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Ström, R.

[Air quality in care facilities: Possibly infectious particles.](#)

halmers tekniska högskola / Institutionen för arkitektur och samhällsbyggnadsteknik (ACE). Thèse 2026

This study investigates how air cleaning reduces airborne particle and bacterial concentrations in healthcare environments, aiming to lower infection risk without increasing mechanical ventilation rates. The study combines laboratory experiments, infection risk modelling, and field measurements in a hospital waiting room.

Ishigaki, Y., Fujita, N., Kato, T., Ochiai, T., Kuroboshi, H., Sakane, A., *et al.*

[Airborne spread of severe acute respiratory syndrome coronavirus 2 between rooms in a sealed, mechanically ventilated ward: Evidence from a hospital outbreak investigation.](#)

PLoS One, Vol. **21** n°(6), (2026)

Airborne transmission of severe acute respiratory syndrome coronavirus 2 in enclosed, mechanically ventilated hospital wards remains poorly characterized. In February 2025, a coronavirus disease cluster involving 17 individuals occurred across multiple rooms in a sealed Japanese hospital ward. Several infected individuals had no documented close contact with the index patient, raising concerns about ventilation-related airflow-induced inter-room aerosol transmission. A multimodal environmental investigation was conducted via (1) CO₂ decay experiments to quantify air change rates (ACHs), (2) particulate matter (PM)_{2.5} aerosol dispersion measurements using fog as a surrogate tracer, and (3) computational fluid dynamics (CFD) simulations to visualize airflow and scalar transport. Measurements were taken in the index room (Room A), corridor, and adjacent Rooms B–D under closed- and open-door conditions. Opening the patient room door significantly increased indoor ACHs (3.29/h → 4.01/h, $p = 0.030$) and allowed CO₂ tracer gas to escape into the corridor. In the PM_{2.5} dispersion experiment, aerosols released in Room A were detected within the room, corridor, and neighboring rooms, with the highest out-of-room aerosol burden observed at the corridor sensor (area under the curve = $2.6 \times 10^5 \mu\text{g}\cdot\text{s}/\text{m}^3$). PM_{2.5} and PM₁₀ concentrations were strongly correlated ($r = 0.9997$), revealing intermediate-sized particles capable of longer-range transport. CFD simulations reproduced key qualitative features of the experiments, including tracer accumulation within curtain-enclosed compartments, delayed leakage through the doorway, and downstream transport toward the corridor. Inter-room aerosol transport can occur in sealed, mechanically ventilated wards without natural ventilation or structural openings between rooms. Opening doors improves in-room ventilation and promotes aerosol leakage, revealing a trade-off between the dilution and contamination of shared spaces. Architectural elements such as privacy curtains contribute to airflow stagnation and uneven aerosol removal. Effective infection control strategies must incorporate airflow pathway management and localized filtration to prevent unintended aerosol migration in mechanically ventilated healthcare settings.

Karumuna, B. V., Tibesigwa, B. M.

[Computational Fluid Dynamics-based simulation to analyse viral dispersion and spatial resilience in Tanzania.](#)

Architecture Papers of the Faculty of Architecture and Design STU, Vol. **31** n°(2), (2026), 36-53 p.

This study offers a CFD-based simulation analysis of the airflow dynamics and viral spread at the COVID-19 isolation facility of Shinyanga Regional Referral Hospital (SRRH) in Tanzania, tackling significant ventilation limitations in resource-limited healthcare environments. The main goal of the study is to find areas where airborne contaminants are likely to become stuck and suggest architectural changes that will make these areas more resistant to future respiratory outbreaks.

Wang, Y., Chen, J., Zhang, S., Zhu, H., Liu, Y., Lai, B., *et al.*

Distribution and exposure risk of bioaerosol in automobiles during the COVID-19 pandemic in China.

Atmospheric Pollution Research, Vol. **17** n°(8), (2026)

Bioaerosols in automobiles can reflect the microbial composition of the atmospheric environment and further more predict exposure risk on human. In this study, we investigated the distribution of bioaerosols by analyzing the microbial communities in automobile air filters from four regions of China. Moreover, correlation analysis were applied to evaluate the risk of human exposure through bioaerosols and air quality, economic-demographic indices. Klebsiella was the main dominant bacterium in Central China (7.62%-27.91%). Microbial diversity analysis suggested that Jilin has the most diverse microbial species, with a Shannon index of 7.07. Potentially Pathogenic bacteria accounted for a significantly higher proportion in Central (78.1%-78.4%) and part of Eastern China (71.4%-76.4%). While Anaerobic bacteria became the absolute dominance (27.1%) in Northeastern China. There was no statistically correlation between the air quality indices, economic demographic indices, influenza incidence and the five types of microbial functional bacteria ($P > 0.05$). But, the abundance of anaerobic bacteria showed a significant negative correlation with PM_{2.5}, PM₁₀, and CO ($P < 0.05$). PCA results showed that bacterial composition in Xinjiang and Sichuan differed from all the other cities. People living in Central and part of Eastern China may have higher risk of Klebsiella and Potentially Pathogenic bacteria infection, which may furthermore increase the risk of respiratory diseases.

R. Rashed, B. A., F. Altawayha.

Health-Resilient Apartment Design for Post-Pandemic Housing: An Integrated Framework for Infection Control and Psychological Well-being.

International Journal of Architectural Engineering Technology, Vol. **13** n°(2), (2026), 160-184 p.

The COVID-19 pandemic exposed critical failures in multi-unit apartment designs with respect to airborne and contact-based disease transmission. This study develops an integrated architectural framework for health-resilient housing using a triangulated mixed-methods approach. Data were synthesized from semi-structured interviews with virology specialists, sustainable engineering experts, and apartment inhabitants. The resulting validated model introduces several novel interventions: a transitional 'entrance garden' to serve as a biological buffer, a negative-pressure isolation room (AIIR) with dedicated facilities, and a 'safe path' escape staircase for secure medical access. Technical enhancements, including air-lock (SAS) doors, wind curtains, and self-cleaning materials, are integrated to minimize viral loads in high-traffic areas. After a three-phase validation by architects and medical experts, the study concludes with a procedural guide for local authorities to standardize health-resilient infrastructure in future residential developments.

Zhang, Z., Wang, Q., Dong, X., Li, X., Lu, B., Xu, D.

Microbial Diversity in Airport Terminal Environments and Potential Aerosol Transmission Risks.

Biomedical and Environmental Sciences, Vol. **39** n°(5), (2026), 512-528 p.

Objective To characterize the distribution of bacterial and fungal pathogens in airport terminal environments, compare airborne aerosol sampling methods, identify high-abundance pathogenic species based on the WHO priority pathogens list, and provide a scientific basis for optimizing microbiological monitoring and control measures. **Methods** Sampling was conducted in the transit transfer area (A1), domestic arrivals area (A2), and domestic departures area (A3). Airborne aerosols were collected using cyclonic and filtration samplers, and surface samples were collected using sterile swabs. DNA analysis was performed using 2bRAD sequencing for microbiome profiling (2bRAD-M). Microbial community diversity and compositional differences were assessed using α -diversity indices (Chao1, Shannon, and Simpson) and β -diversity metrics. **Results** Bacteria dominated the indoor air microbiota of the airport terminal (98.4%), with Pseudomonadota (39.4%–62.9%) and Actinomycetota (18.9%–32.9%) as the predominant phyla. Microbial diversity was significantly higher in surface samples than in airborne aerosols. High-frequency contact surfaces (e.g., handrails) were enriched with human commensal bacteria, including *Cutibacterium acnes* (9.71%–19.4%). Multiple WHO-prioritized pathogens were detected, including *Acinetobacter baumannii* (0.3%–1.4%) and *Pseudomonas aeruginosa* (0.01%–1.24%). The transit transfer area (A1), characterized by poorer ventilation, showed higher microbial richness. Filtration samplers captured more microorganisms per unit volume than cyclonic samplers, with significant differences in detection profiles. **Conclusion** Sampling methods, sample types, and environmental conditions influence microbial distribution patterns across terminals. Detection of WHO Critical and High priority pathogens indicates potential risks of aerosol and contact transmission. Enhanced ventilation and disinfection of high-frequency contact surfaces can mitigate public health risks.

Wang, Y., Liu, Z., Jiang, L., Shi, Z., Li, Z., Liu, J., *et al.*

Mitigating bioaerosol exposure risks in high-traffic clinics: Experimental and numerical optimization of air purifier interventions.

Journal of Hazardous Materials, Vol. **514**, (2026)

In outpatient clinics, close contact between doctors and patients increases the infection risk for doctors due to the presence of pathogenic bioaerosols exhaled by patients. Therefore, investigating the bioaerosols dispersion in outpatient clinics and evaluating the intervention effects of air purifiers is of significant practical importance. In this study, employing *Serratia marcescens* as a tracer to conduct a comparative analysis of the aerosol control effects of air purifiers. Then, numerical simulation is utilized to complement bioaerosol experiments. Analyzed six different placement positions and heights for the air purifiers. The results indicate that air purifiers can effectively reduce aerosol concentrations. The time to reach 95% of the steady-state concentration decreased from about 400 s to 200 s. The peak concentrations being reduced to 25% of those in the original clinic. Placement at breathing height significantly outperformed ground-level placement, achieving "near-source capture." Furthermore, relying solely on spatial average concentrations is insufficient to evaluate the purification effect; incorrect placements may reduce spatial concentrations but primarily increase wall deposition (increased by 13%) rather than actual removal. Additionally, the interference of the purifier exhaust with the original airflow may inadvertently increase the exposure risk for the doctor. Aligning the exhaust of the purifier towards the room's exhaust vent can enhance expulsion efficiency. Considering three dimensions, CPB (Conventional position at breathing height) and SPB (Source capture position at breathing height) emerge as the optimal configurations.

Kalliomäki, P., Koskela, H., Tang, J. W.

Protective local downward ventilation in hospital isolation rooms.

International Journal of Ventilation, (2026), 1-23 p.

Ventilation and supply air distribution play an important role in reducing exposure to airborne pathogens in hospital isolation rooms. Effective supply air distribution should dilute high concentrations readily close to the source and direct them away from the breathing zone of the occupants. In this study a healthcare

worker (HCW) exposure to patient exhaled airborne contaminants was assessed with a typical total volume mixing ventilation (MV) and with a local downward ventilation (LDV) above the patient bed. The experiments were carried out in a full-scale isolation room mock-up with breathing thermal manikins simulating the HCW and the patient. Smoke visualisations and air speed measurements show that LDV increases air movement and enables more effective flushing of the patient's upper body compared to MV. Tracer gas measurements show that several factors, like HCW location, air exchange rate, and occupant movement, affect the HCW exposure and that LDV can reduce the exposure notably compared to MV, at least near the patient. Additionally, thermal comfort measurements indicate that LDV can produce adequate thermal conditions for the patient. These findings can be utilised when designing better ventilation solutions for hospital isolation and patient room environments. LDV and MV solutions were compared in a full-scale hospital isolation room mock-up LDV flushed the upper-body area of the patient more effectively than MV LDV reduced HCW exposure to patient exhaled contaminants notably compared to MV, especially near the patient LDV reduced HCW exposure slightly compared to MV with frequent occupant movement next to patient bed Patient thermal comfort was slightly cooler with LDV compared to MV LDV and MV solutions were compared in a full-scale hospital isolation room mock-up LDV flushed the upper-body area of the patient more effectively than MV LDV reduced HCW exposure to patient exhaled contaminants notably compared to MV, especially near the patient LDV reduced HCW exposure slightly compared to MV with frequent occupant movement next to patient bed Patient thermal comfort was slightly cooler with LDV compared to MV

Kennett, C. E. W., Ross, K., Whiley, H.

[Regulatory frameworks for Legionella control in Australia: a scoping review of public health legislation and policy with New Zealand comparison.](#)

BMC Public Health, Vol. **26** n°(1), (2026)

Public health regulation in Australia operates through complex regulatory frameworks which includes Acts, Regulations, Codes of Practice, Guidelines and policy directives. While the public health significance of Legionella control is well recognised, limited research has examined how regulatory instruments collectively constitute the framework for Legionella management or alignment with international guidance. ISO 31000:2018 Risk Management – Guidelines-provide a structured approach to risk identification, assessment and treatment, emphasising context specific application and continual improvement. This aligns closely with the World Health Organization (WHO) Water Safety Plan approach, adopted across Australian jurisdictions to manage water related hazards. National standards, including AS/NZS 3666, complement this guidance by specifying technical requirements for the prevention and control of Legionella in building water systems. This review examines regulatory frameworks for Legionella management across Australia with New Zealand included as a comparator.

Majumdar, S. S., Delaire, M., Kevin, K., Menon, V. J., Hosking, F., Wu, L., *et al.*

[Safety, feasibility and implementation of upper-room germicidal ultraviolet light in Australian aged care facilities: 12-month interim findings from the ELUCIDAR cluster randomised controlled trial.](#)

International Conference on Indoor Air Quality and Climate (Indoor Air) 14 -18/06/2026, Singapore , Singapore.

The ELUCIDAR cluster randomised controlled trial evaluates UR-GUV effectiveness in reducing respiratory infections in 61 Victorian RACFs over 24 months. We present 12-month interim findings on safety, feasibility, and implementation of UR-GUV (254 nm) installed across 246 communal areas. Installation followed standardised protocols from preliminary validation (Landry et al., 2025), though standardised dosing targets were not achieved in all areas due to built environment diversity. UR-GUV demonstrated acceptable safety profile with no adverse reactions attributable to UV exposure. Median delivery of 7 additional eACH was achieved across installed areas. These interim results inform policy on

air disin-fection technologies and methodological frameworks for evaluating airborne infection control interventions.
