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Asiboroko, O.-E. E., Alfred, A.

## [Air Quality and Microbial Contamination of Hospital Environments in Warri and Its Environs.](#)

Asian Journal of Biology, Vol. **22** n°(5), (2026), 106-116 p.

The quality of air in healthcare environments has become a major public health concern globally, particularly as it relates to the transmission of airborne diseases and hospital-acquired infections (HAIs). The study assessed the microbial contamination and air quality of selected hospital environments in Warri and its environs, with a focus on identifying the types and concentrations of airborne microorganisms, to determine their compliance with World Health Organization (WHO), National Environmental Standards and Regulations Enforcement Agency (NESREA), and Standards Organization of Nigeria (SON) guidelines. Airborne pollutants such as particulate matters (PM<sub>2.5</sub> and PM<sub>10</sub>), carbon dioxide (CO<sub>2</sub>), volatile organic compounds (VOCs), methane (CH<sub>4</sub>), and microbial contaminants were measured using Aeroqual Series 500 monitors and passive culture plate exposure respectively. Results revealed elevated indoor temperatures (29.1°C–32.8°C) and poor ventilation in several departments, especially administrative and emergency units, which corresponded with higher pollutant levels. Hazardous levels of methane (up to 4381 ppm) and VOCs (up to 9458 ppm) were detected, far exceeding recommended indoor limits. Bacterial and fungal analyses identified *Bacillus* spp., *Staphylococcus aureus*, *Proteus mirabilis*, *Enterobacter* spp., and airborne fungi such as *Aspergillus niger*, *Alternaria* spp., and *Rhizopus* spp. The study established a positive correlation between poor indoor air quality indicators and elevated microbial loads, suggesting a significant risk for hospital-acquired infections (HAIs). These findings highlight the urgent need for continuous air monitoring, improved Heating, Ventilation and Air Conditioning (HVAC) systems, and targeted interventions such as High-Efficiency Particulate Air (HEPA) filtration and microbial surveillance, particularly in high-risk zones.

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Barkoci, P., D'costa, W., Verlander, N. Q., Yaxley, N., Moore, G.

## [Assessing the generation and dispersal of respiratory particles using upper respiratory commensal bacteria as index organisms for respiratory pathogens.](#)

Research Square, Vol. **15** n°(1), (2025)

There is a need to better understand the dispersal and spread of respiratory pathogens. However, carrying out controlled microbiology-based simulation studies is difficult, particularly if the target organism is highly pathogenic or is currently unknown. An alternative approach is to use commensal upper respiratory tract (URT) bacteria as index organisms. Healthy volunteers were asked to perform defined respiratory activities within a purpose-built flexible-film isolator. The dispersal of large (L-RPs) and small respiratory particles (S-RPs) was assessed via passive (settle plates) and active air sampling, respectively. Activities were carried out with or without a face covering. Dispersal of respiratory particles differed with individual. During speech, increased vocal volume was associated with a significant increase in the number of URT bacteria deposited as L-RPs and captured by air samplers (S-RPs). Disposable (IIR) medical face masks significantly reduced deposition of L-RPs and reduced the odds of recovering higher numbers of S-RPs by 87% (CI: 63%, 96%). Transparent face coverings were as effective as (IIR) face masks, but face shields had limited efficacy, particularly when worn by individuals who dispersed high numbers of IRPs. Commensal URT bacteria can be used to study the risk of respiratory transmission in the absence of the target pathogen.

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Wu, J., Xu, X., Yang, L., Yuan, J., Wu, C., Deng, G., *et al.*

**Biosynthesized CdSe nanoparticles with antimicrobial activity: a dual-crosslinked coating for HVAC air filtration.**

Appl Surf Sci, Vol. **743**, (2026)

Biofilm contamination on HVAC filters compromises indoor air quality, yet conventional metal antimicrobial coatings are hampered by poor biofilm matrix penetration and metal ion leaching. Here, we address both limitations by using *Meyerozyma guilliermondii* PG-1 to biosynthesize CdSe nanoparticles (Bio-CdSe,  $11.47 \pm 0.39$  nm). The biogenic organic corona simultaneously suppresses Cd<sup>2+</sup> release and enhances visible-light antimicrobial activity. Bio-CdSe achieved MICs of 0.859–6.875 µg/mL against Gram-positive (*S. aureus*, *B. subtilis*) and Gram-negative (*P. aeruginosa*, *E. coli*) bacteria, 8–368-fold lower than copper-based controls, with complete *P. aeruginosa* killing in 3 h. Notably, a biofilm-selective mode was discovered: sub-MIC (0.215 µg/mL) suppressed biofilm formation by >31% without affecting planktonic growth, and mature biofilms were disrupted at >10-fold lower concentrations than silver coatings. Bio-CdSe was immobilized on PET nonwoven via glutaraldehyde-chitosan dual-crosslinking, retaining >99% of nanoparticles after 20 wet-dry cycles and >86% antibacterial efficacy after five reuses. Safety assessment revealed Cd<sup>2+</sup> leaching of only 1.248 µg/L (600-fold lower than CuO filters), algal EC<sub>50</sub> >40 µg/mL, risk quotient <0.025, and inhalation exposure 200–500-fold below OSHA/NIOSH limits. This work demonstrates a sustainable biosynthesis-driven strategy for biofilm-targeting antimicrobial coatings to safeguard indoor air quality.

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Sun, Y., Tran, T., Huang, C. Y., Brenner, L., Nguyen, T., Alsulami, S., *et al.*

**D105-01 Impact of HVAC Systems on Detection of Respiratory Syncytial Virus, Influenza, and SARS-CoV-2 in Elementary School Classrooms.**

American Journal of Respiratory and Critical Care Medicine, Vol. **212** n°(Supplement\_1), (2026)

Adequate ventilation, often achieved with central heating, ventilation, and air conditioning (HVAC) systems, is necessary to reduce indoor viral transmission; however, the actual impact on viral detection within schools are unknown. In this study, we aim to assess the impact of central HVAC systems on the presence of SARS-CoV-2, influenza, and respiratory syncytial virus (RSV) within elementary classrooms. As a part of the School Inner City Air Study (ClinicalTrials.gov NCT05953233), 177 vacuumed dust samples were collected monthly from March - June 2025 from all 45 classrooms across two schools within the same zip code in the Northeastern US - one with central HVAC and the other relying solely on windows and window air conditioning units for passive ventilation. Nucleic acid extraction was performed using the Maxwell HT Viral TNA Kit (Promega) on the Kingfisher Flex platform. Multiplexed real-time quantitative PCR was performed to simultaneously detect SARS-CoV-2, influenza A, influenza B, and RSV over 45 cycles of replication, with a cycle threshold <40 considered positive. Generalized linear mixed effect models were used to model the effect of central HVAC system on viral detection, adjusting for season, class dimensions (m<sup>3</sup>), and number of students per class, as well as random effects for classrooms and school. Viral detection was high across both schools, with overall prevalence rates of 78.5% for SARS-CoV-2, 48.6% for RSV, 7.3% for influenza A, and 17.5% for influenza B (Figure 1). Temporal trends in detection could be seen in all viruses across the study period. Presence of central HVAC system was not associated with a decreased likelihood of detection for SARS-CoV-2 (OR 2.40, 95% CI 0.73-7.94, p = 0.151), and RSV (2.15, 95% CI 0.84 - 5.55, p = 0.112), and was associated with increased likelihood of detection of Influenza A and B (OR 4.64, 95% CI 1.27-16.92, p = 0.020). Despite sampling during the spring, detection of SARS-CoV-2, influenza and RSV in elementary schools remain high. Presence of central HVAC systems was not associated with reduced virus exposure in elementary classrooms. These findings underscore the need for further research on indoor air quality interventions to mitigate viral exposures in school environments. This abstract is funded by: National Institute of Health, American Lung Association

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Liu, W., Wang, M., Xie, Z., Lu, Y., Hu, G., Lin, J., *et al.*

[Effects of non-thermal plasma on disinfection of indoor air and reduction of particulate matter.](#)

Scientific Reports, (2026)

Indoor airborne microorganisms and particulate matter (PM) are associated with respiratory infections and non-communicable diseases, posing a significant public health concern. This study evaluated the effectiveness of non-thermal plasma (NTP) for air disinfection and PM removal under real-world conditions. Chamber experiments were conducted using air artificially contaminated with PM, and reduction rates were compared between NTP and control groups. Field investigations were performed in an unoccupied classroom and a clinic during normal operation, and airborne bacterial concentrations, PM levels, and influence of human activities and environmental factors were evaluated. The results showed that a 30-min NTP treatment reduced approximately 90% of PM<sub>2.5</sub> concentration in the chamber, after adjustment for natural decay. Under unoccupied conditions, airborne bacterial concentrations were significantly decreased after 90 min of NTP disinfection, when compared with no treatment. Under occupied conditions, although human activities increased bacterial and PM levels, both indicators declined with prolonged disinfection duration. The highest bacterial load occurred in the 1.1–2.1- $\mu$ m particle-size fraction. Thus, controlling the number of occupants and minimizing unnecessary door opening during clinical procedures may enhance disinfection efficiency. Overall, NTP effectively inactivated airborne bacteria and removed PM, showing promising potential for improving indoor air quality and reducing airborne disease transmission risks.

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Vieira, V. M., Xia, Y., Bartell, S.

[Elementary school classroom attendance rates in a randomized crossover trial with portable HEPA air cleaners.](#)

Available at SSRN 6760763, (2026)

The goal of this study was to assess the benefits of improved air filtration in elementary schools via the use of standalone High-Efficiency Particulate Air (HEPA) cleaners. In this classroom-level crossover randomized controlled trial, 435 instructional classrooms in 17 Los Angeles Unified School District elementary schools received the HEPA filter intervention during one of two school years (2022-23 and 2023-24). The schools were already using minimum efficiency reporting value (MERV) 13 filters in their HVAC systems because of COVID-19. Epidemiologic analyses were conducted to examine the effect of the intervention on (1) student attendance days by classroom and (2) parental report of asthmatic children's weekly asthma events and respiratory symptoms in a smaller feasibility study during twelve weeks of 2023-2024. The final analytic dataset included 639 classroom-years of attendance records, and 190 parent-weeks of student symptom reports. For the classroom attendance analyses, the rate ratio and 95% confidence interval for the effect of the HEPA filter treatment on attendance rate adjusted for 2021-22 baseline attendance was 1.000 (0.997, 1.003). In our feasibility study of student symptoms, there were 19 parental reports included in the analysis. The average symptom count among students in treatment classrooms per week was 2.24 (SD = 2.78) compared to 2.67 (SD = 3.17) for students in control classrooms, although the difference by treatment group was not statistically significant (Cochran's Q:  $\chi^2 = 0.035$ ,  $p = 0.85$ ). The results of this study suggest that the improvements in classroom air quality achieved with additional HEPA filtration over MERV 13 may be too small to have an impact on classroom attendance. Further studies of longitudinal symptom assessments with more participants are needed to better understand any health impacts from additional HEPA filtration in classrooms.

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Vukotić, A., Mesihović, A., Semić, A., Karakaš, S., Mulić, M., Marić, M.

[Legionella spp. In air-conditioning systems of public facilities in the Sarajevo canton: the role of management and employee absenteeism.](#)

Zdravstveni glasnik, Vol. 12 n°(1), (2026), 31-43 p.

Introduction: Legionella spp. is opportunistic pathogenic bacteria that cause two forms of the disease: more severe, more frequently diagnosed-Legionnaires' disease, and milder, less frequently diagnosed Pontiac fever. Research objectives: The primary objective of the study was to examine the presence of Legionella spp. in the air conditioning systems of the studied facilities. Methods: The study was conducted in the Sarajevo Canton, Federation of Bosnia and Herzegovina. The research included air conditioning systems in public facilities. Sampling was carried out over a two-year period. Water samples and samples collected using the wet swab method were obtained. The samples were laboratory analyzed for the presence of Legionella spp. in accordance with a standard method. During the period of sample analysis, the laboratory was undergoing accreditation in accordance with the relevant standard. A survey was also conducted in the included facilities. Results: Legionella spp. was detected in air conditioning devices of 8 (21%) facilities. No relation was established between knowledge, external education and management with bacterial colonization. Internal training of employees is carried out in three (37.5%) facilities compared to eight facilities in which bacteria were detected ( $p < 0.05$ ). Also, bacteria detected in 4 (40%) facilities where employee absenteeism was associated with respiratory diseases ( $p < 0.05$ ). Conclusion: The results emphasize the need for a systemic approach to risk management and the improvement of practices that contribute to safer stay of users and employees in the air-conditioned spaces of public facilities in the Sarajevo Canton.

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Yooyen, S., Pohsa, A., Hayeema, A., Fuengfung, J., Sookpordee, P., Saipaisri, C., *et al.*

[Ozonation effectiveness on the mitigation of airborne microorganisms and particulate matter for enhanced indoor air quality.](#)

Environmental Pollutants and Bioavailability, Vol. **38** n°(1), (2026)

The efficacy of gaseous ozonation in eliminating indoor air pollutants has been investigated to improve indoor air quality. The ozone generator was operated until the air conditioning room attained ozone concentrations of 25, 50 and 75 ppm for 15 minutes. Rooms exposed to all ozone concentrations were efficacious in eradicating microorganisms and particulate matter (PM) within the air-conditioned room, with the level of elimination contingent upon the ozone concentration and duration of the test. Among these investigations, the 75 ppm ozone condition was the most efficacious in diminishing room microbe numbers. Ozone gas activity exerted a more pronounced effect on diminishing the number of PM. PMs within the 1.0–5.0  $\mu\text{m}$  range were 75%–90% eliminated following the attainment of ozone levels of 75 ppm. This inquiry suggests that pre-treatment of the air with ozone can improve the indoor air quality and make it safer for occupants.

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