Bulletin de veille émissions d’aérosols par l’appareil respiratoire humain N° 24 – Novembre 2025

Objectifs : veille scientifique sur les émissions d’aérosols (gaz et particules) par l’appareil respiratoire humain (nez/bouche).

La validation des informations fournies (exactitude, fiabilité, pertinence par rapport aux principes de prévention, etc.) est du ressort des auteurs des articles signalés dans la veille. Les informations ne sont pas le reflet de la position de l’INRS. Les éléments issus de cette veille sont fournis sans garantie d’exhaustivité.

Les liens mentionnés dans le bulletin donnent accès aux documents sous réserve d'un abonnement à la ressource.

Les bulletins de veille sont disponibles sur le portail documentaire de l’INRS. L'abonnement permet de recevoir une alerte mail lors de la publication d’un nouveau bulletin (bouton « M’abonner » disponible après(1-4) connexion à son compte).

Kaplan O, Abkarian M, Mendez S.

How a table modulates the risk of airborne transmission between facing individuals.

Flow. 2025;5:21.

https://www.cambridge.org/core/services/aop-cambridge-core/content/view/CDE77686D4184E9FCF9156E65896FF2F/S2633425925100287a.pdf/div-class-title-how-a-table-modulates-the-risk-of-airborne-transmission-between-facing-individuals-div.pdf

Airborne transmission has been recognised as an important route of transmission for SARS-CoV-2, the virus responsible for the COVID-19 pandemic. While coughing and sneezing are major aerosol sources, asymptomatic transmission highlights the need to study other exhalation modes in social settings. Gathering around a table, a common scenario for human interactions, may influence airborne transmission by modifying the airflows. Here, we employ high-fidelity large-eddy simulations to investigate the effect of a table for periodic breathing conditions (Reynolds number $Re\approx 10^{3}$ - 3×10^{3}, Froude number $Fr\approx 17$ - 50) as well as during sudden, forceful exhalations at peak values of $Re\approx 1.2\times 10^{4}$ and $Fr\approx 70$, mimicking laughter. During downward exhalations, the distance between the source and the table defines a new length scale that constrains the natural spread of buoyant puffs and jets. The table limits forward particle transport but, in doing so, may increase particle concentrations reaching a recipient, raising transmission risks. Simulations of forceful exhalations, such as laughter, further show that the table acts as an inertial filter - intercepting medium-sized particles that would otherwise remain airborne. This introduces a cutoff size dependent on puff inertia, altering the resulting airborne particle size distribution.

Pallares J.

Buoyancy in the dispersion of aerosols exhaled during violent expiratory events. 2025.

https://conference.unsw.edu.au/content/dam/pdfs/unsw-canberra/engineering/2025-06-convection-workshop/2025-10-13ANCW_Pallares.pdf

Inhalation of aerosols released by infected individuals while talking, laughing, singing, breathing heavily, coughing, or sneezing is recognized as one of the main transmission pathways of COVID-19, as well as other infectious diseases caused by viruses and bacteria, such as human influenza (H1N1), avian influenza (H5N1), SARS, and tuberculosis. Therefore, studying how aerosols are generated, emitted, and dispersed is essential both for understanding the spread of these and future pathogens, and for developing effective, evidence-based strategies for protection, containment, and social distancing. Special attention is paid to dispersion in indoor environments, where the exposure to the inhalation of aerosols and, thus, the risk of infection, is higher than in outdoor situations. Buoyancy effects occur in the short-term, short-range dispersion, within 1–2 seconds after the relatively warm and humid unsteady turbulent jet of exhaled air is released into a typically cooler and drier environment. Beyond this brief period, ambient air currents, often driven by the combined influence of buoyancy and mechanical ventilation, take over, controlling the long-term, long-range transport of micron-sized aerosols that remain afloat.

Panao MRO.

Exploring infodynamics in the study of human aerosol droplet size distributions.

Phys Fluids. 2025;37(11):18.

https://pubs.aip.org/aip/pof/article-abstract/37/11/113313/3371414/Exploring-infodynamics-in-the-study-of-human?redirectedFrom=fulltext

Human respiratory aerosols have a significant influence on disease transmission and public health. However, the intrinsic mechanisms driving their size distribution remain poorly understood. This study introduces an infodynamic analysis to quantify the informational content (infodiversity) of aerosol size distributions from different respiratory activities (breathing, speaking, and coughing). By integrating experimental measurements with probabilistic physical modeling, this study reveals that human aerosols predominantly exhibit lognormal characteristics, often requiring multimodal representations involving mixtures of Lognormal, Gamma, and Weibull distributions. The results indicate that Lognormal distributions dominate aerosol size characterization (64.5%), followed by Weibull (21%), and Gamma (14.5%) distributions, quantified through differential informature values ranging from 0.21 to 5.48 nats. A novel composite normalized infodynamic gap metric was introduced, with a threshold of 0.01, to identify the best mechanistic convergence between the data and statistical models. These findings contribute to aerosol science by providing a rigorous theoretical framework to link microscopic aerosol production mechanisms to macroscopic health-relevant outcomes, thereby guiding future experimental and numerical studies aimed at disease mitigation.

Wang CT, Xu JC, Zhai HY, So LK, Guo H.

Impact of subject position and cough direction on indoor coughing droplet dispersion and transmission using large eddy simulations.

Build Environ. 2026;287:19.

https://www.sciencedirect.com/science/article/pii/S0360132325013745?via%3Dihub

Airborne transmission is an important route for infectious respiratory diseases, yet its dynamics beyond short-range distances remain underexplored. In this study, we investigated full-range transmission using large eddy simulations (LES), validated by particle image velocimetry (PIV) experiments, considering two subject positions and two cough directions. Within the short range (up to 2 m/20 s), airborne droplet concentrations decreased by one order of magnitude for every 0.5 m from the source, regardless of subject position or cough direction. In the medium (2-4 m/60 s) and long range (> 4 m), concentrations declined more gradually by two orders of magnitude, with subject position significantly influencing spatial distribution, but cough direction having little effect. Coughs originating from the center of the room resulted in much higher concentrations in the front half compared to the back, even after 600 s of mixing. In the short range, infection risk at the adult height of 1.6 m was substantially higher than at the child height of 1.2 m, whereas inclined coughs posed a greater risk to children than horizontal coughs. In the medium and long range, infection risks for adults and children were similar.