



Bulletin de veille Maladies aéroportées N°4 – 21/10/2026

Objectif : Air intérieur, ventilation, climatisation et propagation des maladies aéroportées

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Google Scholar, Lens et WoS

Delpont, M., Elbers, A., Dee, S.

[Airborne Transmission of Infectious Diseases and Decontamination of Air.](#)

In: Biosecurity in Animal Production and Veterinary Medicine: From Principles to Practice. CABI, GB; 2026. 160–175 p.

Airborne disease transmission between animals, over short or long distances, requires an infectious agent to be transported on an aerosolized vessel (any liquid or solid particle suspended in the air). For barn-to-barn or farm-to-farm airborne contamination to take place, three steps are required: emission of a contagious aerosol, transport, and arrival in a receptive herd or flock. Any factor influencing the quantity of infectious particles produced (and their vessels), airborne particle and pathogen stability, or infectious dose may influence the probability of infection. There is scientific evidence on the possibility of airborne contamination in a farming context but the contribution of the airborne route of transmission between farms during epidemics appears to be low. Biosecurity measures aiming at reducing the risk of airborne transmission rely mainly on physical mechanisms affecting the stability of airborne particles. They usually rely on the use (on air inlets or outlets) of filters, scrubbers, electrostatic precipitators or natural windbreaks, alone or in association. They require high investments and running costs, and their implementation will depend on the level of risk and the consequences of the diseases.

Li, K., Li, R., Cheng, Y., Wei, J., Cao, Z., Gao, N.

[Effects of ventilation and thermal conditions on the formation and propagation of exhaled vortex rings.](#)

Building and Environment, Vol. **306**, (2026)

Human exhalation produces a vortex ring at the leading edge during the initial stage due to shear layer roll-up, which propagates downstream. The formation and propagation of exhaled vortex rings play a critical role in short-range transport and exposure risk. However, their flow characteristics and implications for transmission remain insufficiently understood. This study employed large eddy simulation combined with smoke visualization experiments to investigate the formation, propagation, and exposure risk of vortex rings generated by exhalation jets through the mouth under different exhalation intensities, thermal conditions, and ventilation systems. The results show that the exhaled jet transitions from a vortex-ring propagation stage to a turbulent jet propagation stage. The vortex ring persists and continues to propagate downstream even after exhalation ceases, traveling approximately 0.3–0.5 m within 0.5 s. This suggests that vortex ring propagation spans the conventional starting jet stage and part of the interrupted jet stage, differing from starting-interrupted jets model reported in previous studies. Furthermore, under non-ventilated conditions, exhaled vortex rings exhibit negligible vertical deflection, with the ratio of vertical displacement to propagation distance below 0.1. Under ventilated conditions, the trajectory of leading vortex rings becomes governed by the indoor flow field when the propagation distance exceeds 0.15 m. Moreover, the formation conditions for saturated vortex rings are not significantly affected by exhalation velocity, buoyancy effects, or ventilation conditions, and can be determined by a dimensionless energy $\alpha_{lim} = 0.27 \pm 0.02$. This study provides a framework for understanding exhalation flows through the mouth and offers insights into short-range infection risks.

Al-Rikabi, I. J., Karam, J., Voelker, C., Ghaddar, N., Alsaad, H.

[An innovative desk push-pull device for reducing airborne contaminant exposure in office environments.](#)

Indoor Environments, Vol. 3 n°(4), (2026)

Most human-centred ventilation devices aim to reduce cross-contamination by targeting the breathing zone, potentially causing contaminant accumulation and spread into the surrounding area. This study introduces a novel desk push-pull system (Desk_PPS) that aims to reduce contaminant transfer within the occupant microenvironment. The device employs two perforated plates on each side of the desk: one supplies clean air while the other extracts contaminated air, establishing a clean-air barrier that minimizes contaminant exchange between the occupant's microenvironment and surroundings. A computational fluid dynamics model was developed to predict contaminant spread, with the flow-inducing device model experimentally validated. A parametric analysis was conducted to optimize the Desk_PPS for face-to-face and side-to-side sitting configurations, focusing on operating flowrate and perforation diameter. Cross contamination was quantified using intake fraction (IF). The Desk_PPS substantially reduced exposure relative to the No Desk_PPS case. In the face-to-face setup, the lowest IF values occurred at 54 l/s: 2.56×10^{-4} and 2.41×10^{-4} for 5 mm and 10 mm perforations, corresponding to reductions of 60% and 62%, respectively. The 5 mm perforation generated a narrower, higher-momentum jet that better confined contaminants near the source and reduced downstream accumulation near the exhaust, whereas the 10 mm perforation produced a broader flow field creating a larger low-contaminant zone around the exposed occupant, particularly at 43–54 l/s. In the side-to-side configuration, IF fell from about 7.1×10^{-4} without Desk_PPS to 1.9×10^{-4} at 54 l/s for 5 mm diameter, a 73% reduction. Overall, Desk_PPS performance depends on the interaction between flowrate, perforation diameter, and room-scale contaminant transport.

Mahmoud, M. M. A., Macintyre, C. R., Green, D., Doolan, C., De Silva, C.

[The link between aerosol dispersion, infection risk and air filtration.](#)

Building and Environment, Vol. 306, (2026)

Portable HEPA filters are widely used to reduce airborne disease transmission in indoor environments. However, their performance is commonly evaluated using aerosol decay rates rather than infection risk. This study applies a radius-resolved infection risk framework that combines measured aerosol concentrations with CFD simulations to quantify infection risk and maximum occupancy time in classrooms with one or three portable HEPA filters, using a stale-air classroom as the baseline. An Aerosol Removal Model (ARM) is also developed to evaluate filtration performance. For the specific HEPA design and intake–discharge arrangements tested, the single-HEPA arrangement performed worse than the stale-air case under unfavourable airflow conditions because filter-induced circulation promoted infectious-aerosol dispersion. In contrast, the three-HEPA configuration substantially reduced exposure, although its effectiveness remained sensitive to filter placement and airflow alignment. The ARM predicted a removal time of approximately 50 min for the three-HEPA configuration, compared with about 5 hours for the single-HEPA configuration. The three-HEPA system approximately doubled the maximum occupancy relative to the stale-air case, whereas activating the tested single-HEPA arrangement after occupancy resulted in all occupants exceeding the infection threshold within approximately 2 min. These findings support operating HEPA filtration before classroom occupancy. The results further reveal a non-linear relationship between clean air delivery rate (CADR), airflow-induced mixing, and infection risk, demonstrating that filtration effectiveness depends not only on CADR but also on the airflow patterns induced by filter placement and orientation. The proposed framework provides a practical tool for optimising the design and operation of portable HEPA filtration systems.

Aganović, A.

[Mechanistic reconstruction as complementary evidence for reported ancestral-lineage SARS-CoV-2 long-distance airborne outbreaks.](#)

Indoor Environments, Vol. 3 n°(4), (2026)

Several short-duration indoor SARS-CoV-2 outbreaks before Alpha were interpreted as consistent with transmission beyond 2 m, but retrospective evidence cannot distinguish shared-air exposure from close contact. I developed a size-resolved framework to test how demanding pure long-distance airborne transmission is, using literature-derived source-to-deposition distributions, restricted to ancestral/pre-VOC conditions between January and September 2020. Four events were analysed: the Skagit and Wihr-au-Val choir rehearsals, the Hunan bus journey, and the Vaud courtroom hearing. Activity-matched particle and RNA emission rates for breathing, speaking, and singing were first compared against measurement to establish baseline source coverage and its dependence on the assumed source population. For each event, 100,000 realizations were evaluated across a scenario grid combining viral-load priors, RNA-to-TCID50 conversion scenarios, and deposition mechanisms, alongside a separate analysis retaining empirically paired RNA and FFU measurements. Compatibility required at least the reported number of susceptible occupants to deposit one or more infectious-unit equivalents (IUE), TCID50- or FFU-derived. No dose-response model was applied, as no validated function links deposited ancestral SARS-CoV-2 dose to infection. Compatibility under the RNA-TCID50 framework was consistently low under the RNA-positive viral-load priors, reaching at most 1.14% for Skagit, 0.61% for Wihr, 0.02% for Hunan, and 0.04% for Vaud. It was approximately an order of magnitude higher under the culture-positive prior, though the highest single scenario cell reached 22.7% under this upper-bound scenario. The matched RNA-FFU analysis was substantially lower, remaining below 0.01% in every cell, underscoring the model's high sensitivity to the choice of infectious-unit conversion basis. For the outbreaks that were reproduced as compatible, the pure long-distance airborne hypothesis required more than poor ventilation and elevated aerosol-generating activity: it also required an unusual draw from the upper tail of the viral-load distribution and, to a lesser extent, emitted liquid volume and infectious fraction. The proposed long-distance route is physically possible but demands an unusual conjunction of source and exposure conditions. This small compatible region supports caution in attributing these outbreaks to pure long-distance transmission, since unreported short-range exposure, additional infectious sources, and other unmeasured contributors remain plausible.

Sessler, D. I., Mascha, E. J., Ekrami, E., Bravo, M., Dussan, C., Almonacid-Cardenas, F., *et al.*

[Operating Room Air Filtration-Sterilization and Surgical Infections: The ORACLE Randomized Trial in 110,538 Surgeries.](#)

Anesthesiology, (2026)

Methods:

Operating rooms, our clusters, were each randomized in each 4-week blocks to either active or identical-looking sham supplemental air sterilization. All investigators, clinicians, and patients were fully blinded to treatment. No other aspect of anesthetic or surgical management was proscribed. Intent-to-treat analysis was restricted to adults who had surgery lasting at least an hour without evidence of pre-existing wound infections. We tested the primary hypothesis that supplemental active purification reduces a collapsed (one or more) composite of surgical wound infections, infection-related complications, or death within 30 days after inpatient surgery. Secondarily, we tested the hypothesis that supplemental air purification reduces the same composite after combined inpatient and outpatient surgeries.

Results:

A total of 110,538 combined inpatients and outpatients were enrolled across 68 operating rooms, with 107,334 qualifying for analysis. At the third interim analysis, the futility boundary on the composite outcome was crossed for inpatients and for all patients. Enrollment thus stopped with 58,938 randomized inpatients. The primary composite outcome occurred in 8.1% (n=2,389) of inpatients randomized to active purification versus 8.2% (n=2,405) with sham purification: odds ratio 0.98 (95%CI: 0.92 to 1.05), P=0.609. Across all patients, the secondary composite outcome occurred in 5.5% (n=2,959 / 53,730) of active purification cases versus 5.6% (n=2,981 / 53,604) sham cases: odds ratio 0.98 (95% CI: 0.93 to 1.05), P=0.669). Treatment effect did not vary over the weeks in the randomized periods.

Conclusion:

Supplemental active purification did not reduce surgical wound infections or mortality in surgical patients. Infection-control efforts might better focus on limiting direct wound contamination.

Teoh, Y. C., Sadrizadeh, S., Senneby, E., Löndahl, J., Gram, A.

Portable air cleaners in neonatal facilities: Hybrid experimental-CFD assessment of different configurations.

Building and Environment, (2026)

Neonates are highly vulnerable to airborne infections, and respiratory illnesses remain a major cause of morbidity and mortality in neonatal facilities. Portable air cleaners (PACs) are increasingly used to reduce indoor particle concentrations, yet evidence remains limited on how different PAC configurations affect their performance. This study combines long-term onsite measurements in a neonatal patient room with computational fluid dynamics (CFD) simulations to evaluate different PAC configurations. Field measurements of particle concentrations were used to validate a detailed CFD model. The validated CFD model was then applied to investigate PAC placement, number of units, and clean air delivery rate (CADR). An additional case examined the effect of placing PAC under a table to reflect realistic space constraints. Both onsite measurements and CFD simulations consistently showed that PAC deployment reduced particle concentrations. Among the single-unit configurations, placing the PAC at the centre of the room achieved the greatest reduction, lowering the normalised particle concentration by 58.6% compared with the no-PAC baseline case. Doubling the CADR at this centre location further improved removal performance but introduced higher noise levels. Two-PAC configurations with higher combined CADR provided only marginal improvements over the optimal single-PAC configuration. Locating the PAC underneath a table did not noticeably degrade performance. Overall, these findings highlight that PAC performance in neonatal facilities depends strongly on strategic placement and operating conditions.
