What does ventilation have to do with TB control?

Transmission of Mycobacterium tuberculosis

Tuberculosis (TB) infection and disease are caused by the bacterium, *Mycobacterium tuberculosis (M. tb)*. *M. tb* is released in tiny particles when a person with TB disease of the lungs or larynx coughs, sings, talks, or breathes, etc. These particles, called **droplet nuclei**, are approximately 1-5 microns in size. (A micron is one millionth of a meter.) If air containing these droplet nuclei is inhaled by an other person, TB infection may result.

M. tb transmission and ventilation

Ventilation can reduce the risk of M. tb transmission in two ways: **dilution** and **removal**.

When clean air is supplied to a room, it **dilutes** the concentration of airborne contaminants in the room. In the case of *M. tb*, this effect means that a room occupant is less likely to inhale one or more droplet nuclei.

For the purposes of TB control, clean air is usually either fresh outside air or recirculated air that has been passed through a high efficiency particulate air (HEPA) filter.

The **removal** effect occurs when air from a room is either discharged outdoors to a safe place, or disinfected with a HEPA filter before recirculation.

Increasing the ventilation rate (the amount of air that is removed per unit time) is an effective engineering control for TB. For example, doubling the ventilation rate will halve the time needed to clear a room of airborne contaminants. Or, halving the ventilation rate doubles the time needed to clear the room.

Air mixing, stagnation, and short-circuiting

As clean air is supplied to a room, it mixes with room air. Infectious particles in the room become part of this mixture. The air that is removed (or exhausted) from the room will contain some of these particles. The better the air mixing, the more effective the dilution and removal and the lower the risk of *M. tb* transmission. Good air mixing prevents **stagnation** and **short-circuiting**.

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Stagnation occurs when an area does not benefit from the clean supply air. Infectious particles generated in, or migrating to, a stagnant area are not rapidly diluted or removed.

Short-circuiting occurs when clean air is removed from a space before it has a chance to effectively mix with and dilute contaminants in all parts of the room. For example, if the supply outlet in a space is located too close to the exhaust outlet, most of the room will not enjoy the benefits of the clean air.

Incense sticks can be used to visualize air mixing in a facility. Hold two lit incense sticks together and observe smoke movement at various locations. If the smoke dissipates quickly, air mixing is good. If the smoke dissipates slowly, air mixing is poor.

Airflow direction

Air mixing is not perfect. Generally, air becomes more contaminated as it moves from the location where it supplied to the location where it is removed. The flow direction is from clean to less clean.

In settings occupied by both staff and known or suspected TB patients, knowing the direction of airflow can help reduce the risk of TB infection among staff. This is done by locating staff near the clean air supply while locating patients near the exhaust.

Incense sticks can be used to visualize the direction of airflow in a facility. For example, the reception area in clinics is often adjacent to the patient waiting area. To help protect health-care workers in the reception area, air supply should be at the reception area and air exhaust should be in the patient waiting area. The clean air is delivered next to staff before it becomes contaminated and exhausted in the waiting area.

This information is available at our website: www.nationaltbcenter.edu