



# Continuous Monitoring of Airborne Pathogens in Healthcare Facilities

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# Research Gaps & Research Questions



- Lack of continuous monitoring (high infection risk)
- Energy Efficient HVAC control
- Impact of Air flow rates and ventilation in different settings



# IndoorAir 2026



## **Parametric Study of Airflow rate and Air Cleaning in Healthcare Settings: Correlating Particle Concentration with Infection Risk under Continuous Monitoring**

- The study varies airflow rates and air-cleaning configurations to quantify how changes in total effective clean air (ventilation plus devices) alter airborne particle concentrations and infection risk in a single-zone clinical space.
- Using a custom tool and dose response models, it shows that lowering respirable particle levels leads to proportional reductions in modeled infection risk, especially for droplet nuclei mediated pathogens.
- Continuous monitoring of CO<sub>2</sub> and particles enables real-time detection of inadequate ventilation and supports adaptive strategies (e.g., boosting outdoor air, balancing flows, activating filtration) that align environmental performance with HAI prevention goals.

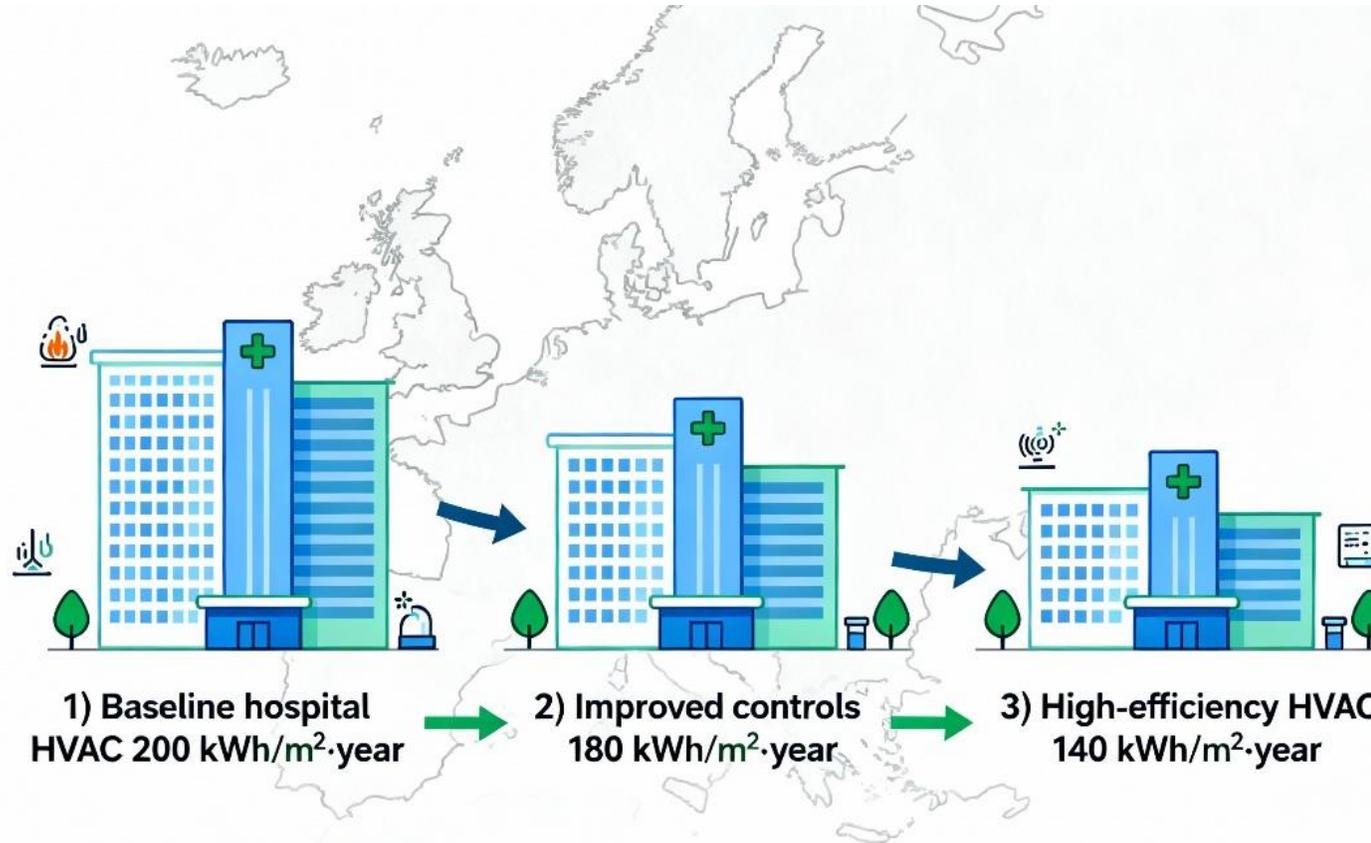
# RoomVent 2026



## Improved indoor climate and reduced infection risk in health care settings via ventilation strategies and informed decisions based on a continuous monitoring system

- **Need for Continuous Monitoring:** Conventional manual or periodic checks of Indoor Environmental Quality (IEQ) in healthcare settings fail to capture rapid fluctuations that influence airborne transmission and infection risk.
- **Multi-Parameter Sensing Approach:** The study uses continuous, high-resolution monitoring of CO<sub>2</sub>, VOCs, particulate matter (PM), temperature, humidity, sound levels, and illuminance in patient rooms to identify ventilation inefficiencies and pollutant peaks linked to occupancy and environmental conditions.
- **Data-Driven Infection Prevention:** Continuous IEQ data enables dynamic, evidence-based adjustments to ventilation, filtration, and space use: improving air quality management, informing operational decisions, and strengthening infection prevention strategies.

# Energy Efficiency Literature



# Tool Development



Occupancy Data      Air Cleaner data & control      App control

**Contaminant Source**

BioEmission Source: active, 1000 Pfu/min, Half-life time (h): 1, PFU / quanta: 120, K Factor: 0.01, Caughing C Mult. Factor: 10, Sneezing S Mult. Factor: 100

**Use of Masks**

Use of Mask (Emitter): non active, Mask\_Efic (%): 70, Use of Mask (Receiver): active, Mask\_Efic (%): 70

**Initial & Outdoor Concentrations**

Cini CO2(mg/m3): 680, Cext CO2(mg/m3): 680, C ini (Pfu/m3): 0, Cext (Pfu/m3): 0

**Fresh Air Flow Rate**

Q fresh air (m3/h): 2000, Room Vol (m3): 150, Speed of simulation: 1000

**Occupants**

Present, Nr of Occupants: 20, Height (m): 1.7, Weight (kg): 70, Metabolic Rate: 1.2, Air Exchange Rate (h-1): 6, 740 G CO2 (g/h), 60000 G (Pfu/h)

**Air Cleaner**

AirCleaner ON, Q\_Purif (m3/h): 1000, Efic Purif (%): 80

**App control**

START, Simulation Time (h): 1, STOP, Save to File Yes, CONCLUDE

**Concentration (Pfu/m3)**

33

**Time Evolutions of Doses**

Dose with Mask (Pfu): 1882, Dose no Mask (Pfu): 6274

**Infection Risk Sliders**

Infection Risk (%): No Mask@Rcv: 41, Mask@Rcv: 15

**Statistical Descriptors Data**

	Avg	Max	Mini	Std Dev
C (Pfu/m3)	39.9	57.7	1.11	11.8
C (mg/m3)	1368	1500	694	192

**Path of Recorded Data File**

Data saved in C:\Simulation\_Logs\test\_20250501\_222000\_150\_1000\_1000\_6.00\_...\_txt

Simulator of the Time Evolution of the Mean Concentration of a BioContaminant and CO<sub>2</sub> in a Uni-Zone Indoor Enclosure - Exposure Dose and Infection Risk Calculator © Manuel C. Gameiro da Silva, 2020

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# Future Plans



- Development of data analytics
- Tool Development and Integration
- Possibility of supervised learning for different healthcare setting designs and data parametrics
- Energy Efficiency integration of tool using automated control (informed decision making)