. 4 edition. Philadelphia, PA: Lippincott Williams & Wilkins; 2003:229-52.
15. Respiratory hygiene/cough etiquette in Health care settings. In: Department of health and human services, centre for disease control and prevention,Nov 2004: 1