



## KEY POINT SUMMARY

### OBJECTIVES

To investigate the effectiveness of a novel surgical ventilation system in inhibiting SSI risk when compared to mixing ventilation within a surgical theater setting.

### DESIGN IMPLICATIONS

The design of an operating theater should carefully consider all possible airborne sources of particle flow, particularly near the area of an open wound. Reducing the overall amount of particles near and on the wound by using localized ventilation systems in conjunction with larger central systems could help reduce instances of surgical site infections. While the novel system described in this study did not meet the standards set by the authors, it may have valuable applications in similar operative settings.

## Alternative ventilation system for operating theaters: Parameter study and full-scale assessment of the performance of a local ventilation system

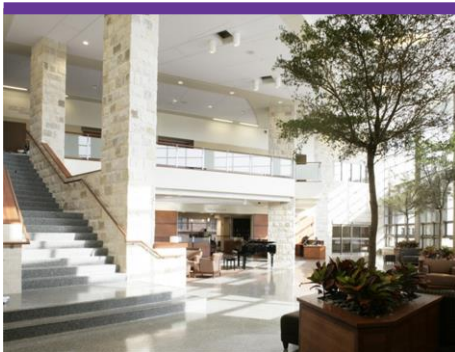
Loomans, M. G. L. C., De Visser, I. M., Loogman, J. G. H., & Kort, H. S. 2016 | *Building and Environment*. Volume 102, Pages 26-38

### Key Concepts/Context

Surgical site infections (SSIs) were found in 2.9% of all surgical operations conducted in conventionally ventilated operating theaters in the Netherlands between 2002 and 2011. SSIs can lead to permanent injuries, additional surgeries, increased healthcare costs, and even mortality. A new performance-based guideline offering opportunities to develop and use innovative ventilation systems within operating theaters was introduced in the Netherlands in 2014. The guideline led the researchers involved in this study to develop and study a new ventilation device that ventilates only the area around a particular wound in a surgical theater setting. This novel localized ventilation device is combined with a blanket that lies over the patient during surgical procedures.

### Methods

The researchers evaluated the efficacy of the novel ventilation system within two contexts: a “simplified representation” and a “full-scale mock-up test.” The simplified representation, which took place in a laboratory setting, investigated the turbulence intensity, supply velocity, effect of disturbance caused by contaminated airflow over a given wound, and the supply temperature of the HEPA-filtered airflow. The full-scale mock-up test involved a scale model of an operating theater and a more realistic prototype of the ventilation configuration that included both the ventilated blanket along with an instrument table. In both study contexts, two different configurations of the ventilation system were also analyzed: Configuration 1 featured a local ventilation device with clean air being supplied around and parallel to the area of the wound, while Configuration 2 supplied clean air from the top surface of the blanket used with the ventilation device. Particle concentrations



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within the central area of a wound were used as the main measurements for the efficacy of the new system in all scenarios.

## Findings

In the simplified representation portion of the study, particle measurements indicated that a higher supply velocity of filtered airflow significantly reduced particle concentrations. Higher supply temperature of the HEPA-filtered airflow negatively influenced the performance of Configuration 1. For Configuration 2, all analyzed velocities of filtered airflow yielded similar results (no statistically significant differences in particle concentration). Overall results from all study contexts revealed that the novel ventilation system could not yet compete with local ventilation efficiency standards within a class 1 operating theater with performance level 1. However, the system is nonetheless capable of reducing disturbances from the outside area around a given wound and may have useful applications outside of an operating theater.

## Limitations

The authors noted a number of limitations within their study. Simulations run in the context of Configuration 2 were inherently more sensitive to turbulence intensity from filtered air supplies and higher supply temperatures. There was no investigation into potential temporal disturbances caused by the system, and the authors note that investigating this may add credibility to their current approach. While the study's full-scale analysis encompassed both the wound area and the instrument table surface, including the area between the instrument table and the wound area could have provided a more thorough investigation into potential exposure factors.

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