Bulletin de veille Maladies aéroportées
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Objectif : *Air intérieur, ventilation, climatisation et propagation des maladies aéroportées*

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Google Scholar, Lens et WoS

Ikeda, T., Takii, A., Yamakawa, M., Chung, Y. M., Kim, M.

Characterizing layout-dependent breathing-zone contaminant concentration in office spaces with mixing ventilation using an occupant-to-exhaust distance index: A parametric CFD study.

Building and Environment, (2026)

Office layouts can affect the accumulation and removal of occupant-generated contaminants, yet these effects remain insufficiently characterized across diverse occupant layouts and inlet/outlet arrangements using simple geometric descriptors. This study characterizes layout-dependent variations in ventilation performance using an occupant-to-exhaust distance index. We analyzed 198 cases covering different room sizes, ventilation airflow rates, desk arrangements, and two reciprocal inlet/outlet configurations. Using previously validated CFD airflow fields [A. Takii et al., Results Eng., 2026], we solved a steady passive-scalar transport equation for an idealized continuously emitted, air-following contaminant and evaluated ventilation-performance indices. The concentration distributions varied widely among layouts, affecting the magnitudes of the indices and their sensitivity to ventilation conditions. The occupant-to-exhaust distance index captured first-order variations in breathing-zone concentration. Within the present dataset, layouts above the estimated change point, , tended to exhibit higher normalized breathing-zone concentrations; thus, this value is interpreted as a dataset-specific screening boundary rather than a universal design criterion. Configurations that deviated from this trend were associated with wall proximity and occupant clustering, exhibiting recirculating or stagnant regions and elevated breathing-zone concentrations. These findings demonstrate the potential of a simple geometric index for preliminary screening of occupant–ventilation layouts. The applicability of these findings is limited to the tested windowless, relatively densely occupied offices with ceiling-mounted mixing ventilation, two reciprocal inlet/outlet configurations, and no air-conditioning recirculation.

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Sosa Zambrano, K. X., Cedeño Mendoza, R. E.

Estudio del Efecto de la Recirculación de Aire y la Concentración de CO2 en el Habitáculo Vehicular.

Reincisol, Vol. **6** n°(10), (2026)

This study analyzed the effect of air recirculation on carbon dioxide (CO_2) concentration in vehicle cabins, considering its relationship with indoor air quality, thermal comfort, and the energy efficiency of the air conditioning system. A structured literature review, with a descriptive and analytical approach, was conducted using searches carried out between May and July 2026 in Scopus, Google Scholar, SciELO, and ScienceDirect. Of the 134 records initially identified, 20 studies met the established inclusion criteria and comprised the final sample. The results showed that CO_2 concentration increases when air exchange decreases, especially under conditions of sustained recirculation, a higher number of occupants, and prolonged stays. It was also determined that recirculation can reduce the entry of particles from the outside and decrease the energy demand of the HVAC system, although these benefits may be accompanied by a greater accumulation of CO_2. A comparison of technical strategies showed that there is no single recirculation percentage applicable to all driving conditions. Variable ventilation systems with dynamic control, supported by CO_2 sensors and variables such as occupancy, heating/cooling demand, and outdoor air quality, offer better potential for balancing ventilation, comfort, and energy efficiency. It is concluded that the use of recirculation should be managed adaptively and not as a permanent operating condition.

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Elsarraj, M., Dunne, M., Rannard, D., Mahmoudi, Y., Keshmiri, A.

Experimental validation of a CFD model for an ultra-clean ventilation system in a UK operating theatre under HTM-03-01.

Building and Environment, Vol. **305**, (2026)

Ultra-clean ventilation (UCV) systems are used in operating theatres to reduce airborne contamination associated with surgical site infection risk by supplying downward unidirectional airflow over the surgical zone. In the UK, UCV commissioning is assessed against Health Technical Memorandum (HTM) 03–01 Part A (2021), with acceptance criteria defined for airflow velocity and particle entrainment. However, these tests rely on discrete probe locations and limited sampling heights, providing limited insight into the three-dimensional flow structures that govern velocity distribution and particle transport beneath UCV canopies. This study combines full-scale HTM-compliant measurements with computational fluid dynamics (CFD) to examine the relationship between HTM acceptance criteria and underlying airflow behaviour. Experimental testing was conducted beneath a Howorth UCV canopy in a UK operating theatre, including velocity mapping at 1 m and 2 m above floor level and particle entrainment testing using 0.3 µm aerosols released at prescribed HTM challenge positions. A CFD model was developed to reproduce the same commissioning conditions and simulate three-dimensional airflow and Lagrangian particle transport. The model showed close agreement with measured velocity data and reproduced particle penetration trends across the HTM challenge positions within experimental uncertainty. The UCV system satisfied all HTM acceptance criteria. This study demonstrates how validated CFD can reveal flow mechanisms underpinning commissioning metrics and provides a reproducible HTM-aligned benchmark dataset for future UCV model development and performance assessment.

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Satwikasari, A. F., Setyowati, E., Dwiyanto, A., Prianto, E.

Housing Spatial Configuration and Natural Ventilation as Environmental Determinants of Tuberculosis Transmission Risk: A Bibliometric–Systematic Review.

International Journal of Built Environment and Scientific Research, Vol. **10** n°(1), (2026), 77–96 p.

Household tuberculosis (TB) transmission is routinely attributed to overcrowding, poor ventilation, humidity and low housing quality. What the literature explains far less clearly is how the spatial configuration of a dwelling physically produces those exposure conditions. This review asks how existing studies connect housing form and thermal conditions to natural-ventilation performance and household TB risk, and where that chain of evidence breaks. We used a sequential two-phase design. Phase I mapped the intellectual structure of the field with VOSviewer, using network, density and overlay visualisations of Scopus records published between 2016 and 2026. Phase II followed PRISMA 2020: a broader, block-based search of Scopus, PubMed and ScienceDirect returned 626 records, of which 88 were read in full and 11 met the inclusion criteria. The bibliometric maps reveal three adjacent but weakly connected domains: inadequate housing and public health; architecture, building performance and computational fluid dynamics (CFD); and TB epidemiology and environmental risk. Environmental variables are usually handled as statistical predictors, while airflow simulation and performance-based ventilation metrics rarely reach household TB outcomes. The synthesis is therefore organised along the mechanistic pathway that runs from spatial configuration and thermal driving forces, through airflow distribution and ventilation performance, to indoor exposure and transmission risk. We propose a four-level hierarchy of ventilation evidence and a six-layer evidence framework that makes the missing links explicit. The clearest discontinuity lies between measured airflow and observed transmission, and it is widest in low-income, naturally ventilated housing in the humid tropics.

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Wang, G., Shi, H., Zhang, C., Pan, Y., Sun, C., Li, J.*, et al.*

A Lagrangian jet model and experimental investigation of expiratory airflow transport from moving occupants in thermally stratified indoor environments.

Journal of Building Engineering, Vol. **131**, (2026)

Human movement and indoor thermal stratification can jointly shape exhaled airflow dispersion, yet most exposure assessments still treat infectious sources as stationary, which may underestimate secondary exposure risks in pedestrian-intensive spaces. In this study, we proposed a Lagrangian buoyant jet (JETLAG) model to predict the trajectory, lock-up height, and decay characteristics of expiratory airflow from a moving person in a thermally stratified indoor environment. Full-scale environmental chamber experiments were also conducted using smoke visualization. The results showed that the JETLAG model captured two-stage expiratory airflow development: an initial forward impinging region followed by a backward wake region. Unlike stationary-source cases, the lock-up tendency of the moving expiratory jet occurred mainly in the wake region behind the moving person. Parametric analysis showed that increasing the jet velocity enhanced horizontal penetration but lowered the lock-up height, whereas faster walking suppressed vertical rise. Thermal stratification exerted the strongest control, reducing the lock-up height from 1.01 to 0.62 m as the temperature gradient increased from 1 to 5 °C/m. Decay analysis further revealed a decoupling mechanism: concentration dilution was governed mainly by momentum-driven turbulent entrainment, whereas the trajectory height and lock-up position were controlled by buoyancy and ambient thermal stratification. These findings indicate that human movement can shift exhaled airflow into a low-level lock-up region behind the moving source, potentially creating an additional exposure pathway along the movement path. The proposed JETLAG model provides an efficient, physically interpretable tool for dynamic exposure assessment and ventilation optimization in stratified indoor environments.

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Mang, T. S.

Photoinactivation: Introduction and Perspective.

In: Handbook of Antimicrobial Photoinactivation.

Springer Nature Switzerland; 2026. 1–18 p.

Light as a tool in therapeutic applications in medicine can be traced back to antiquity. Evidence of sensitizing organisms to ultraviolet light can be found in ancient writings, where plant compounds could ameliorate superficial disease manifestations when exposed to sunlight. These plant compounds most likely would have contained photosynthetic pigments that would absorb light energy, which would convert light energy into chemical energy. Hence, this is an early example of photodynamic interaction, where activation of the compounds could result from UV and visible illumination. Photobiology is a diverse field that seeks to understand the mechanisms of biological effects of light interaction with living organisms. In this regard, light refers to wavelengths that are visible to the human eye but also ultraviolet and infrared light. The field of photobiology encompasses a range of research disciplines, including UV radiation effects, photophysics, photochemistry, photosensitization, photomedicine, environmental photobiology, and bioluminescence, among other specialties. Light affects biological systems at the atomic level, and its impact also influences ecological populations. The fields of photochemistry and photophysics combine to demonstrate that, while photons do not carry sufficient energy to cause ionization of atoms or molecules, rather photons interact when they are absorbed and cause excitation of biomolecules. This concept, in part, is a fundamental aspect of light therapy in the application of photomedicine.

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