Discussion Brief: Design of Isolation Rooms for MDR-TB Patients
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According to the World Health Organization (2009), “Isolation precaution is an important strategy in the practice of infection control. [...] Although there is no single study showing the effectiveness of isolation, there are many reports documenting the efficacy of the various components of isolation, including use of private rooms.” In this discussion, GHDonline members and moderators exchange knowledge on designing isolation rooms that maximize ventilation for patients with drug-resistant TB in areas with limited resources.

Key Points
- The objective of isolation rooms is to minimize nosocomial transmission to individuals outside the room, but also to individuals inside the room by ensuring appropriate air flow.
- Appropriate air flow in a room is the result of pressure gradients and establishing negative air pressure, which can be achieved by a combination of natural and mechanical ventilation methods as well as room design.
- Natural ventilation is a tricky aspect of building design because of its inherent variability. Outside pressure gradients are unpredictable and depend on prevailing wind conditions and temperature.
- Building and room designs differ based on environmental factors such as topography (elevation, coastline, etc.), climate, and rural vs. urban settings.
- Isolation rooms should be easy to maintain.
- Visitors should not enter the isolation room.
- The construction of naturally ventilated isolation rooms should be arranged in parallel, with windows and doors opposite one another and opening directly to the outside to maximize cross-ventilation. Windows should be as large as possible.
- Exhaust window fans, stack ventilation, tall/open ceilings, and upper-level vents can provide ventilation during periods when windows cannot be opened. An exhaust window fan requires an air source for cross-ventilation such as a crack under a door (~2-3 cm) that does not lead to a waiting room or a small screen in the door panel.
- **Design employed by engineers of the Johns Hopkins Hospital in the 19th century:** Large, awning windows that may remain open during rain; Tall ceilings with stack ventilation to reduce transmission rates; roof stacks function to conduct hot air outside and increase air intake through windows regardless of wind direction (stack effects are temperature induced, because lesser-dense warm air rises over cold air and creates an upward stream.
- For ventilation to occur via stack effects, indoor and outdoor temperatures must differ so that warmer indoor air rises and escapes the building at higher apertures, while exterior colder air enters the building through lower level openings.
- **Ana Serralheiro, Infection control Specialist at MSF in Switzerland, notes** that they have shifted to “individual isolation rooms for suspected and confirmed MDR patients with windows/doors directly open to the outside area. In the present structure there will be no indoor corridors and all the common areas will be outside. The rooms disposed in parallel with maximization of cross-ventilation through windows/doors in opposite walls.”
- **Computational Fluid Dynamics** is a tool that is increasingly being used to look at airflow in buildings and risk of infection, but, in the words of **member Dr. Catherine Noakes of the School of Civil Engineering at the University of Leeds, U.K.**, “It is a specialist tool that requires expert knowledge to use correctly and once again natural ventilation complicates the whole issue as it is harder to define how and where air enters and leaves the room.”
- As discussed here and elsewhere, upper room UVGI can be used to complement natural or mechanical ventilation as a means of air disinfection. It does not depend on outside conditions, but does require proper planning, equipment, and maintenance – just like all other air disinfection strategies.

Key References
- WHO policy on TB infection control in health-care facilities, congregate settings and households, WHO/HTM/TB/2009.419
- Natural Ventilation for Infection Control in Health-Care Settings, WHO. 2009
- Minimum requirements for building TB facilities in warm climates, Médecins Sans Frontières. 2009

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Please consider replying to this discussion with the following information
- Blue prints and design details for isolation rooms, your experience with isolation room

Recommendations
You may also be interested in the following content in GHDonline communities
- Design in renovation to optimize Ventilation - Case Study (Resource)
- Elements of TB Infection Control in Murmansk Region (Resource)
- Applications of Natural Ventilation at Health-Care Facilities (Resource)
- Implementation of Ventilation in Healthcare Settings - Case Studies (Resource)
- OJHA Hospital TB Center at the Dow University of Medical Sciences TB Isolation Room (Resource)
- How to Measure Natural Ventilation in Resource-Limited Settings using Carbon Dioxide (CO2) (Resource)
- Infection Control in a Cold Climate without Electricity (Discussion Brief)