SYNOPSIS

KEY POINT SUMMARY

OBJECTIVES

The study aimed at investigating how environmental factors including window size in relation to room volume may impact the rates of SARS infections in healthcare workers in an acute care hospital in China.

DESIGN IMPLICATIONS

The study showed the importance of ventilation in preventing transmission of SARS from patients to healthcare workers. Both natural ventilation and mechanical ventilation may be effective.

In buildings with natural ventilation, the size of windows and other openings in relation to room volume may be an important factor impacting the effectiveness of ventilation.

Ventilation of Wards and Nosocomial Outbreak of Severe Acute Respiratory Syndrome Among Healthcare Workers

Jiang, S. P., Huang, L. W., Chen, X. L., Wang, J. F., Wu, W., Yin, S. M., Chen, W., Zhan, J., Yan, L., Ma, L., Li, J., Huang, Z.

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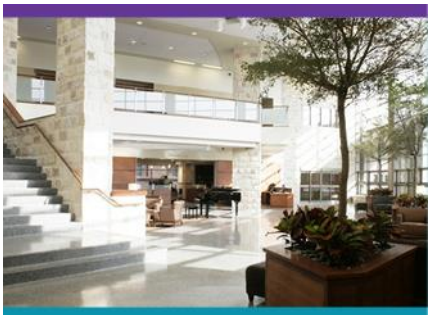
Key Concepts/Context

Severe acute respiratory syndrome (SARS) is a contagious respiratory disease caused by a virus called SARS-associated coronavirus. The disease may cause flu-like symptoms including fever (100.4 F or higher), myalgia, lethargy symptoms, cough, and sore throat. Most patients may develop pneumonia. Environmental contamination is an important factor contributing to SRAS transmission. The main route of SARS transmission is through the infectious droplets (from the cough or sneeze of infected patients and aerosol-generating patient care procedures) being propelled a short distance through air onto the mouth, nose or eyes of a nearby person. The transmission also happens when an individual's hands touch an inanimate surface that is contaminated with infectious droplets and transmit the droplets to the mouth, nose, and eyes.

Ventilation may be an effective method in removing pathogens and reduce air contamination. When nature ventilation is used, windows size and room volume are two factors impacting ventilation rate and the effectiveness of reducing air contamination. Laminar air flow is another ventilation method of reducing air contamination.

Methods

This observational study focused on about 430 healthcare workers who worked in four isolation wards for SARS patients. The room volume and window size at each ward were measured. A ratio of ventilation window area to room volume was calculated. The four wards varied in the amount of natural or mechanical ventilation: one ward with windows closed due to a construction project, one



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without opening ventilation windows but with laminar air flow ventilation, one with a ratio of window area to room volume as 1/95, one with a ratio of 1/40. The infection rate of healthcare workers at each ward was calculated as the percentage of healthcare workers entering the isolation wards who were diagnosed with SARS. Statistical tests were conducted to compare infection rates between the four wards.

Findings

Among the four wards, the lowest rate of SARS infections in healthcare workers was found in the ward with the highest ratio of window area to room volume (1.7% healthcare worker infected). Higher infection rates (27.5% and 32.1% respectively) were found in the ward with relatively lower ratio of window size to room volume and the ward with laminar air flow mechanical ventilation but no window. The highest infection rate (73.2%) was associated with the ward with all windows closed.

Limitations

There were several limitations of this study:

- It was proposed in the article that larger windows might lead to better ventilation and lower air contamination level. However, in this observational study, the actual ventilation rates and the air contamination levels in different wards were not measured. In addition to window size, the wards were different in other factors, such as room orientation, which might have impacted the ventilation rate. The causal linkages between larger windows and lower infection rates were not verified.
- There were likely differences in other risk factors (e.g. compliance with personal protection measures, personal health status) among healthcare workers working at different wards. It is also probable that personal protection measures were strengthened during the process of study period. The potential risk factors were not measured in the study.