Bulletin de veille émissions d'aérosols par l'appareil respiratoire humain N° 25 – Décembre 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.

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Hilger A, Stockman T, Murphey C, McCurdy J, Miller S.

The influence of glottal and respiratory factors on aerosol emission during phonation.

PLoS One. 2025;20(12):14.

https://journals.plos.org/plosone/article/file?id=10.1371/journal.pone.0321909&type=printable

Introduction Speech-driven aerosol generation plays a key role in airborne disease transmission, yet the physiological mechanisms remain poorly understood. Beyond vocal-fold vibration, airflow and glottal configuration may be key determinants. We tested how phonation type affects aerosol generation while accounting for ventilatory output estimated from exhaled CO2.Methods Five healthy female adults (22-43 years) sustained vowels across six phonation types: modal register, glottal fry, falsetto register, forced whisper, loud modal register, and vowels preceded by/h/. Aerosol concentration and size distribution (0.1-20 mu m) were measured using an aerodynamic particle sizer (APS). Laryngoscopy, conducted in a separate session, was used to estimate the normalized glottal gap during the open phase of phonation (NGG). Exhaled CO2 range was recorded concurrently as a control for ventilatory variation across tasks.Results Phonation types that had greater ventilatory output and a larger open-phase glottal gap (e.g., forced whispering, loud modal register) produced the highest aerosol concentrations; types with less ventilatory output and smaller open-phase glottal gap (e.g., glottal fry and modal register) produced the lowest. Submicron particles (0.1-1 mu m) dominated across conditions. Forced whispering exhibited a bimodal aerosol distribution, with increased emissions at both the smallest (0.1-1 mu m) and largest (10-20 mu m) particle sizes. Despite the assumption that vocal fold vibration is necessary for aerosol production, whispering, a voiceless sound production, generated a high concentration of particles, suggesting a primary role for airflow and glottal configuration. Normalized glottal gap was the strongest predictor of aerosol output, and CO2 range

(ventilatory output) was also positively associated.Conclusion Sustained sound production can generate substantial aerosols even without vocal fold vibration. The strong association between normalized glottal gap and aerosol output indicates that airflow and glottal configuration, rather than vibration alone, are primary contributors under these task conditions.

Nava GW, Szczepanska A, Ng LJ, Khan S, Hamilton F, Scott R, et al.

Determinants of respiratory tract aerosol generation in a diverse clinical population: an observational study.

BMJ Open Respir Res. 2025;12(1):7.

https://bmjopenrespres.bmj.com/content/bmjresp/12/1/e003494.full.pdf

Rationale Respiratory tract infections are transmitted in part by infectious aerosol. Developing a greater understanding of how clinical and demographic factors affect aerosol generation could help to identify airborne infection 'superspreaders'.Objectives To measure respiratory aerosol from a diverse clinical population, exploring the impact of demographics, physiological factors and disease status.Methods We recruited people with chronic lung disease, respiratory infection and healthy volunteers. We sampled aerosol from an enclosed circuit to exclude background non-respiratory aerosol, uniquely enabling bedside measurements of respiratory aerosol generation from an unwell population, while participants performed simple manoeuvres such as speaking and coughing.Measurements and main results Across 128 participants, we detected lower aerosol generation among patients with a lung disease during a forced expiratory manoeuvre. This is likely to be related to differences in forced exhalation rather than demographic or clinical status. We observed a 500-fold variation in peak aerosol production when coughing. There was an association between aerosol generation and higher body mass index during coughing, but not with other clinical or demographic factors, and most of the variation remained unexplained.Conclusions Our measurement of respiratory aerosol generation from patients with lung disease and infection is comparable with those published previously for healthy subjects. The amount of aerosol generation across the studied population was most closely linked with expiratory flow. While we observed variation in respiratory aerosol generation between participants in a clinical environment, there was no meaningful impact of demographics or respiratory disease on aerosol generation.

Saccente-Kennedy B, Szczepanska A, Harrison J, Archer J, Watson NA, Orton CM, et al.

Mitigation of Respirable Aerosol Particles from Speech and Language Therapy Exercises.

J Voice. 2025;39(5):1267-75.

https://www.sciencedirect.com/science/article/pii/S0892199723001248?via%3Dihub

Introduction. Phonation and speech are known sources of respirable aerosol in humans. Voice assessment and treatment manipulate all the subsystems of voice production, and previous work (Saccente-Kennedy et al., 2022) has demonstrated such activities can generate >10 times more aerosol than conversational speech and 30 times more aerosol than breathing. Aspects of voice therapy may therefore be considered aerosol generating procedures and pose a greater risk of potential airborne pathogen (eg, SARS-CoV-2) transmission than typical speech. Effective mitigation measures may be required to ensure safe service delivery for therapist and patient. Objective. To assess the effectiveness of mitigation measures in reducing detectable respirable aerosol produced by voice assessment/therapy. Methods. We recruited 15 healthy participants (8 cis-males, 7 cis-females), 9 of

whom were voice-specialist speech-language pathologists. Optical Particle Sizers (OPS) (Model 3330, TSI) were used to measure the number concentration of respirable aerosol particles (0.3 mm-10 mm) generated during a selection of voice assessment/ therapy tasks, both with and without mitigation measures in place. Measurements were performed in a laminar flow operating theatre, with near-zero background aerosol concentration, allowing us to quantify the number concentration of respiratory aerosol particles produced. Mitigation measures included the wearing of Type IIR fluid resistant surgical masks, wrapping the same masks around the end of straws, and the use of heat and moisture exchange microbiological filters (HMEFs) for a water resistance therapy (WRT) task. Results. All unmitigated therapy tasks produced more aerosol than unmasked breathing or speaking. Mitigation strategies reduced detectable aerosol from all tasks to a level significantly below, or no different to, that of unmasked breathing. Pooled filtration efficiencies determined that Type IIR surgical masks reduced detectable aerosol by 90%. Surgical masks wrapped around straws reduced detectable aerosol by 96%. HMEF filters were 100% effective in mitigating the aerosol from WRT, the exercise that generated more aerosol than any other task in the unmitigated condition. Conclusions. Voice therapy and assessment causes the release of significant quantities of respirable aerosol. However, simple mitigation strategies can reduce emitted aerosol concentrations to levels comparable to unmasked breathing.