

Research Article

Environmental Factors and Ventilation Affect Concentrations of Microorganisms in Hospital Wards of Southern Thailand

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Hospitals tend to have high density of occupancy. Poor indoor environmental quality in hospital buildings can exacerbate the health problems of patients and also harm visitors and staff. This study investigated the environmental characteristics and ventilation affecting the concentration of microorganisms in multiple-bed hospital wards. The measurements were accomplished by using a biosampler and an open plate method at four wards, different positions of electric fans, and different times. Data were analyzed by *t*-test and MANOVA. The results revealed that the concentrations of airborne bacteria were higher than the concentrations of fungi. There were significant differences in the concentrations of bacteria and fungi between sampling times and between hospital wards ($p < 0.05$), while no difference was observed by positions of electric fans. Correlations between the concentrations and other environmental parameters indicate that temperature, number of occupants, and humidity were physical factors associated with the concentrations of microorganisms. In addition, mostly, Gram-positive bacteria were observed. This indicates the conditions in buildings in the tropical climate, and regular housekeeping of all room areas is needed to prevent the growth of airborne contaminants and the related risks to patients, visitors, and staff.

1. Introduction

Hospitals are dynamic environments exposed to various indoor and outdoor environmental sources and can support microbial survival and growth [1–3]. Characterizing the airborne microorganisms in hospital buildings is important. There is an opportunity to spread infections via air by coughing, conversation, laughing, or sneezing. Outbreaks of infectious diseases, such as tuberculosis, measles, and influenza, have been linked with poor microbiological quality of hospital indoor air [4–6]. The presence of nosocomial infectious microorganisms is a source of nosocomial infections in hospitals [7]. These conditions may negatively impact the health of those working in such buildings, and microbial contamination may cause diseases.

Several studies have shown that microbial contamination of indoor air in a hospital is mostly by bacteria and

fungi. There is increasing evidence of high airborne concentrations of bacteria in hospitals of Singapore [8]. The wards are potentially risky places for human occupants in a hospital. Investigation of airborne concentrations in different wards of a hospital was carried out in Isfahan, and high levels of airborne bacteria were observed [9]. Previous studies have focused on airborne concentrations of bacteria, while the concentrations of fungi have received less attention. In Thailand, Srion and Nathapindhu [10] found bacteria on about half the sampled surfaces, in Nonsang and Nongbua Lamphu hospitals. Also, seven genera of bacteria and fungi were identified in the air of Khonkaen hospital [11]. The environmental characteristics affecting airborne concentrations have not yet been determined.

The presence of high concentrations of bacteria and fungi within hospital buildings is related to the number of occupants, their activities, and ventilation. Microorganisms