Rapport de veille n° 87

Aéraulique et COVID-19

28/02/2024

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Google Scholar, Lens et WoS

Abdulrahman, G., Diego, P., Harpinder, K., Sonica, S.
Aerosol Generating Procedures and Associated Control/Mitigation Measures: A position paper from the Canadian Dental Hygienists Association and the American Dental Hygienists' Association.
American Dental Hygienists' Association, Vol. **98** n°(1), (2024), 6 p.

Background Since the outbreak of COVID-19, how to reduce the risk of spreading viruses and other microorganisms while performing aerosol generating procedures (AGPs) has become a challenging question within the dental and dental hygiene communities. The purpose of this position paper is to summarize the existing evidence about the effectiveness of various mitigation methods used to reduce the risk of infection transmission during AGPs in dentistry.Methods The authors searched six databases, MEDLINE, EMBASE, Scopus, Web of Science, Cochrane Library, and Google Scholar, for relevant scientific evidence published in the last ten years (January 2012 to December 2022) to answer six research questions about the the aspects of risk of transmission, methods, devices, and personal protective equipment (PPE) used to reduce contact with microbial pathogens and limit the spread of aerosols.Results A total of 78 studies fulfilled the eligibility criteria. There was limited literature to indicate the risk of infection transmission of SARS-CoV-2 between dental hygienists and their patients. A number of mouthrinses are effective in reducing bacterial contaminations in aerosols; however, their effectiveness against SARS-CoV-2 was limited. The combined use of eyewear, masks, and face shields are effective for the prevention of contamination of the facial and nasal region, while performing AGPs. High volume evacuation with or without an intraoral suction, low volume evacuation, saliva ejector, and rubber dam (when appropriate) have shown effectiveness in reducing aerosol transmission beyond the generation site. Finally, the appropriate combination of ventilation and filtration in dental operatories are effective in limiting the spread of aerosols.Conclusion Aerosols produced during clinical procedures can potentially pose a risk of infection transmission between dental hygienists and their patients. The implementation of practices supported by available evidence are best practices to ensure patient and provider safety in oral health settings. More studies in dental clinical environment would shape future practices and protocols, ultimately to ensure safe clinical care delivery.

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Zhang, Y., Nannu Shankar, S., Vass, W. B., Lednicky, J. A., Fan, Z. H., Agdas, D.*, et al.*
Air change rate and SARS-CoV-2 exposure in hospitals and residences: A meta-analysis.
Aerosol Science and Technology, Vol. **58** n°(3), (2024), 217-243 p.

As COVID-19 swept across the globe, increased ventilation and implementation of air cleaning were emphasized by the US CDC and WHO as important strategies to reduce the risk of inhalation exposure to the virus. To assess whether higher ventilation and air cleaning rates lead to lower exposure risk to SARS-CoV-2, 1274 manuscripts published between April 2020 and September 2022 were screened using key words ?airborne SARS-CoV-2 or ?SARS-CoV-2 aerosol.? Ninety-three studies involved air sampling at locations with known sources (hospitals and residences) were selected and associated data were compiled. Two metrics were used to assess exposure risk: SARS-CoV-2 concentration and SARS-CoV-2 detection rate in air samples. Locations were categorized by type (hospital or residence) and proximity to the location housing the isolated/quarantined patient (primary or secondary). The results showed that hospital wards had lower airborne virus concentrations than residential isolation rooms. A negative correlation was found between airborne virus concentrations in primary-occupancy areas and air changes per hour (ACH). In hospital settings, sample positivity rates were significantly reduced in secondary-occupancy areas compared to primary-occupancy areas, but they were similar across sampling locations in residential settings. ACH and sample

positivity rates were negatively correlated, though the effect was diminished when ACH values exceeded 8. While limitations associated with diverse sampling protocols exist, data considered by this meta-analysis support the notion that higher ACH may reduce exposure risks to the virus in ambient air. Copyright ? 2024 American Association for Aerosol Research

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Satheesan, M. K., Tsang, T. W., Wong, L. T., Mui, K. W.
The air we breathe: Numerical investigation of ventilation strategies to mitigate airborne dispersion of MERS-CoV in inpatient wards.
Heliyon, Vol. **10** n°(4), (2024)

Ventilation strategies for infection control in hospitals has been predominantly directed towards isolation rooms and operating theatres, with relatively less emphasis on perceived low risk spaces, such as general wards. Typically, the ventilation systems in general wards are intended to optimize patient thermal comfort and energy conservation. The emission of pathogens from exhalation activity, such as sneezing, by an undiagnosed infectious patient admitted to general wards, is a significant concern for infection outbreaks. However, the ventilation guidelines for general wards with respect to infection control are vague. This research article presents a numerical study on the effect of varying air change rates (3 h−1, 6 h−1, 9 h−1, 13 h−1) and exhaust flow rates (10%, 50% of supply air quantity) on the concentration of airborne pathogens in a mechanically ventilated general inpatient ward. The findings imply that the breathing zone directly above the source patient has the highest level of pathogen exposure, followed by the breathing zones at the bedside and adjacent patients close to the source patient. The dispersion of pathogens throughout the ward over time is also apparent. However, a key difference while adopting a lower ACH (3 h−1) and a higher ACH (13 h−1) in this study was that the latter had a significantly lower number of suspended pathogens in the breathing zone than the former. Thus, this research suggests high ventilation rates for general wards, contrary to current ventilation standards. In addition, combining a higher air change rate (13 h−1) with a high exhaust flow rate (50% of supply air) through a local exhaust grille dramatically reduced suspended pathogens within the breathing zone, further mitigating the risk of pathogen exposure for ward users. Therefore, this study presents an effective ventilation technique to dilute and eliminate airborne infectious pathogens, minimizing their concentration and the risk of infection.

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Bhagat, R. K., Dalziel, S. B., Wykes, M. S. D., Linden, P. F.
Building Ventilation: The Consequences for Personal Exposure.
Annual Review of Fluid Mechanics, Vol. **56**, (2024), 405-434 p.

Ventilation is central to human civilization. Without it, the indoor environment rapidly becomes uncomfortable or dangerous, but too much ventilation can be expensive.We spend much of our time indoors, where we are exposed to pollutants and can be infected by airborne diseases. Ventilation removes pollution and bioaerosols from indoor sources but also brings in pollution from outdoors. To determine an appropriate level of ventilation and an appropriate way of providing it, one must understand that the needs for ventilation extend beyond simple thermal comfort; the quality of indoor air is at least as important. An effective ventilation system will remove unwanted contaminants, whether generated within the space by activities or by the simple act of breathing, and ensure that the ventilation system does not itself introduce or spread contaminants from elsewhere. This review explores how ventilation flows in buildings influence personal exposure to indoor pollutants and the spread of airborne diseases.

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Makris, R., Kopic, C., Schumann, L., Kriegel, M.

A Comprehensive Index for Evaluating the Effectiveness of Ventilation-Related Infection Prevention Measures with Energy Considerations: Development and Application Perspectives.
Indoor Air, Vol. **2024**, (2024)

In the wake of the COVID-19 pandemic, prioritizing indoor air quality has emerged as a crucial measure for preventing infections. Effective ventilation is vital in mitigating airborne pathogen transmission and maintaining a healthy indoor environment by diluting and removing infectious particles from enclosed spaces. However, increasing the supply of pathogen-free air to enhance infection control can lead to a rise in energy consumption. Nevertheless, evaluating the overall efficacy of ventilation-based infection prevention strategies while considering their energy requirements has posed challenges. This scientific paper introduces the ICEE (Infection Control's Energy Efficiency) index, a newly developed simple integrated index to assess the effectiveness of ventilation strategies in reducing infection risks while accounting for associated energy demands. The paper reviews the current understanding of ventilation strategies, their impact on infection prevention, and their corresponding energy consumption. By employing a straightforward analytical approach, this metric offers a comprehensive framework to optimize ventilation systems for both infection prevention and energy efficiency. To quantify infection risk, a simplified equation model is utilized, incorporating factors such as ventilation effectiveness and filter efficiency, in case of recirculation. Energy demand is determined using approximations and relevant values from existing literature. Reference cases are defined, distinguishing between natural and mechanically ventilated scenarios, as these reference situations influence the energy-related effects of any implemented measures. The paper outlines the methodology employed to develop the index and illustrates its applicability through exemplary measures. The proposed index yields valuable insights for the design, operation, and retrofitting of ventilation systems, enabling informed decision-making towards fostering a healthier and more sustainable built environment.

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Mohammad, A. L. R., Wang, L., Zhou, H.
A computational fluid dynamics approach for hospitalization at home during the pandemic.
ASME 2023 International Mechanical Engineering Congress and Exposition. October 29–November 2, 2023. New Orleans, Louisiana, USA

Recently due to the COVID-19 pandemic, caused by the SARS-COV-2 virus which spreads via airborne transmission, there has been greater attention on the concept of acute hospitalization at home (HaH). Whilst HaH has been investigated for over three decades, the need for development of this method was highlighted by the pandemic which overloaded tertiary (hospital) health care services. HaH requires advanced medical equipment that is not always readily available for non-wealthy households; however middle-class households have the means to purchase less advanced ventilation equipment to treat the air, for example, using HEPA filters in a particulate air cleaner (CC 410). To assess the ventilation efficiency, Computational Fluid Dynamics (CFD) modelling using ANSYS CFX 2022 R2 is applied and then validated experimentally to ensure the reduction of CO2 concentration in the HaH space in terms of age of air (AoA). Additionally, thermal comfort parameters were assessed using CFD modelling and validated experimentally. The predicted mean vote (PMV) and percentage dissatisfaction (PPD) while running the device were aligned with the ASHRAE 55 standard to ensure users would not switch off the device based on dissatisfaction or discomfort. The results show that the device improved the AoA in 105 seconds of the time of CO2 produced by one of the occupants in the room. This type of analysis is helpful to reduce the time during a crucial period of treatment, when infected occupants are hospitalized at home up to a maximum space of 140 m2.

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Andreotti, B., Noûs, C.
Contre l'expertise. Retour sur un savoir inaudible.
Zilsel, Vol. **13** n°(2), (2023), 333-366 p.

En 2015, l'introduction du Dictionnaire critique de l'expertise rappelait la phrase de Philippe Roqueplo selon laquelle « l'expression d'une connaissance scientifique ne revêt valeur d'expertise que dans la mesure où elle s'articule à un processus décisionnel et c'est précisément cette articulation qui lui confère sa valeur d'expertise. ». Le Dictionnaire lui-même possède deux entrées incluant le terme de sciences : « Sciences réglementaires » et « Sciences sociales », mais pas d'entrée pour les sciences naturelles, comme si ces dernières étaient en deçà du processus d'expertise. Il se pourrait que la crise sanitaire ait éclairé d'un jour cruel cet « en deçà ». Les premières années de la pandémie de Covid-19 ont donné lieu à une débauche d'expertises allant des cabinets de consultance privés aux cabinets ministériels, des agences sanitaires aux médias, en passant par des comités scientifiques. Mais il a été très difficile aux scientifiques de se faire entendre sur de nombreux points parmi lesquels la transmission de SARS-CoV-2 par voie d'aérosol. Au travers d'un retour d'expérience, détaillant comment cette donnée scientifique majeure a été, dans ces circonstances de crise, écoutée par des agents économiques privés et occultée par le pouvoir politique, cette étude entend analyser et montrer les limites de la stratégie de contre-expertise prétendant retourner la rhétorique expertale pour en faire un levier d'action publique.

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Haowei, Y., Mahyuddin, N., Bin Nik Ghazali, N. N., Wang, Z., Liu, Y., Pan, S., Badruddin, I. A.
A critical review of research methodologies for COVID-19 transmission in indoor built environment.
Int J Environ Health Res, (2024), 1-65 p.

The Coronavirus Disease 2019 (COVID-19) has caused massive losses for the global economy. Scholars have used different methods to study the transmission mode and influencing factors of the virus to find effective methods to provide people with a healthy built environment. However, these studies arrived at different or even contradictory conclusions. This review presents the main research methodologies utilized in this field, summarizes the main investigation methods, and critically discusses their related conclusions. Data statistical analysis, sample collection, simulation models, and replication transmission scenarios are the main research methods. The summarized conclusion for prevention from all reviewed papers are: adequate ventilation and proper location of return air vents, proper use of personal protective equipment, as well as the reasonable and strict enforcement of policies are the main methods for reducing the transmission. Recommendations including standardized databases, causation clarification, rigorous experiment design, improved simulation accuracy and verification are provided.

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Habibi, S., Kamel, E., Memari, A. M.
Design strategies for addressing COVID-19 issues in buildings.
Energy, Vol. **293**, (2024)

The past COVID-19 pandemic has created new demand and expectations for next-generation buildings. Besides proper indoor air quality (IAQ) and daylight in the indoor environment, the building should provide appropriate working conditions. Due to this pandemic, millions have spent longer hours indoors over the past few years. It is imperative to address a multi-objective and multi-function design to control air circulation in the building's shared and isolated spaces while maintaining energy efficiency, humidity control, and other performance standards. This paper analyzed two architectural design concepts that can eliminate energy usage and daylighting inefficiencies and increase the ventilation rate to reduce indoor transmission of airborne particulates and pathogens and unwanted indoor humidity. We have analyzed the impact of courtyards and atria in typical commercial buildings based on architectural principles and practical experience to create a safe and healthy indoor environment for working and living that will improve indoor protection against the past COVID-19 and future similar virus pandemics. The results show that the use of a courtyard or atrium in design builds a positive effect on controlling the indoor environment.

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Hodgson, L., Jones, B., Cross, M. J., Copeland, R. J., Bonadonna, L., Adams, E. R.*, et al.*
End-to-end SARS-CoV-2 transmission risks in sport: Current evidence and practical recommendations.
South African Journal of Sports Medicine, (2023)

The coronavirus disease 2019 (COVID-19) pandemic has caused disruption to professional and recreational sports across the world. The SARS-CoV-2 virus can be transmitted by relatively large respiratory droplets that behave ballistically, and exhaled aerosol droplets, which potentially pose a greater risk. This review provides a summary of end-to-end SARS-CoV-2 transmission risk factors for sport and an overview of transmission mechanisms to be considered by all stakeholders. The risk of SARS-CoV-2 transmission is greatest indoors, and primarily influenced by the ventilation of the environment and the close proximity of individuals. The SARS-CoV-2 transmission risks outdoors, e.g. via water, and from fomites, appear less than initially thought. Mitigation strategies include good end-to-end scenario planning of activities to optimise physical distancing, face mask wearing and hygiene practice of individuals, the environment and equipment. The identification and removal of infectious individuals should be undertaken by means of the taking of temperature and COVID-19 symptom screening, and the use of diagnostic monitoring tests to identify asymptomatic individuals. Using adequate video footage, data from proximity technology and subject interviews, the identification and isolation of 'close contacts' should also be undertaken to limit SARS-CoV-2 transmission within sporting environments and into the wider community. Sports should aim to undertake activities outdoors where possible, given the lower SARS-CoV-2 transmission risk, in comparison to indoor environments

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Afacan, Y.
Experimental assessment of impact of different ventilation modes on cognitive and academic performance: A study based on classrooms in Türkiye.
Journal of Building Engineering, Vol. **86**, (2024)

In closed spaces, such as classrooms, poor ventilation, indoor exposure to CO2, and non-optimal humidity and temperature conditions are global concerns associated with health and performance. This study experimentally assesses the effects of different ventilation modes on the air quality parameters and cognitive and academic performances of 120 s-grade primary school children in two buildings with different characteristics during heating and non-heating seasons. Based on a retrospective analysis of 455 primary schools in Türkiye during 2017–2018, the study was conducted in six classrooms of the two representative school buildings. Indoor air quality monitoring and performance (of the students) assessment was carried out from December 9, 2019, to September 28, 2020. The non-heating season measurements were conducted during the COVID-19 pandemic. According to our findings, the traditionally constructed school without energy efficiency regulations exhibited the worse scenario. The success percentages of arithmetic attention in both traditional and natural ventilation modes were significantly lower in the non-heating season than in the heating season, which indicates the impact of using a facemask inside a classroom during cognitive tasks. This study demonstrated that the heating season is more critical than the non-heating season in terms of ventilation of closed spaces.

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Kong, M.
Feasibility test of a breath-tracking personalized ventilation (BTPV) for mitigating the airborne transmission of respiratory virus.
Building and Environment, (2024)

Severe acute respiratory syndrome coronavirus-2 (SARS-CoV-2) spreads from one person to another primarily via airborne transmission. Personalized ventilation (PV) has been recommended as one of the effective tools for protecting people from infection. Compared to personal protective equipment, such as masks, PV has the potential to provide a more comfortable experience. A first-of-its-kind breath-tracking personalized ventilation (BTPV) system was invented and tested for feasibility in a simulated indoor environment with two breathing manikins. It basically delivers fresh or clean air to people's breathing zones as well as removes and cleans the exhaled air locally in sync with the breathing cycle. The results demonstrate that a BTPV system could: 1) reduce more exposure to infectious particles (up to 88%) for a susceptible person than most of the commonly used interventions, including surgical masks; 2) reduce more than 70% exposure when the susceptible and infector manikins were within 2 m from each other; 3) work more effectively on the infector (50%) than on the susceptible person (40%) if only one of them was wearing it. The BTPV system thus gives evidence of its superior performance and greater potential over masks and other interventions to protect people in scenarios of all kinds, including circumstances where personal connections are important, high-volume breathing or food intake is necessary, or social distancing is not possible to be maintained.

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Berneiser, J., Auerswald, S., Maier, D., Goelz, S., Carbonare, N. A., Pflug, T.
Feeling the breeze ? Ventilation practices and occupant requirements for mechanical ventilation in residential buildings.
Energy and Buildings, Vol. **302**, (2024)

The progression of climate change and the resulting need for improved energy efficiency, as well as the impact of the COVID-19 pandemic, have drawn attention to the importance of understanding ventilation practices and mechanical ventilation systems in residential buildings. The technical requirements for ventilation systems typically consider the energy efficiency of ventilation systems as the most important criterion. However, previous research has indicated a discrepancy between the necessary ventilation practices to maximize the technical performance of mechanical ventilation systems and the actual behavior of occupants. In this mixed-methods study, indoor climate needs, natural ventilation practices and occupants' requirements for mechanical ventila-tion were examined using qualitative interviews and an online questionnaire survey carried out in the German population (N = 952). Three main findings were identified: First, our results imply that ventilation practices vary among occupants and are influenced by situational, habitual, and goal-directed factors. Second, while our sample demonstrated a range of perceptions on optimal indoor climate and ventilation practices, we identified some shared prompts and strategies across four groups. Third, occupants highly valued quiet mechanical ventilation devices that provide fresh air and filter particles, while also maintaining control over window opening. The results for system requirements partially differed according to socio-demographic variables, e.g. older occupants valued comprehensible and intuitive devices more than younger respondents. We therefore conclude that it is essential to consider occupant needs and preferences in the design and implementation of mechanical ventilation systems to optimize their operation for optimal energy efficiency.

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Sangwijit, C., Abdulsalam, F. I., Phoosuwan, N.
Health and safety in hair salons during the Covid-19 situation: A cross-sectional study in a semi-urban district in Thailand.
Public health in practice (Oxford, England), Vol. **7**, (2024)

Objective: Since the COVID-19 crisis in Thailand, the need for salons to have impeccable hygiene and client-hairdresser monitoring heightened. Due to scarce research on the COVID-19 preventive measures taken by hairdressing salons in semi-urban locations in Thailand during the pandemic, this study aimed to evaluate the standard of hair salons in preventing COVID-19 disease transmission in a semi-urban district in the

northeastern region of Thailand. Methods: Using the purposive sampling method, data were collected from 22 Hair Salons. Data collection tools were a self-completed questionnaire designed into different sections to obtain information on demographics, work conditions and environmental health standard compliance according to guidelines set by the Thai Ministry of Public Health during the COVID-19 pandemic. Descriptive analyses were done, such as mean, standard deviation, and frequency. Results: The mean age of our respondents was 41.82 (±8.18) years, more than half were females (63.6%). Most of the criteria assessing beauty salon standards according to Department of Health guidelines were passed, with all of the salons passing the lighting evaluation and mostly passing the heat and electric shock protection system evaluation, but the implementation of guidelines for preventive measures during the COVID-19 epidemic, according to Department of Health guidelines, suggested non-compliance by most hair Salons. Conclusion: Beauty salons should implement and strictly adhere to guidelines according to Department of Health standards. Training or education sessions regarding the prevention of infectious disease transmission should be conducted, as hairdressers should be motivated to comply with health and environmental health standards for both salon staff and clients' confidence. Further research should also be done on the behaviours associated with health risks in beauty salons at the national or border-nation level.

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Digby, R. a. R., Gillett, N. P., Monahan, A. H., Von Salzen, K., Gkikas, A., Song, Q., Zhang, Z.
How well do Earth system models reproduce the observed aerosol response to rapid emission reductions? A COVID-19 case study.
Atmos Chem Phys, Vol. **24** n°(4), (2024), 2077-2097 p.

The spring 2020 COVID-19 lockdowns led to a rapid reduction in aerosol and aerosol precursor emissions. These emission reductions provide a unique opportunity for model evaluation and to assess the potential efficacy of future emission control measures. We investigate changes in observed regional aerosol optical depth (AOD) during the COVID-19 lockdowns and use these observed anomalies to evaluate Earth system model simulations forced with COVID-19-like reductions in aerosols and greenhouse gases. Most anthropogenic source regions do not exhibit statistically significant changes in satellite retrievals of total or dust-subtracted AOD, despite the dramatic economic and lifestyle changes associated with the pandemic. Of the regions considered, only India exhibits an AOD anomaly that exceeds internal variability. Earth system models reproduce the observed responses reasonably well over India but initially appear to overestimate the magnitude of response in East China and when averaging over the Northern Hemisphere (0–70◦ N) as a whole. We conduct a series of sensitivity tests to systematically assess the contributions of internal variability, model input uncertainty, and observational sampling to the aerosol signal, and we demonstrate that the discrepancies between observed and simulated AOD can be partially resolved through the use of an updated emission inventory. The discrepancies can also be explained in part by characteristics of the observational datasets. Overall our results suggest that current Earth system models have potential to accurately capture the effects of future emission reductions.

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D’agostino, D., Minelli, F., Minichiello, F., Musella, M.
Improving the Indoor Air Quality of Office Buildings in the Post-Pandemic Era—Impact on Energy Consumption and Costs.
Energies, Vol. **17** n°(4), (2024)

Before the COVID-19 pandemic, ventilation in buildings was not always given its due importance. The World Health Organization has highlighted the important role of air exchange with the outdoors in improving the air quality in buildings; buildings should, therefore, be equipped with mechanical ventilation or adequate air conditioning systems. This paper aims to investigate different retrofit solutions for air conditioning, evaluating them in terms of energy consumption and cost and the impact of increased outdoor air exchange rates on

countering the propagation of COVID-19; the latter is the main novelty of the paper. As a case study, we take an existing office building located in Central Italy that was previously not equipped with a mechanical ventilation system (a system with primary air was introduced during the study). The energy analysis was conducted using dynamic simulation software after validation through energy bills; energy and economic analyses were conducted considering different external-air exchange rates. An optimal number of outdoor air changes was found to mitigate the risk of COVID-19 infection, a finding in line with the international literature. The increase in air changes with outdoor air leads to a rise in energy consumption and costs. These values were evaluated for different air conditioning systems and operational schedules. These drawbacks can be made less significant by combining interventions in the system with energy-efficiency measures applied to the building envelope.

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Faridah, F., Utami, S. S., Wijaya, D. D. A., Yanti, R. J., Putra, W. S., Adrian, B.
An indoor airflow distribution predictor using machine learning for a real-time healthy building monitoring system in the tropics.
Building Services Engineering Research & Technology, (2024)

Indoor air quality is the foundation of a good indoor environment. The COVID-19 pandemic further highlighted the importance of providing real-time airflow distribution information within the Building Environmental Monitoring System (BEMS) to minimize the risk of infectious airborne transmission. This paper discusses the process of developing a predictive model for indoor airflow distribution prediction with indoor and outdoor input parameters using machine learning and its implementation in healthy BEMS for a classroom in the tropical climate region of Yogyakarta, Indonesia. This paper encompassed field measurement and simulation involving outdoor climate conditions and the operational status of the classroom's windows, Air Conditioning units, and fans. Three machine learning models were constructed using OLS, LASSO, and Ridge methods. Datasets for the modeling were generated from CFD model simulations in IES VE and were assessed for correlation. The mean temperature and velocity differences between the CFD model simulation and measurement results are 0.21 degrees C and 0.083 m/s, respectively. Outdoor climate conditions and the operational status of the classroom's utilities significantly influence the indoor airflow distribution characteristics. The three models indicate a relatively poor performance, where the classroom had a relatively low sensitivity to input changes. However, the best model performance was achieved using the LASSO method, with average values from post-normalization of R 2 and Root Mean Square Error (RMSE) of 0.336 and 0.077, respectively. The model was implemented in healthy BEMS on the "Platform for Healthy and Energy Efficient Building Management System."Practical Application: This research proposed a machine learning model of indoor airflow characteristics of a classroom in Yogyakarta. The proposed model can be adapted to produce monitoring systems that best represent the related conditions. The method can be adopted to develop a relatively simple, low-cost sensor or model to monitor an indoor environment. Future studies may explore the results of the real-world implementation in a case study.

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Zeno, E.
Qualité de l'air intérieur, protégeons nos enfants!
Ecole oubliée, (2023)

Présentation à destination des parents qui souhaitent échanger avec d'autres parents, des personnels de l'établissement scolaire, des représentants de collectivités pour les convaincre de l'importance et de l'urgence de amélioration de la qualité de l'air intérieur des classes et des locaux communs [...]

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Martín-Quintero, I., Cervera-Sabater, A., Cortés-Bretón Brinkmann, J., Aragoneses-Lamas, J. M., Flores-Fraile, J., Santos-Marino, J.
Reduction by air purifier of particulate concentration during orthodontic procedures: a pilot study.
BMC Oral Health, Vol. **24** n°(1), (2024)

The SARS-CoV-2 pandemic has raised awareness of the importance of air quality. This pilot study arose from the need to reduce the concentration of particulate matter in the dental office during orthodontic procedures. To evaluate the efficacy of using an air purifier during orthodontic care in the dental office to reduce the concentration of ambient particulate matter.

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Liu, F., Ma, Q., Sabuj, M. M. A., Yen, S.-H., Govindan, D., Gao, J.*, et al.*
Revolutionizing Airborne Virus Defense: Electromagnetic MXene-Coated Air Filtration for Superior Aerosol Viral Removal.
ACS Applied Materials & Interfaces, Vol. **16** n°(8), (2024), 10148-10157 p.

The COVID-19 pandemic sparked public health concerns about the transmission of airborne viruses. Current methods mainly capture pathogens without inactivation, leading to potential secondary pollution. Herein, we evaluated the inactivation performance of a model viral species (MS2) in simulated bioaerosol by an electromagnetically enhanced air filtration system under a 300 kHz electromagnetic induction field. A nonwoven fabric filter was coated with a 2D catalyst, MXene (Ti3C2Tx), at a coating density of 4.56 mg·cm–2 to absorb electromagnetic irradiation and produce local heating and electromagnetic field for microbial inactivation. The results showed that the MXene-coated air filter significantly enhanced the viral removal efficiency by achieving a log removal of 3.4 ± 0.15 under an electromagnetic power density of 369 W·cm–2. By contrast, the pristine filter without catalyst coating only garnered a log removal of 0.3 ± 0.04. Though the primary antimicrobial mechanism is the local heating as indicated by the elevated surface temperature of 72.2 ± 4 °C under the electromagnetic field, additional nonthermal effects (e.g., dielectrophoresis) on enhanced viral capture during electromagnetically enhanced filtration were investigated by COMSOL simulation to delineate the potential transmission trajectories of bioaerosol. The results provide unique insights into the mechanisms of pathogen control and thus promote alternative solutions for preventing the transmission of airborne pathogens.

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Leão, P. J. T.
Solução Combinada de AVAC Adaptativo. **(en portugais)**
Universidade do Minho, Portugal. Thèse 2023

HVAC systems need automated control to be able to comply with the expected responses to ensure the standards required for a space that can be occupied by people or not. These requirements can be: temperature, humidity and air quality. In order to fulfill all requirements, it must be chosen control systems that are capable of constant analysis of the various parameters of space by using sensors and, with that data, to change the equipments in order to meet the needs. Therefore, a range of control methods that could be applied in the field of air conditioning and ventilation of buildings was analyzed. These methods, which use both mathematical formulations or computational intelligence or both, were studied with regard to their grounding, implementation and gaps in order to understand which method would better suit with the temperature and relative humidity parameters responses, required for an industrial space. The performance of this analysis, which went through a comparison between adaptive and predictive control, culminated in the choice of fuzzy logic as an alternative control method to be applied in the AHU that supplies the industrial space. Based on the requirements of the commercial space managers and the AHU manufacturing team, a range of control rules were implemented in MATLAB to allow the temperature values of the water flow

circulating in the AHU cooling/heating coil that is mounted in the working area to be changed. Obtaining adequate temperature values to exchange heat with the air that passes in the AHU, will cause temperature values and relative humidity values of the space to match the required, as well as being able to lower energy consumption, since the system is not oversized.

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Neil-Sztramko, S. E., Belita, E., Traynor, R. L., Hagerman, L., Akaraci, S., Burnett, P.*, et al.*
What is the specific role of schools and daycares in COVID-19 transmission? A final report from a living rapid review.
The Lancet Child & Adolescent Health, (2024)

Due to rapidly evolving conditions, the question of how to safely operate schools and daycares remained a top priority throughout the COVID-19 pandemic. In response to growing and changing evidence, the National Collaborating Centre for Methods and Tools in Canada maintained a living rapid review on the role of schools and daycares in COVID-19 transmission to guide evidence-informed decision making. This Review presents the final iteration of this living rapid review. 31 sources were searched until Oct 17, 2022. In the final version, eligible studies reported data from Jan 1, 2021 onward on transmission of COVID-19 in school or daycare settings, the effect of infection prevention and control measures on transmission, or the effect of operating schools or daycares on community-level COVID-19 rates. As a rapid review, titles and abstracts were screened by a single reviewer with artificial intelligence integrated into later versions. Full-text screening, data extraction, and critical appraisal were completed by one reviewer and checked by a second reviewer. The Johanna Briggs Institute tools were used for critical appraisal. The certainty of evidence was assessed using the Grading of Recommendations Assessment, Development, and Evaluation approach, and results were synthesised narratively. Three citizen partners provided input for the final interpretation. This final update includes 73 primary studies. Secondary attack rates were low within school settings when infection prevention and control measures were in place (moderate certainty). Masks might reduce transmission, test-to-stay policies might not increase transmission risk compared with mandatory quarantine, cohorting and hybrid learning might make little to no difference in transmission (low certainty), and the effect of surveillance testing within schools remained inconclusive (very low certainty). Findings indicate that school settings do not substantially contribute to community incidence, hospitalisations, or mortality (low certainty). This living review provides a synthesis of global evidence for the role of schools and daycares during COVID-19, which might be helpful in future pandemics.

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Ren, C., Yu, H., Wang, J., Zhu, H.-C., Feng, Z., Cao, S.-J.
Zonal demand-controlled ventilation strategy to minimize infection probability and energy consumption: A coordinated control based on occupant detection.
Environ Pollut, Vol. **345**, (2024)

Due to the outbreak of COVID-19, an increased risk of airborne transmission has been experienced in buildings, particularly in confined public places. The need for ventilation as a means of infection prevention has become more pronounced given that some basic precautions (like wearing masks) are no longer mandatory. However, ventilating the space as a whole (e.g., using a unified ventilation rate) may lead to situations where there is either insufficient or excessive ventilation in localized areas, potentially resulting in localized virus accumulation or large energy consumption. It is of urgent need to investigate real-time control of ventilation systems based on local demands of the occupants to strike a balance between infection risk and energy saving. In this work, a zonal demand-controlled ventilation (ZDCV) strategy was proposed to optimize the ventilation rates in sub-zones. A camera-based occupant detection method was developed to detect occupants (with eight possible locations in sub-zones denoted as ‘A’ to ‘H’). Linear ventilation model (LVM), dimension reduction, and artificial neural network (ANN) were integrated for rapid prediction of pollutant

concentrations in sub-zones with the identified occupants and ventilation rates as inputs. Coordinated ventilation effects between sub-zones were optimized to improve infection prevention and energy savings. Results showed that rapid prediction models achieved an average prediction error of 6 ppm for CO2 concentration fields compared with the simulation under different occupant scenarios (i.e., occupant locations at ABH, ABCFH, and ABCDEFH). ZDCV largely reduced the infection risk to 2.8% while improved energy-saving efficiency by 34% compared with the system using constant ventilation rate. This work can contribute to the development of building environmental control systems in terms of pollutant removal, infection prevention, and energy sustainability.

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