

## **Improving natural ventilation in hospitals to reduce nosocomial tuberculosis risk in a low resource setting**

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*Background:* Nosocomial tuberculosis transmission remains an important public health problem, exacerbated by HIV and drug-resistant TB. Natural ventilation is a low-cost environmental control measure that should be more widely implemented in TB and HIV control programmes where climate permits.

*Aims:* To measure the effect of simple architectural modifications in hospital settings in a high TB-burden region on (a) improving natural ventilation (b) reducing TB transmission risk; and to use this data to estimate cost-effectiveness.

*Methods:* Room ventilation was measured using a CO<sub>2</sub> tracer-gas technique in four waiting rooms and two consulting rooms pre- and post-modification in two hospitals in Lima, Peru. Modifications included additional windows for cross-ventilation (n=2); removal of glass from un-openable windows (n=2); sealed skylight raised on 1m supports to permit air entry (n=1); re-building of waiting-room in the open air (n=1). TB transmission risk for a healthcare worker on a 12 hour shift was estimated using the Wells-Riley airborne infection model.

*Results:* Following the infrastructure modifications, room ventilation in the four waiting rooms increased from mean 5.5 to 15; 11 to 16; 10 to 17; and 9 to 66 air-changes/hour. In the two consulting rooms, ventilation increased from mean 3.6 to 17; and 2.7 to 12 air-changes/hour. Median TB transmission risk calculated for all rooms was reduced from 79% to 30%. The modifications were cost free in two rooms, cost less than US\$100 in two other rooms, and cost US\$1000 and US\$7000 each in the remaining two rooms.

*Conclusions:* Simple modifications to hospital infrastructure, such as the installation of skylights or additional windows to facilitate cross ventilation, considerably increased measured natural ventilation, and were highly cost-effective in reducing modelled TB transmission risk.