SYNOPSIS

KEY POINT SUMMARY

OBJECTIVES

The objective of this study was to experimentally and quantitatively investigate the effect of door operation on air transfer and consequent airborne contamination.

DESIGN IMPLICATIONS

Although further studies are required before specific design implications can be drawn, designer may consider the use of air curtains to dissuade the movement of contaminants.

Experimental analysis of the transport of airborne contaminants between adjacent rooms at different pressure due to the door opening

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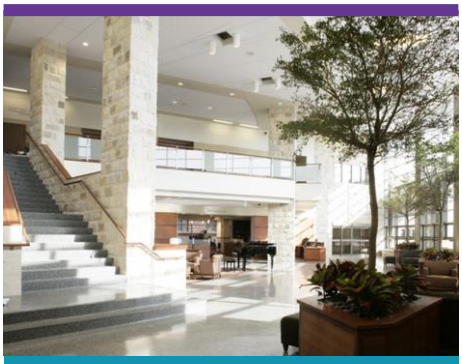
Key Concepts/Context

Creating pressurization and depressurization spaces in hospitals is practiced to control airborne contamination. The authors indicate that the literature suggests that turbulence created by the opening and closing of doors between spaces of different pressure allows for the difference in pressure to be overcome and consequently for the transfer of contaminated air into the clean area. This study simulated clean and contaminated rooms in two tanks, one filled with water and the other with water and ink (to represent contamination) and fitted with a device to simulate real-time door operations. The experiment indicated that the operation of doors does allow for a transfer of colored water to the clean tank despite the difference in pressure.

Methods

A simulation exercise was carried out with research participants simulating the behavior of healthcare workers walking in and out of the room. The door operations of the participants were recorded by means of a movie camera installed above the door, dividing two rooms with the lens facing downwards. The sample size was 10 and included teachers, employees, and students. A total of 40 recordings were done. These recordings were imported into AutoCAD and the total operation time and maximum opening angle of the door were measured and angular velocity calculated. Based on these measurements, the researchers built a device that replicated door operations in a 1/10th scale model of two rooms (two tanks) to simulate air transfer between two rooms. Both tanks were filled with water and the tank representing the room with airborne contaminants was infused with ink. The device was operated to open and close the doors built in the model rooms and the transfer/movement of fluid between the two rooms was photographed.



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Findings

The researchers found:

- When the door was opened it caused fluid to move from the contaminated room to the clean room.
- The differential pressure did not impact the transfer of fluids.
- The fluid transferred was strongly related to the volume of air displaced during the door operation.
- The dimensions of the door influenced the volume of fluid displaced when the door was opened.

Limitations

The authors did not specify any limitations to their experimental study. However, they indicated that contamination of the clean room depends on the concentration ratio of contaminants in both the clean and the dirty room.

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