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Aéraulique et COVID-19

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Google Scholar, Lens et WoS

Da Silva, P. G., Hemnani, M., Gonçalves, J., Rodriguéz, E., García-Encina, P. A., Nascimento, M. S. J.*, et al.*
Airborne SARS-CoV-2 is more frequently detected in environments related to children and elderly but likely non-infectious, Norway, 2022.
Virology Journal, Vol. **20** n°(1), (2023), 275 p.

This study investigates the presence of SARS-CoV-2 in indoor and outdoor environments in two cities in Norway between April and May 2022. With the lifting of COVID-19 restrictions in the country and a focus on vaccination, this research aims to shed light on the potential for virus transmission in various settings. Air sampling was conducted in healthcare and non-healthcare facilities, covering locations frequented by individuals across different age groups. The study found that out of 31 air samples, only four showed the presence of SARS-CoV-2 RNA by RT-qPCR, with no viable virus detected after RNAse pre-treatment. These positive samples were primarily associated with environments involving children and the elderly. Notably, sequencing revealed mutations associated with increased infectivity in one of the samples. The results highlight the importance of considering children as potential sources of virus transmission, especially in settings with prolonged indoor exposure. As vaccination coverage increases globally, and with children still representing a substantial unvaccinated population, the study emphasizes the need to re-implement mask-wearing mandates indoors and in public transport to reduce virus transmission. The findings have implications for public health strategies to control COVID-19, particularly in the face of new variants and the potential for increased transmission during the autumn and winter seasons.

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Szekeres, S.
Analysis of indoor air parameters in the occupied zone.
Journal of Physics: Conference Series, Vol. **2628** n°(1), (2023)

Since the COVID-19 pandemic, the number of occupants in many office buildings has decreased around the world, but the comfort parameters in the buildings had to be maintained. Various measures have been taken by the facilities to ensure that the people in the buildings are as protected and safe as possible. Put plexiglass sheets on the desks between the people as a physical barrier and arranged the desks to manage to keep a distance from each other. As a result of these measures, the existing air ventilation system may not be able to provide the designed condition. Analysis of the fresh air ratio was carried out with two different desk arrangements and examined the effect of barriers. As the HVAC systems contribute significantly towards the final energy consumption by buildings it is important to minimalize the level of ventilation. This study focused on the air volume flow, and the mean air velocity. Furthermore investigated the turbulence intensity in percentage as well as the drought rate and comfort levels according to standards. After analyzing the measurement results, various proposals for action have been established.

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Gao, S., Xie, H., Yang, M., Zhang, Q., Zhang, M., Wang, X.*, et al.*
A BIM-Based Simulation Approach for Life-Cycle Quality Control in Post-Pandemic Hospitals.
Buildings, Vol. **13** n°(6), (2023)

The outbreak of COVID-19 has engendered extensive challenges for conventional hospital operations. To adapt to this problematic issue, a mixed-use hospital functioning system for normal and epidemic situations is proposed. However, the inherent complexity of a hospital embedded with a function of epidemic prevention

and control renders a restrained construction process that may compromise quality. In this stance, we developed a BIM (building information modelling)-based simulation approach addressing life-cycle quality control in post-pandemic hospitals. An illustrative case study approach, which draws on the grey literature, was used to address the research question. BIM forward design was employed to integrate with such elements as functional streamline, emergency site, and ward conversion in the process of transformation from normal to epidemic-related operations. Computational fluid dynamics-based fluid simulation was conducted to obtain the most suitable air supply and exhaust solutions for negative pressure wards. BIM forward design method contributed to improving design efficiency and quality. The results of ventilation simulation and environmental analysis showed that the design scheme met all the functional requirements and technical specifications. Meanwhile, the best pipeline synthesis scheme was obtained, which reduced the rework and saved on construction time. The proposed method is beneficial to improve the efficiency of design information sharing and business collaboration. Implications generated from this study can be used as a significant reference for the future construction of various healthcare facilities.

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Sobek, E., Elias, D. A.
Bipolar ionization rapidly inactivates real-world, airborne concentrations of infective respiratory viruses.
Plos one, Vol. **18** n°(11), (2023)

The SARS-CoV-2 (COVID-19) pandemic has highlighted the urgent need for strategies that rapidly inactivate airborne respiratory viruses and break the transmission cycle of indoor spaces. Air ions can reduce viable bacteria, mold, and virus counts, however, most studies use small test enclosures with target microbes and ion sources in close vicinity. To evaluate ion performance in real-world spaces, experiments were conducted in a large, room-size BSL-3 Chamber. Negative and positive ions were delivered simultaneously using a commercially available bipolar air ion device. The device housed Needle Point Bipolar ionization (NPBI) technology. Large chamber studies often use unrealistically high virus concentrations to ensure measurable virus is present at the trial end. However, excessively high viral concentrations bias air cleaning devices towards underperformance. Hence, devices that provide a substantial impact for protecting occupants in real-world spaces with real-world virus concentrations are often dismissed as poor performers. Herein, both real-world and excessive virus concentrations were studied using Influenza A and B, Human Respiratory Syncytial Virus (RSV), and the SARS-CoV-2 Alpha and Delta strains. The average ion concentrations ranged from 4,100 to 24,000 per polarity over 60-minute and 30-minute time trials. The reduction rate was considerably greater for trials that used real-world virus concentrations, reducing infectivity for Influenza A and B, RSV, and SARS-CoV-2 Delta by 88.3–99.98% in 30 minutes, whereas trials using in-excess concentrations showed 49.5–61.2% in 30 minutes. These findings strongly support the addition of NPBI ion technology to building management strategies aimed to protect occupants from contracting and spreading infective respiratory viruses indoors.

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Greentree, D. H., Wilson, B. M., Donskey, C. J.
Carbon Dioxide Monitoring Demonstrates Variations in the Quality of Ventilation on Public Transportation Buses and University Student Shuttle Vans and Identifies Effective Interventions.
Pathogens and Immunity, Vol. **8** n°(1), (2023), 148-160 p.

Background: There is a risk for transmission of severe acute respiratory syndrome 2 (SARS-CoV-2) and other respiratory viruses in motor vehicles, particularly if ventilation is inadequate.
Methods: We used carbon dioxide monitoring to examine the quality of ventilation in several public transportation buses and in university student shuttle vans in the Cleveland metro area during peak and non-peak travel times. Carbon dioxide levels above 800 parts per million (ppm) were considered an indicator of suboptimal ventilation for the number of people present. In the shuttle vans, we evaluated the impact of an intervention to improve ventilation.

Results: In large articulated buses with 2 ventilation systems, carbon dioxide concentrations never exceeded 800 ppm, whereas in standard buses with 1 ventilation system concentrations rose above 800 ppm during peak travel times and on some trips during non-peak travel times. In shuttle vans, the ventilation system was not turned on during routine operation, and carbon dioxide levels rose above 800 ppm on all trips during peak and non-peak travel times. In the shuttle vans, an intervention involving operation of the existing ventilation system resulted in a significant reduction in carbon dioxide levels (mean concentration, 1,042 no intervention versus 785 with intervention; P<0.001).
Conclusion: Our findings demonstrate substantial variability in the quality of ventilation in public transportation buses and university shuttle vans. There is a need for efforts to assess and optimize ventilation in motor vehicles used for public transportation to reduce the risk for aerosol-mediated transmission of respiratory viruses. Carbon dioxide monitoring may provide a useful tool to assess and improve ventilation.

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Liu, M., Nejat, P., Cao, P., Jimenez-Bescos, C., Calautit, J. K.
A critical review of windcatcher ventilation: Micro-environment, techno-economics, and commercialisation.
Renewable and Sustainable Energy Reviews, Vol. **191**, (2024)

Windcatcher natural ventilation is a low-energy approach that can provide effective ventilation during favourable weather conditions. When combined with different cooling, heating, and dehumidification technologies, windcatchers can provide enhanced indoor environment quality. This work provides a critical review of windcatchers' performance. It covers aspects such as ventilation, thermal comfort, overheating risk, indoor air quality (IAQ), energy performance, economic cost, and life cycle assessment (LCA). Although many studies have investigated windcatchers' performance in terms of thermal comfort, little attention has been paid to the potential overheating risk. This oversight is particularly important in the context of global warming trends and the increasing likelihood of extreme weather conditions. Moreover, previous studies on windcatchers' IAQ performance have primarily focused on indoor CO2 concentrations, while the influences of pollutants such as volatile organic compounds (VOCs) have not been reported. The quantification of energy performance for windcatchers remains an underexplored area, and very few studies have conducted economic analyses or LCAs of windcatcher systems. There is a clear need for more field experiments to investigate these aspects comprehensively. This review also provides insights into the current trends and future perspectives in the commercial windcatcher market, including available options, opportunities, and threats. The findings highlight the importance of several factors that must be considered before the large-scale commercial rollout of windcatcher technology. These include the lack of awareness and regulatory incentives, cost considerations, aesthetic preferences, and misconceptions or concerns regarding the effectiveness of windcatchers.

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Barberá-Riera, M., Barneo-Muñoz, M., Bellido Blasco, J., Gascó-Laborda, J. C., Porru, S., Alfaro, C.*, et al.*
Detection of SARS-CoV-2 in aerosols in long term care facilities and other indoor spaces with known COVID-19 outbreaks.
Environmental Research, (2023)

Coronavirus outbreaks are likely to occur in crowded and congregate indoor spaces, and their effects are most severe in vulnerable long term care facilities (LTCFs) residents. Public health officers benefit from tools that allow them to control COVID-19 outbreaks in vulnerable settings such as LTCFs, but which could be translated in the future to control other known and future virus outbreaks. This study aims to develop and test a methodology based on detection of SARS-CoV-2 in aerosol samples collected with personal pumps that could be easily implemented by public health officers. The proposed methodology was used to investigate the levels of SARS-CoV-2 in aerosol in indoor settings, mainly focusing on LTCFs, suffering COVID-19 outbreaks, or in the presence of known COVID-19 cases, and targeting the initial days after diagnosis. Aerosol samples (N = 18)

were collected between November 2020 and March 2022 in Castelló (Spain) from LTCFs, merchant ships and a private home with recently infected COVID-19 cases. Sampling was performed for 24-h, onto 47 mm polytetrafluoroethylene (PTFE) and quartz filters, connected to personal pumps at 2 and 4 L/min respectively. RNA from filters was extracted and SARS-CoV-2 was determined by detection of regions N1 and N2 of the nucleocapsid gene alongside the E gene using RT-PCR technique. SARS-CoV-2 genetic material was detected in 87.5% samples. Concentrations ranged ND-19,525 gc/m3 (gene E). No genetic traces were detected in rooms from contacts that were isolated as a preventative measure. Very high levels were also measured at locations with poor ventilation. Aerosol measurement conducted with the proposed methodology provided useful information to public health officers and contributed to manage and control 12 different COVID-19 outbreaks. SARS-CoV-2 was detected in aerosol samples collected during outbreaks in congregate spaces. Indoor aerosol sampling is a useful tool in the early detection and management of COVID-19 outbreaks and supports epidemiological investigations.

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Brainard, J., Jones, N. R., Swindells, I. C., Archer, E. J., Kolyva, A., Letley, C.*, et al.*
Effectiveness of filtering or decontaminating air to reduce or prevent respiratory infections: A systematic review.
Prev Med, (2023)

Installation of technologies to remove or deactivate respiratory pathogens from indoor air is a plausible non-pharmaceutical infectious disease control strategy.
Objective: We undertook a systematic review of worldwide observational and experimental studies, published 1970–2022, to synthesise evidence about the effectiveness of suitable indoor air treatment technologies to prevent respiratory or gastrointestinal infections.

Methods: We searched for data about infection and symptom outcomes for persons who spent minimum 20 h/week in shared indoor spaces subjected to air treatment strategies hypothesised to change risk of respiratory or gastrointestinal infections or symptoms.
Results: Pooled data from 32 included studies suggested no net benefits of air treatment technologies for symptom severity or symptom presence, in absence of confirmed infection. Infection incidence was lower in three cohort studies for persons exposed to high efficiency particulate air filtration (RR 0.4, 95%CI 0.28–0.58, $p < 0.001$) and in one cohort study that combined ionisers with electrostatic nano filtration (RR 0.08, 95%CI 0.01–0.60, $p = 0.01$); other types of air treatment technologies and air treatment in other study designs were not strongly linked to fewer infections. The infection outcome data exhibited strong publication bias.
Conclusions: Although environmental and surface samples are reduced after air treatment by several air treatment strategies, especially germicidal lights and high efficiency particulate air filtration, robust evidence has yet to emerge that these technologies are effective at reducing respiratory or gastrointestinal infections in real world settings. Data from several randomised trials have yet to report and will be welcome to the evidence base.

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Hoskin, Z.
Estimating Indoor Airborne Concentrations of SARS-CoV-2 Using Quantitative Filter Forensics.
University of Toronto (Canada). Hub for Advancing Buildings. Thèse 2023

Through this work we aimed to understand how airborne viral concentrations vary across different locations such as residences, classrooms, and dining locations. Additionally, we were interested in characterizing occupant residencies and how concentrations vary across three locations in an isolation home: the isolation room, the hallways outside of the isolation room, and the living room area on a different floor. Recent studies have shown the potential for airborne virus-containing particles to travel beyond an isolation room to other

areas of a singlefamily home (Madewell et al., 2020; Vass et al., 2022). Additionally, classrooms have high occupancy and seasonal occupancy variation, and airborne concentrations are impacted by the presence or absence of mask mandates. Dining locations have high occupancy and occupants are unmasked and typically talking more than in a classroom, which may be important for airborne concentrations of SARS-CoV-2. Overall, it is critical that we examine the benefits of environmental surveillance to room-specific and week-long surveillance of airborne SARS-CoV2 concentrations for future implementation.

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Serrano Lapuente, C., Herrada, H., Jose Jimenez, M., Nuria Sanchez, M.
Long-Term Assessment of a Set of CO2 Concentration Sensors in an In-Use Office Building.
Sensors, Vol. **22** n°(23), (2022)

The measurement of the CO2 concentration has a wide range of applications. Traditionally, it has been used to assess air quality, with other applications linked to the experimental assessment of occupancy patterns and air renewal rates. More recently, the worldwide dissemination of COVID-19 establishing a relationship between infection risk and the mean CO2 level has abruptly led to the measurement of the CO2 concentration in order to limit the spread of this respiratory disease in the indoor environment. Therefore, the extensive application of this measurement outside of traditional air quality assessment requires an in-depth analysis of the suitability of these sensors for such modern applications. This paper discusses the performance of an array of commercial wall-mounted CO2 sensors, focusing on their application to obtain occupancy patterns and air renovation rates. This study is supported by several long-term test campaigns conducted in an in-use office building located in south-eastern Spain. The results show a spread of 19-101 ppm, with a drift of 28 ppm over 5 years, an offset of 2-301 ppm and fluctuations up to 80 ppm in instantaneous measurements not related to concentration changes. It is proposed that values averaged over 30 min, using a suitable reference value, be used to avoid erroneous results when calibration is not feasible.

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Wei, J., Zhu, S., He, F., Guo, Q., Huang, X., Yu, J.*, et al.*
Numerical investigation of airborne transmission of respiratory infections on the subway platform.
Geoscience Frontiers, Vol. **13** n°(6), (2022)

Underground subway platforms are among the world's busiest public transportation systems, but the air-borne transmission mechanism of respiratory infections on these platforms has been rarely studied. Here, computational fluid dynamics (CFD) modeling is used to investigate the airflow patterns and infection risks in an island platform under two common ventilation modes: Mode 1-both sides have air inlets and outlets; Mode 2-air inlets are present at the two sides and outlets are present in the middle. Under the investigated scenario, airflow structure is characterized by the ventilation jet and human ther-mal plumes. Their interaction with the infector's breathing jet imposes the front passenger under the highest exposure risk by short-range airborne route, with intake fractions up to 2.57% (oral breathing) or 0.63% (nasal breathing) under Mode 1; oral breathing of the infector may impose higher risks for the front passenger compared with nasal breathing. Pathogen are efficiently diluted as they travel further, in particular to adjacent crowds. The maximum and median value of intake fractions of passengers in adjacent crowds are respectively 0.093% and 0.016% (oral breathing), and 0.073% and 0.014% (nasal breathing) under Mode 1. Compared with Mode 1, the 2nd mode minimizes the interaction of ventilation jet and breathing jet, where the maximum intake fraction is only 0.34%, and the median value in the same crowd and other crowds are reduced by 23-63%. Combining published quanta generation rate data of COVID-19 and influenza infectors, the predicted maximum and median infection risks for passengers in the same crowds are respectively 1.46%-40.23% and 0.038%-1.67% during the 3-10 min waiting per-iod, which are more sensitive to ventilation rate and exposure time compared with return air. This study can provide practical guidance for the prevention of respiratory infections in subway platforms.

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Hsieh, K.-L., Lee, Y.-H., Lee, C.-Y., Peng, S.-Y., Lee, S.-M.

Numerical Simulation Of Epidemic Prevention And Ventilation Efficiency In Indoor Spaces With Partitions And An Air Curtain.

Journal of Applied Science and Engineering, Vol. **27** n°(5), (2023), 2413-2421 p.

In this study, computational fluid dynamics (CFD) were used to simulate the effect of a partition and air curtain on the concentration of a pollution source in an indoor space with different ventilation configurations. First, in the partition simulation, the performances of six different ventilation configurations were compared. Based on the results obtained, air curtain simulations were then carried out. In this study, carbon dioxide was chosen as the tracer gas in all simulations, and the realizable k - epsilon turbulence model was selected. In the partition simulation, a front-and-back ventilation configuration with ventilation inlets/outlets near the side walls (in diagonal) showed the best performance. This configuration was adopted for the air curtain simulation so as to investigate the effect of different air inlet velocities and air curtain velocities. It was found that as the height of the partition increases, although it has a higher chance of blocking the Covid-19 virus, it lowers the ventilation efficiency, resulting in the increase of carbon dioxide concentration in the indoor space. When the partition was replaced with an air curtain, it was found that the higher the height of the air curtain, the lower the carbon dioxide concentration in the indoor space. Compared with the partition, the air curtain can reduce the carbon dioxide concentration by up to 74.6%, indicating that the introduction of the air curtain can have an improving effect on the ventilation in the indoor space.

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Geng, C.-L., Zhu, X.-Y., Chen, N.

Optimizing indoor air quality: CFD simulation and novel air cleaning methods for effective aerosol particle inhibition in public spaces.

Environmental science and pollution research international, (2023)

In contemporary building ventilation, displacement and mixing ventilation demand high air volumes for rapid virus elimination, resulting in elevated energy consumption. To minimize the spread of viruses and decrease energy consumption for ventilation, this study employed CFD to explore the efficacy of a downward uniform flow field in impeding the transmission of aerosol particles in a high-traffic public facility, like a supermarket. The findings indicate that the downward uniform flow field proves insufficient when individuals remain static for extended periods. A wind speed of 0.1 m/s or higher becomes essential to overpower the stationary thermal plume, which disrupts this flow field. In areas with human presence, however, this technique is found to be particularly efficient since mobile heat sources do not generate a fixed thermal plume. A 0.05 m/s downward uniform flow field can settle 90% of particles within just 22 s. This flow pattern contributes to the swift settling of aerosol particles and effectively diminishes their dispersion. Employing this flow pattern in public places with increased foot traffic, like supermarkets, can lower the risk of contracting novel coronavirus without augmenting energy consumption. In order to implement the flow field in a part of the domain, a new air purification device is proposed in this study. The device combined with shelves can optimize the flow field uniformity through the MLA (PSO-SVR) algorithm and alteration of the air distribution structure. The uniformity of the final flow field increased to 0.925. The combination of data-driven MLA with CFD showed good performance in predicting the flow field uniformity. These findings offer valuable insights and practical applications for the prevention and control of respiratory diseases, particularly in post-epidemic scenarios.

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Yoshihara, J., Yamanaka, T., Kobayashi, T., Choi, N., Kobayashi, N.

Performance of combination of local exhaust system and floor-supply displacement ventilation system as prevention measure of infection in consulting room.

Japan Architectural Review, Vol. **6** n°(1), (2023)

Droplet nuclei and tiny enough droplets to move as an aerosol are regarded as one of the modes of infection transmission SARS-CoV-2. Various measures have been taken to prevent it worldwide. Nevertheless, many scenarios cannot be avoided close-distance conversations, for example, in a consulting room, restaurant, or crowded train. A consulting room has significant potential for doctors to contact infected patients. Therefore, this study proposes a novel approach combining a local exhaust ventilation (LEV) and floor-supply displacement ventilation system (FSDV) in a consulting room. This study assumes that two persons (doctor and patient) are sitting face to face and talking without a mask in a simple room regarded as a consulting room. The velocity and volume of exhaled air from talking were acquired through field measurements. Then, computational fluid dynamics (CFD) steady analysis was carried out, using the results of exhaled air measurement with various parameters (hood height, hood flow rate, horizontal hood position, and air flow rate). The capture efficiency for tracer gas and contribution distribution for the hood (SVE5: scale for ventilation efficiency 5) have been calculated to reveal the hood's capture performance. In addition, infection risk for the doctor was also calculated using the Wells-Riley model to estimate the infection performance of this ventilation system. By measuring exhaled air from talking, a speed of 0.30 m/s, a volume of 5.21 L/min, and a vertical angle of 11.9 degrees were obtained, and these values were installed into CFD. The CFD results showed that hood flow rate significantly impacts capture efficiency at SA 120 m3/h (6 ACH), and horizontal hood position significantly impacts at SA 1000 m3/h (50 ACH). SVE5 also showed hood's effective area is greatly influenced by the flow rate balance between the hood and the other exhaust routes. Under high air supply conditions: SA 1000 m3/h (50 ACH), there was almost no airborne transmission risk for a doctor with or without a hood. However, under 120 m3/h (6 ACH) conditions, the combination of the hood and FSDV system could reduce an infection risk sufficiently. The hood should be located above the infected person's head to keep the counter person's infectious risk low, indicating that the introduction of the hood is reasonable in the consulting room, where it is easy to find where the infected person is. This study revealed that the combination of the hood and floor-supply displacement ventilation (FSDV) can work to prevent infection.image

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Burdzik, R.
Probability of transmission of SARS-CoV-2 virus pathogens in long-distance passenger transport.
Archives of Transport, Vol. **68** n°(4), (2023), 21-39 p.

This paper presents a description of the methodology developed for estimation of pathogen transmission in transport and the results of the case study application for long-distance passenger transport. The primary objective is to report the method developed and the application for case studies in various passenger transport services. The most important findings and achievements of the presented study are the original universal methodology to estimate the probability of pathogen transmission with full mathematical disclosure and an open process formula, to make it possible to take other specific mechanisms of virus transmission when providing transport services. The results presented conducted an analysis on the mechanisms of transmission of SARS-CoV-2 virus pathogens during the transport process, to examine the chain of events as a result of which passengers may be infected. The author proposed a new method to estimate the probability of transmission of viral pathogens using the probability theory of the sum of elementary events. This is a new approach in this area, the advantage of which is a fully explicit mathematical formula that allows the method to be applied to various cases. The findings of this study can facilitate the management of epidemic risk in passenger transport operators and government administration. It should be clearly emphasised that the developed method and estimated values are the probabilities of pathogen transmission. Estimating the probability of transmission of the SARS-CoV-2 virus pathogen is not the same as the probability of viral infection, and more so the probability of contracting COVID-19. Viral infection strongly depends on viral mechanisms, exposure doses, and contact frequency. The probability of contracting COVID-19 and its

complications depends on the individual characteristics of the immune system, even with confirmed viral infection. However, it is undoubtedly that the probability of transmission of the SARS-CoV-2 virus pathogen is the most reliable measure of infection risk, which can be estimated according to the objective determinants of pathogen transmission.

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Christianson, C. D., Baylis, J. B., Komisar, V., Brinkerhoff, J.
Quantifying Ventilation Design, Room Layout, and Occupant Activity Parameters during Aerosol-Generating Medical Procedures in Hospitals.
Indoor Air, (2023)

The risk of airborne disease transmission in hospital rooms during aerosol-generating medical procedures is known to be influenced by the size of the room, air ventilation rate, input-to-output flow ratio, vent surface area, and vent location. However, quantitative recommendations for each ventilation design parameter are scarce. Moreover, room layout and occupant activity parameters, such as furniture locations and healthcare worker movement, are often omitted from studies on airborne disease transmission in hospital settings. As a result, the development of policies and technologies aimed at mitigating airborne disease transmission in hospitals has been limited. To address this shortfall, this study is aimed at first characterizing existing ventilation, room layout, and occupancy parameters in hospital rooms where aerosol generation medical procedures (AGMPs) occur and then testing the hypotheses that ventilation, room layout, and occupancy parameters vary significantly between hospital rooms and, in some cases, with time. Information on AGMPs was collected via a survey circulated to healthcare workers within British Columbia's Interior Health Authority (IHA), while hospital room and ventilation system information was collected by reviewing drawing packages of 37 IHA hospital rooms. The survey results indicate that AGMPs commonly occur in trauma, ICU, or general ward rooms with positive or negative pressure ventilation systems. Statistical tests, with room type (trauma, ICU, or general), room pressure (positive or negative), and/or time as independent variables, show that variables relating to ventilation (number of supply vents, supply and exhaust vent location, ventilation rate, and supply and exhaust area) and room layout (congestion score, room volume, light area, and number of lights) vary with room type but not with room pressure. Occupant activity variables (number of workers, number of moving workers, and speed score) also vary with room type, although to differing extent with room pressure and time. The survey and drawing review data presented in this study can help guide systematic comparisons of mitigative technologies as well as parametric investigations on how room layout, ventilation, and operational parameters influence airborne disease spread. This is a crucial first step in achieving quantitative and clinically relevant recommendations for mitigating airborne disease transmission in healthcare settings.

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Blatchley, E. R., Iii, Cui, H.
Quantitative Microbial Risk Assessment for Quantification of the Effects of Ultraviolet Germicidal Irradiation on COVID-19 Transmission.
Environmental Science & Technology, Vol. **57** n°(45), (2023), 17393-17403 p.

Quantitative microbial risk assessment (QMRA) is presented as a tool for evaluation of the effectiveness of ultraviolet germicidal irradiation (UVGI) systems for the disinfection of indoor air. The QMRA is developed in the context of UVGI system implementation for control of SARS-CoV-2 infection and comprises submodels to address problem formulation, exposure assessment, and health effects assessment, all of which provide input to a risk characterization submodel. The model simulations indicate that UVGI systems can effectively control the risk of infection associated with SARS-CoV-2 for low to moderate virus emission rates. The risk of disease transmission is strongly influenced by the rate of pathogen emission by an infected individual, the output power of UVGI fixtures and their configuration, the source of UV-C radiation implemented in the UVGI

fixtures, and the characteristics of the heating, ventilation, and air conditioning (HVAC) system. The QMRA framework provides a quantitative link between UVGI/HVAC system characteristics and changes in the risk of disease transmission. The framework can be adapted to other airborne pathogens and provides a rational basis for the design, testing, and validation of UVGI systems.

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Scheipers, H., Janssens, A., Laverge, J.
Review of international standards describing air cleaner test methods.
43rd AIVC Conference, 11th TightVent Conference, 9th venticool Conference - Ventilation, IEQ and health in sustainable buildings. Aalborg University, Copenhagen, Denmark. 04-05 october 2023

The offer of air cleaners has increased significantly since the SARS-CoV-2 pandemic. However, it is not clear to what extent they can contribute to indoor air quality. There are multiple standards that describe test methods for air cleaners, but no consensus can be found on how to determine the performance of the air cleaners. This paper contains a review of test methods for several types of air cleaners, (e.g. photocatalytic devices). This allows to make a holistic analysis of the existing test methods, in order to make recommendations for legislation regarding test methods to be used on the Belgian market. For this paper, a literature study has been conducted to investigate the similarities and differences between several standards. The investigated documents include, among others, a French standard, ISO standards, ASHRAE standards and AHAM standards. The literature study results in a structured overview of similarities, knowledge gaps and challenges. The main differences between the standards concern the test apparatus and the pollutants used. Most of the test methods use either a test duct, which measures the single-pass efficiency, or a test chamber, where the decay of the pollutants is measured over a certain period of time. All standards define different pollutants in different concentrations that should be tested. The test pollutants consist of VOCs, aerosols, (synthetic) dust, (acid) gases and microorganisms. They also differ in the type of air cleaners being tested. Several test methods are suited for any type of air cleaner. Other methods can only be used for a specific type of air cleaner, e.g., UV-C lights. In this case the test pollutants, measurements and test apparatus are adapted to the specific kind of air cleaner. Most standards lack a non-targeted analysis of the treated air, because this is too complicated or expensive to test. However, the by-products can be harmful and are relevant to test. Overall, the test methods are not suitable to predict the air quality in a room where the air cleaner may be used. They provide a means to compare the performances of different air cleaners to each other, but they do not predict real life performance. Furthermore, most of the test methods do not test the long-term performance of the air cleaners. This is because the test methods are kept as short as possible to reduce the costs.

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Coelho, L., Luz, P., Pires, D., Jalil, E., Perazzo, H., Torres, T.*, et al.*
SARS-CoV-2 transmission in a highly vulnerable population of Brazil: results from a household longitudinal study.
Research Square, (2023)

We estimated within/extra-household SARS-CoV-2 infection risk and associated factors in a household cohort study in one of the most vulnerable neighborhoods in Rio de Janeiro city. Individuals ≥1 years-old with suspected or confirmed COVID-19 in the past 30 days (index cases) and eligible household contacts were enrolled (Nov/2020-Dec/2021) and followed at 14 and 28 days. RT-PCR testing, COVID-19 symptoms, and SARS-CoV-2 serologies were ascertained in all visits. Chain binomial household transmission models were fitted using data from 2,024 individuals (593 households). Extra-household infection risk was 74.2% (95% credible interval [CrI] 70.3 - 77.8), while within-household infection risk was 11.4% (95 %CrI 5.7 - 17.2). Vaccination reduced both within/extra-household infection risks. Within-household infection risk was higher among participants aged 10-19 years, from overcrowded households, and with low family income.

Contrastingly, extra-household infection risk was higher among participants aged 20-29 years, unemployed, and public transportation users.

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Sixou, M.

Un nouveau défi au cabinet dentaire: la gestion de l'air.

AO News, Vol. n°(61), (2023)

Chaque crise sanitaire apporte son lot d'enseignements et nous amène à modifier nos procédures d'hygiène et d'asepsie en cabinet dentaire. Dans les années quatre-vingt, l'apparition du SIDA et des hépatites virales C, D et E ont rendu systématique le port des gants et du masque chirurgical pour pratiquer des soins bucco-dentaires, ainsi que la désinfection poussée ou la stérilisation des instruments. L'apparition des maladies à Prion dans les années quatre-vingt-dix, nous ont fait modifier les conditions d'utilisation des autoclaves avec l'apparition de cycles spécifiques. Puis la multiplication des maladies virales émergentes respiratoires se transmettant par voie aérienne comme le SRAS en 2003, la grippe H1N1 en 2009, le MERS en 2012, la Covid19 en 2019 nous impose de prendre en compte dans nos procédures d'hygiène en cabinet dentaire la gestion de l'air et des aérocontaminants. Mais comment gérer l'air en cabinet dentaire ?

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Ulum, M. S., Arminda, W., Kamaruddin, M., Satria, W. D.

Ventilation Performance of Air Duct in Double Loaded Corridor Building: A Case Study.

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Buildings with double-loaded corridor types are often found in Indonesia and generally function as offices or lecture rooms. This type of building is popular because of its efficient circulation path to accommodate the movement of occupants. However, a wall separating the room from the corridor makes it impossible to put windows to implement a cross-ventilation system due to acoustic problems. Hence, to achieve indoor thermal comfort, this type of building relies on using an air conditioning (AC) system. However, with the WHO's call to reduce the use of AC during the COVID-19 pandemic, it is necessary to evaluate cross-ventilation in double-loaded corridor buildings to meet comfort standards while still preventing acoustic problems due to noise from corridors and other spaces. The study proposes a new natural ventilation system using air ducts placed above the corridor ceiling to create cross-ventilation in lecture buildings. The E-ITERA building was chosen as a case study in this research. The building has a glass facade with several small windows that can be opened outside. The corridor of this building is designed with openings at both ends, allowing for direct connection to the outside air. The walls facing the passage have a single door and four small ventilations on the aisle's upper side. Simulations were carried out in two classrooms on the 3rd floor using CFD (Computational Fluid Dynamics) software. Experiments were carried out to change the size of the air duct and the size of the ventilation on the wall that leads to the corridor. The results showed that the air duct was able to create cross-ventilation. Ventilation performance is improved when the WWR air duct is the same as the WWR window. The highest air velocity in the centre of the room is 0.6 m/s.

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