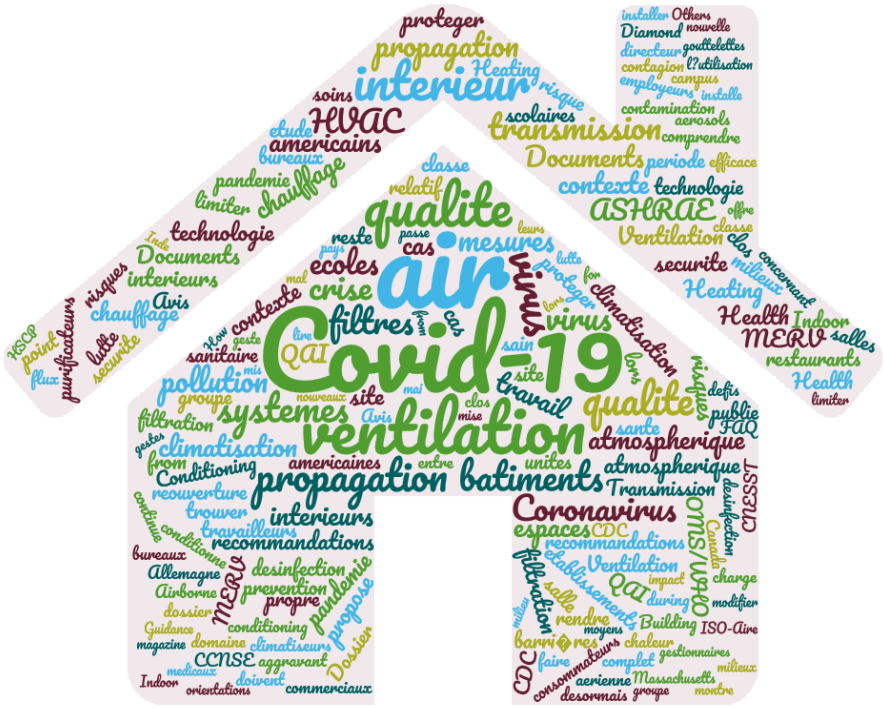

Bulletin de veille AéroCovid
N°129 – 14/01/2026

Objectif : *Air intérieur, ventilation, climatisation et propagation du Covid-19*

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Google Scholar, Lens et WoS

Mommert, M., Westhoff, A.

Aerosol transmission and air quality in a generic conference room – comparison of aerosol- and tracer-gas-based methods.

E3S Web Conf., Vol. **672**, (2025)

Assessing air quality indicators, including the age of air, by means of tracer-gas measurements is a prevalent technique used to evaluate the effectiveness of indoor ventilation systems. The COVID-19 pandemic has recently drawn attention to the transmission of pathogens via indoor air flows. Measurement techniques for the investigation and characterization of ventilation effects have moved from global to local measurements, using local aerosol sources and particle sensors to determine the aerosol dispersion of specific source-receptor combinations. The study at hand introduces a new test environment that can be used to carry out such investigations. It is a n modular conference room equipped with 20 thermal manikins that simulate the obstruction and heat release of a human body. The study further aims to determine the capacity to estimate air age using investigations that involve distributed or local tracer injections.

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Bang, J.-I., Choi, A., Rim, D., Sung, M.

Disinfection performance of upper-room UVGI in a multi-bed patient room: Experimental assessment using equivalent clean airflow.

Journal of Building Engineering, Vol. **119**, (2026)

Upper-room ultraviolet germicidal irradiation (UR-UVGI) is an established technology for controlling airborne pathogens, and its application has gained renewed attention following the COVID-19 pandemic. In hospital environments, both safety and quantitative performance should be carefully considered. This study experimentally evaluated the effectiveness of UR-UVGI in a full-scale multi-bed patient room using Bacillus subtilis (ATCC 6633) as a surrogate for airborne pathogens. Viable airborne bacteria were cultured and quantified to determine the equivalent air change rate (eACH), which was converted into equivalent clean airflow (ECAi) according to ASHRAE Standard 241. Experiments were conducted under two ventilation rates (2.5 h−1 and 6.9 h−1) and three UR-UVGI conditions: 1) OFF, 2) one-lamp, and 3) two-lamps. Considering the effect of UR-UVGI alone, relative improvements were approximately 44 % at 2.5 h−1 and 26 % at 6.9 h−1. Using the measured ventilation rates as a baseline, incremental eACH due to UR-UVGI ranged from 2.94 to 2.98 h−1 at 2.5 h−1 and 1.43–1.99 h−1 at 6.9 h−1. When accounting for total clean-air delivery, the 6.9 h−1 condition met the ASHRAE 241 criterion, while the 2.5 h−1 condition showed meaningful improvement and approached the criterion. Overall, these results demonstrate that UR-UVGI can significantly enhance clean-air delivery in under-ventilated patient rooms operating below the ASHRAE Standard 170 minimum requirement for healthcare buildings (≥4 ACH) and serves as an effective supplementary strategy. In practice, its performance may be further optimized when combined with improved air distribution and filtration.

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Moreno-Pérez, M. P. A., Sánchez, Y. C., Durán, N. R., Calderón, M. Á. K.

El ABC de los contaminantes emergentes en la salud humana; guía rápida de comprensión en el siglo XXI (ABC des polluants émergents dans la santé humaine ; guide rapide de compréhension au XXIe siècle.).

Dilemas contemporáneos: Educación, Política y Valores, (2026)

Los contaminantes emergentes (CE) son sustancias químicas, sintéticas o biológicas entre las que se encuentran productos farmacéuticos, productos de cuidado personal, hormonas, esteroides, pesticidas, retardantes de flama, surfactantes, aditivos de combustibles, nanomateriales y compuestos industriales. Los CE han llamado la atención en la comunidad científica porque se han detectado en múltiples ambientes, generando preocupación por su potencial peligro para los seres humanos y los ecosistemas, debido a la evidencia de sus efectos tóxicos. La remoción y eliminación de los CE no es fácil comparada con los contaminantes tradicionales y sobre esta esencia se desarrolla el presente trabajo.

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Quimbita-Quimbita, M. C., Salazar-Tigcilema, J. P., Llamusca-Aspiazu, E. F.

Estrategias Ambientales Para Prevenir Enfermedades Respiratorias En Los Profesionales De Salud En El Área Hospitalaria (Stratégies environnementales pour prévenir les maladies respiratoires chez les professionnels de santé dans le milieu hospitalier.).

Innova Science Journal, Vol. **3** n°(E1), (2025), 19-33 p.

Las enfermedades respiratorias representan un riesgo significativo para el personal de salud debido a su constante exposición a diversos factores ambientales en el entorno hospitalario. Esta revisión sistemática analizó estudios con nivel descriptivo-analítico, con modalidad documental y retrospectiva, publicados entre 2020 y 2025 en bases de datos biomédicas y académicas, con el objetivo de identificar los factores ambientales más relevantes y las estrategias implementadas para prevenir dichas enfermedades. Los resultados evidencian que los principales factores de riesgo se agrupan en tres categorías: químicos (formaldehído, xileno, compuestos orgánicos volátiles), biológicos (virus, bacterias y microorganismos en ambientes mal ventilados) y físicos (deficiencias en ventilación, humedad, polvo y mala calidad del aire). Entre las estrategias preventivas más destacadas se encuentran la mejora de los sistemas de ventilación y control ambiental, el uso adecuado de equipos de protección personal, la capacitación del personal sanitario y la implementación de protocolos de higiene y bioseguridad. Aunque la mayoría de los estudios presentan limitaciones metodológicas, los hallazgos refuerzan la necesidad de fortalecer las políticas de salud ocupacional, así como de impulsar investigaciones futuras con diseños más sólidos que permitan establecer relaciones causales. Se concluye que garantizar un ambiente hospitalario saludable contribuye a la protección de los profesionales de la salud, a la reducción del ausentismo laboral y a una mejor calidad de atención para los pacientes.

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Chen, H., Markusson, C., Ruud, S.

Impacts of ventilation designs on airborne particle transportation.

E3S Web Conf., Vol. **672**, (2025)

This study aimed to evaluate impacts of ventilation designs on indoor airborne transmission for mixing ventilation (MV) focusing on ventilation effectivness. Different flow rates (8 to 40 l/s), exhaust positions (high and low), source locations and effects of air cleaning were tested, and particle concentrations with different size fractions were measured. The results showed that the ventilation effectiveness was decreased with an increased flow rate, which was reduced from about 1.15 (with 8 l/s) to 0.9 (with 40 l/s) for a standard MV configuration. With 30 l/s the effectiveness was about 1. This trend was due to stratification with low flow rates and short-circuit related to high flow rates. Although lower flow rates showed greater ventilation effectivness at the compared locations, higher flow rates would always provide better dilution. This suggested that a balance between the contaminant dilution and removal should be considered when increasing flow rates to enable sufficient and effective ventilation. Moving the exhaust from the ceiling to floor level was less effective due to short-circuit. Placing the source close to, and under the exhaust helped to remove contaminants more efficiently. Air cleaning added significant impacts on ventilation to reduce particles for the supply flow rate of 15 l/s.

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Wu, X., Zhang, H., Ng, T. S. T., Lai, A. C. K.

Improving far-UVC disinfection efficiency in portable devices: Optical enhancement and agent-based lamps' layout optimization.

Building and Environment, Vol. **290**, (2026)

This study investigated a portable 222 nm far ultraviolet C (far-UVC) air disinfection device by progressing through three key phases: model validation, followed by sequential enhancement, and culminating in real-room validation. The irradiance prediction and Eulerian CFD disinfection models were validated by measurements, with an average error of <5 %. Based on this validation, a sequential enhancement strategy was developed. The addition of reflective anodized aluminum not only increased the volume-averaged irradiance from 112.4 to 169.3 μW/cm², but also altered the light distribution, resulting in an improvement in disinfection efficiency from 49.3 % to 61.6 %. Further optimization using an agent-based actor–critic algorithm increased the volume-averaged irradiance to 175.8 μW/cm², raised the uniformity index from 0.51 to 0.61, and lifted the single-pass efficiency to 66.4 %. Validation in a room-sized chamber at an airflow rate of 84 m³/h showed that applying the baseline single-pass efficiency of 49.3 % would yield a UVC-induced decay rate kuv of only 0.0333 min^{-1}, whereas the optimized device achieved 0.0466 min^{-1}—an improvement of about 39.9 %. These results confirm the effectiveness of irradiance enhancement and optimized lamp placement in improving device performance.

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Borham, B. E.-M., Abdel-Azeem, A.-a. F., El-Gamal, M. a.-M., Ibrahim, M. G.

Improving Indoor Air Quality in Closed Broiler Houses by Evaporating a Mixture of Some Essential Oils.

Egyptian Journal of Veterinary Sciences, (2025), 1-25 p.

It is scientifically proven that the air in broiler houses is vital, but the bacteria and fungi in the air cause serious health problems. Interestingly, vaporizing a mixture of some essential oils (MEOs) in broiler houses helps reduce air pollution. The main objective was to evaluate the synergistic effect of vaporizing different levels of MEOs at various time intervals and their interaction effect on indoor air quality of broiler houses. 1,080 Ross-308 chicks were randomly distributed in a completely randomized design into 4 groups (N = 270) in three replicates each (n=90). The results of GC/MS showed the presence of 35 chemical components in MEOs, the most important of which are: monoterpenes and sesquiterpenes, with a total percentage of 98.31%. In addition, MEOs exhibited strong synergistic activity against the microbial species tested, although its efficacy varied depending on the type of bacteria. The lowest MIC value was observed against S. aureus (1.875% v/v), indicating high efficacy even at low dilutions, while K. pneumoniae and B. cereus showed intermediate sensitivity (3.75% and 7.5% v/v). The evaporation of MEOs has improved the state of hygiene standards by reducing TBC and TFC in houses air. A significant positive effect of MEOs evaporation on productive and physiological performance measured at 35 d of age ($p \leq 0.05$). In conclusion, one of the most important findings of this study is that MEOs evaporation is an effective and safe method for improving air quality in closed broiler houses, where evaporation at a rate of 0.75 ml/L with an exposure period of 2 h was the most effective in terms of its ability to improve productive and physiological performance.

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Gameiro Da Silva, M.

An Interactive Biological Contaminant and CO2 Exposure Dose Calculation Tool.

E3S Web Conf., Vol. **672**, (2025)

An interactive computational tool based upon the differential equation modeling the time evolutions of the concentrations of both CO2 and a bio contaminant in an indoor uni-zone compartment was developed to

support teaching and training activities during the COVID-19 pandemic. It uses the finite differences formulation, calculating the concentration change along equally spaced sampling time instants. The calculation tool has been developed in the LabView programming software, benefitting from its good graphical display tools. It was designed to allow the change of the governing parameters during the simulation of cases, allowing an immediate perception of the effect of the introduced changes. It takes into account the impact of the following variables: emission rate of bio contaminant source, half-life time of bio contaminant, efficiency of protective mask wearied by the emitter, efficiency of protective mask worn by the receiver, fresh air flow rate, volume of the room, number of occupants in the room and respective corpulence data and metabolic rate, flow rate of an indoor installed air cleaner device and individual one-pass purification efficiency. For a previously defined duration running test, the tool displays the time evolutions of the concentrations of CO2 and the bio contaminant and the time history of the dose inhaled by a receiver with and without a protective mask. The results presented in the paper refer to a parametric study where the air exchange rate, the use of protective masks, and an air cleaning device were changed in a typical classroom with 20 occupants.

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Xu, R., Wu, F., Shen, L., Pan, X., Huang, Z., Yu, J.*, et al.*

Investigation of airborne transmission and thermal comfort in a train cabin: Effects of air change rate and supply mode.

Case Studies in Thermal Engineering, Vol. **76**, (2025)

Developing ventilation strategies that balance protection, comfort, and well-being is crucial for efficient train operations and enhanced passenger experience. Although raising the Air Change per Hour (ACH) can mitigate bioaerosol transmission, it may induce undesirable airflow disturbances and increase energy consumption. To elucidate the roles of ACH and large-scale airflow patterns, a three-dimensional computational fluid dynamics (CFD) model based on the Eulerian-Lagrangian approach is established. The study investigates the impacts of particle size, ventilation configuration, and airflow velocity on the cabin environment. Results indicate that simply intensifying ventilation does not consistently reduce aerosol deposition on passengers due to the asymmetric arrangement of seats and vents. Excessive ventilation (24 ACH) demonstrates clear diminishing returns in performance, whereas inadequate ventilation (6 ACH) significantly elevates aerosol concentration and infection risk. Compared with merely boosting the ventilation rate, optimizing the supply layout is more effective for achieving a safe and comfortable environment. At 12 ACH, the sidewall air supply mode outperforms the top air supply mode in controlling aerosol deposition on passengers, while lowering the airflow non-uniformity index by 20.0 % and the draught rate (DR) in the breathing zone by 32.1 %. These findings provide guidance for improving train cabin ventilation toward coordinated management of infection control, comfort, and energy utilization.

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Cappelli, G., Rapi, I., Dugheri, S., Fanfani, N., Traversini, V., Baldassarre, A.*, et al.*

Managing and monitoring indoor air quality and surface decontamination in healthcare environments.

Arhiv za higijenu rada i toksikologiju (Archives of Industrial Hygiene and Toxicology), Vol. **76** n°(4), (2025), 222-241 p.

Indoor air quality (IAQ) in healthcare facilities is a critical yet often underestimated factor associated with adverse health effects and increased risk of infectious outbreaks. Key pollutants include volatile organic compounds (VOCs), particulate matter, and various biological agents such as bacteria and viruses. While numerous variables contribute to IAQ, European regulations still have significant gaps, having historically focused more on individual substances than on the overall air environment. This review examines the most relevant IAQ parameters, current technologies available for their detection, and the regulatory landscape at the European level. Special attention is given to real-time monitoring systems. We also propose a concise operational guideline for IAQ management which combines continuous monitoring, evidence-based

mitigation, and improvements to reduce exposure, increase resilience to airborne and surface threats, and produce measurable safety outcomes for patients and healthcare personnel within hospital settings.

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Fernandes, S., Sengupta, R.

Pathogen Control System for Buildings.

medRxiv, (2025), 2025.

Background Environmental control systems in buildings are typically designed to maintain occupant comfort while minimizing energy use. However, the significant role of airborne pathogens in respiratory illness transmission has highlighted the imperative to address how these control systems can mitigate infection risk. Traditional CO2-based ventilation control does not necessarily correlate with infectious aerosol presence, limiting its effectiveness for pathogen mitigation.Objective To develop and evaluate a pathogen control system (PCS) that combines real-time pathogen sensing with in-duct germicidal ultraviolet (GUV) irradiation to reduce infection risk while maintaining energy efficiency and occupant comfort.Methods We developed a closed-loop control system using pathogen air quality (PAQ) sensors with hysteretic threshold control (7-20 copies/m3) to dynamically activate GUV systems achieving 99% single-pass inactivation efficiency. System performance was evaluated across four activity scenarios (1.33-750 copies/s generation rates) in a simulated 70 m3 office environment using eight complementary metrics: peak concentration (Cpeak), steady-state concentration (Css), clearance time improvement (Δtclear), time to safety (tsafe), cumulative inhaled dose (Dinh), infection risk probability (Prisk), equivalent clean air rate (ECAi), and energy consumption.Results In talking scenarios, the PCS reduced peak concentration from 40 to 22 copies/m3 (45% reduction), time to safety from 75 to 25 min (67% improvement), cumulative inhaled dose from 1.1×10−2 to 4.4×10−3 copies (60% reduction), and infection risk from 56.07% to 28.88%. In high activity scenarios, peaks decreased from 90 to 45 copies/m3, time to safety from 90 to 30 min, dose from 2.4×10−2 to 8.4×10−3 copies (65% reduction), and risk from 83.93% to 47.83% (43% relative reduction). Baseline active control increased ECAi from 108 to 191 m3/h, with geometric scaling enabling pathways to full ASHRAE 241 compliance (920-3,680 m3/h). System performance was robust across sampling intervals (30-300 s) while achieving 37-52% energy savings through duty-cycle operation.Significance This study provides the first comprehensive quantitative framework for sensor-based pathogen control in building environments. The demonstrated ability to achieve substantial infection risk reduction while maintaining energy efficiency supports the viability of pathogen-responsive building control as an effective intervention for indoor air quality management. Results establish fundamental design principles and performance benchmarks that can inform regulatory guidelines, building codes, and public health recommendations for pathogen control system deployment in the era of healthy buildings.Impact Statement This research addresses a critical gap in building environmental control by demonstrating how real-time pathogen sensing can enable targeted, energy-efficient disinfection strategies that traditional CO2-based systems cannot achieve. By providing quantitative evidence that sensor-based pathogen control systems can reduce infection risk by 43-67% across realistic occupancy scenarios while maintaining operational efficiency, this work establishes a scientific foundation for next-generation healthy building technologies. The systematic evaluation framework and performance benchmarks developed herein directly support evidence-ng based implementation of pathogen-responsive building control systems, contributing to improved occupant health outcomes and enhanced pandemic preparedness in built environments. These findings are particularly relevant for the Journal of Exposure Science and Environmental Epidemiology's focus on environmental health and exposure assessment, as they provide quantitative tools for evaluating and optimizing indoor air quality interventions that reduce infectious disease transmission risk.Competing Interest StatementThe authors have declared no competing interest.Funding StatementThis study did not receive any fundingAuthor DeclarationsI confirm all relevant ethical guidelines have been followed, and any necessary IRB and/or ethics committee approvals have been obtained.YesI confirm that all necessary patient/participant consent has been obtained and the appropriate institutional forms have been archived, and that any patient/participant/sample identifiers included were not known to anyone (e.g., hospital staff, patients or participants themselves) outside the research group so cannot be used to identify individuals.YesI understand that all clinical trials and any other prospective interventional studies must be registered with an ICMJE-approved registry, such as ClinicalTrials.gov. I confirm that any such study

reported in the manuscript has been registered and the trial registration ID is provided (note: if posting a prospective study registered retrospectively, please provide a statement in the trial ID field explaining why the study was not registered in advance).YesI have followed all appropriate research reporting guidelines, such as any relevant EQUATOR Network research reporting checklist(s) and other pertinent material, if applicable.YesData available upon request

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Chen, M., Lan, G., Li, T.

Spatiotemporal dynamics of exhaled aerosols in dental clinics: comparing heating systems and developing a novel pressure-driven dispersion model.

Developments in the Built Environment, Vol. **25**, (2026)

Dental clinics face high cross-infection risks due to aerosol-generating procedures. This study employed computational fluid dynamics to analyze indoor airflow and aerosol distribution in a typical dental clinic, evaluating two heating systems (warm air supply vs. radiator) and three ventilation strategies. A new metric was introduced to assess heating methods' impact on initial aerosol dispersion. Results demonstrated that warm air supply heating enhanced aerosol removal rate by up to 33.4 %, significantly lowering exposure risk for healthcare workers (HCWs). Conversely, radiator heating reduced aerosol removal rate to 10.9 % and increased deposition rate to 70.6 %, elevating surface-transmission risk. The highest aerosol deposition density on HCWs occurred with radiator heating and side vents (40.1 pc/m2), while the lowest was with warm air supply (4.1 pc/m2). These findings provide theoretical guidance for optimizing heating and ventilation to improve infection control in dental settings.

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