The influences of ventilation on biological concentration of air in a tuberculosis patient room

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Abstract

Background: Ventilation plays a crucial role in reducing the number of air transmitted pathogens in isolated rooms. Determination of the suitable type of ventilation system and the proper ventilating rate has always been a challenge. Patients' bed arrangement and the location of the staff are also expected to influence the occupational exposure of the staffs' to harmful airborne particles. The purpose of this project was to determine the state of ventilation systems, patient's bed and the location of the healthcare staff in these rooms, upon the risk to the staff being exposed to the airborne pollution in these places.

Methods: Throughout this practical study, a single-bed hospital room, where a tuberculosis patient had been admitted, was chosen. Thereafter, 5 types of ventilation systems were applied for the experiment. Whilst applying various ventilating scenarios, a patient's bed and a statue of a hypothetical healthcare staff were positioned in 2 different locations. During each of these experiments, 3 occupational samples were taken from the bio-aerosols in the room.

Results: The total density of the bio-aerosols in the patient's room changes significantly ($P<0.001$) within different plans. The least amount of capacity and the worst aeration and the concentration of indoor air bio-aerosols meaningfully decreased ($p<0.001$) in comparison with the air of a room within which no ventilation system is utilized. When air is supplied via a vent on the ceiling and it is exhausted from a vent situated on a wall at the southern part of the room, the total density of the bio-aerosols reduced to 25cfu/m^3 (application of 12 air changes per hour). The arrangement of patients' bed caused 17.75% reduction in total density of the sampled pollutions from the air.

Conclusion: Application of a system as determined in this study is recommended for isolated rooms.

Key words: bio-aerosols, isolated rooms, tuberculosis bacteria, ventilation

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