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Aéraulique et COVID-19

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Lens, Google Scholar et WoS

Monteith, L., Tsan, S. H., Phuong Le, D., Li, M.
Aerosol Transmission and the COVID-19 Pandemic.
California State Polytechnic University, Pomona. Thèse 2021

In 2020, a novel coronavirus called Severe Acute Respiratory Syndrome Coronavirus 2, or COVID-19, started a global pandemic, forcing public places to shut down to prevent the spread of the virus. Resulting research has shown that, while infectious agents have multiple modes of transmission, COVID-19 predominantly spreads through droplet and aerosol transmission paths [1]. For clarification, an aerosol is the "suspension of small particles in air or another gas" [2]. Whenever people exhale through either their nose or mouth, droplets and aerosol particles are released into the surrounding air. Thus, when infected people sneeze or cough, viral particles are released into the air [1]. These viral particles thus have the potential to infect other individuals. Since these particles are considerably important to understanding and slowing the spread of the COVID-19 virus, it became critical to find methods to map the movement and speed of aerosol transmission in air. Under the direction of Dr. Mingheng Li, the aerosol project team researched aerosol transmission in relation to the COVID-19 pandemic. The project used MATLAB, a technical computing software program capable of computing and generating graphs based on mathematical equations, including differential equations. In MATLAB, a series of differential equations based on Navier-Stokes equations and Stokes' Law was developed that could track the velocity and displacement of an aerosol particle as it travels through the air. The results have shown that particle size significantly influences the displacement and velocity of aerosol particle transmission, thus affecting how aerosols settle out of the air. Particles smaller than 0.1-micron can take hours to fall, while a 300-micron particle falls to the ground within seconds. The scope of this project and its result with further current knowledge and understanding on aerosol transmission and how COVID-19 spreads.

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Shinohara, N., Tatsu, K., Kagi, N., Kim, H., Sakaguchi, J., Ogura, I.*, et al.*
Air exchange rates and advection-diffusion of CO2 and aerosols in a route bus for evaluation of infection risk.
Indoor air, Vol. **32** n°(3), (2022)

As COVID-19 continues to spread, infection risk on public transport is concerning. Air exchange rates (ACH) and advection-diffusion of CO2 and particles were determined in a route bus to evaluate the infection risk. ACH increased with bus speed whether windows were open or closed, and ACH were greater when more windows were open. With two open windows, ACH was greater when a front and rear window were open than when two rear windows were open. With both front and rear ventilation fans set to exhaust, ACH was more than double that when both were set to supply. With air conditioning (AC) off, CO2 and particles spread proportionally at the same rate from a source, whereas with the AC on, the spread rate of particles was about half that of CO2 , because particles might be trapped by a prefilter on the AC unit. Infection risk can be reduced by equipping AC unit with an appropriate filter. Calculations with a modified Wells-Riley equation showed that average infection risk was reduced by 92% in the moving bus with windows open comparing to with windows closed. When the bus was moving with windows closed, exhaust fan operation reduced the average risk by 35%.

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Mori, T., Akamatsu, T., Kuwabara, K., Hayashi, M.
Comparison of Indoor Environment and Energy Consumption before and after Spread of COVID-19 in Schools in Japanese Cold-Climate Region.

Energies, Vol. **15** n°(5), (2022)

A report released by the WHO indicates that aerosols from infected people are one of the major sources of the spread of COVID-19. Therefore, as the COVID-19 infection caused by the SARS-CoV-2 virus spreads, it has become necessary to reconsider the design and operation of buildings. Inside school buildings in cold regions, not only is it not easy to increase ventilation during the winter, but it may also be difficult for students to attend classes while wearing masks during the summer because such buildings are not equipped with air-conditioning systems. In short, school buildings in cold climates have more problems than those in warm climates. We report on the results of indoor environmental measurement using our developed CO2-concentration meters, a questionnaire survey on students' feeling of being hot or cold (i.e., 'thermal sensation'), and a comparison of energy consumption before and after the spread of COVID-19 infection in schools in Sapporo, Japan, a cold-climate area. The results indicate that (1) more than 70% of the students participated in window ventilation by the CO2 meter, and (2) a relatively good indoor environment was maintained through the efforts of teachers and students. However, we also found that (1) 90% of the students felt hot in summer and (2) 40% felt cold in winter, (3) energy efficiency worsened by 7% due to increased ventilation, and (4) air quality was not as clean as desired during the coldest months of the year. Therefore, investment in insulation and air conditioning systems for school buildings is needed.

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Oberlin, T. J., Dubois, C. K., Sheppard, M., Quam, J. D., Kramer, A. J., Logan, P. W.*, et al.*
COVID-19 aerosol transmission modeling in support of company HVAC guideline.
Journal of Occupational and Environmental Hygiene, (just-accepted), (2022), 1-11 p.

A company-wide COVID-19 Heating, Ventilation, and Air Conditioning Guideline was implemented globally as part of a larger control measure tool set to minimize the potential for workplace airborne transmission of SARS-CoV-2 virus. The COVID-19 Heating, Ventilation, and Air Conditioning Guideline informed and provided the process to optimize existing ventilation systems and set occupancy duration limits and clearance periods for a given space. Aerosol transmission modeling was used extensively to determine space limitations to reduce the potential for aerosol transmission in various manufacturing, lab, warehouse, aircraft, and administrative workspaces. This paper focuses on the modeling completed for administrative workspaces (e.g., offices, conference rooms, restrooms, elevators) due to their lower ventilation rates, higher occupant densities, and greater vocalization levels. A detailed description of how the Guideline was implemented with examples showing the evaluation and determinations made for specific spaces is provided. Implementation of this Guideline worldwide as one of the layers of protection was a key component in the overall strategy to reduce aerosol transmission of the SARS-CoV-2 virus.

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De Sousa, N. R., Steponaviciute, L., Margerie, L., Nissen, K., Kjellin, M., Reinius, B.*, et al.*
Detection and isolation of airborne SARS-CoV-2 in a hospital setting.
Indoor air, Vol. **32** n°(3), (2022)

Transmission mechanisms for severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) are incompletely understood. In particular, aerosol transmission remains unclear, with viral detection in air and demonstration of its infection potential being actively investigated. To this end, we employed a novel electrostatic collector to sample air from rooms occupied by COVID-19 patients in a major Swedish hospital. Electrostatic air sampling in conjunction with extraction-free, reverse-transcriptase polymerase chain reaction (hid-RT-PCR) enabled detection of SARS-CoV-2 in air from patient rooms (9/22; 41%) and adjoining anterooms (10/22; 45%). Detection with hid-RT-PCR was concomitant with viral RNA presence on the surface of exhaust ventilation channels in patients and anterooms more than 2 m from the COVID-19 patient. Importantly, it was possible to detect active SARS-CoV-2 particles from room air, with a total of 496 plaque-forming units (PFUs)

being isolated, establishing the presence of infectious, airborne SARS-CoV-2 in rooms occupied by COVID-19 patients. Our results support circulation of SARS-CoV-2 via aerosols and urge the revision of existing infection control frameworks to include airborne transmission.

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Dunne, A.
Digital Twins–Utilising Data Driven Digital Twins to monitor and maintain Indoor Air Quality (IAQ).
MaREI: Research Centre for Energy, Climate and Marine 2022

The significance of the airborne transmission of SARS-CoV-2 through the exhalation of small micro-droplets has been the object of extensive discussion within the International scientific community[2]. [...] Given that most of the documented spread of the disease has happened in indoor environments [3], control of indoor air is essential to reduce the risk of airborne pathogens [4]. [...] Thus, the challenge that this project will seek to address how to balance ventilation system energy consumption with the prevention of infection risk in the indoor environment. [...] As Europe embarks on its twin transition towards climate neutrality and digital leadership [12], the uptake of digital solutions and the use of data will help in the transition to a climate neutral, circular and more resilient economy [13] Project Call for 2022 ERBE Cohort PhD Proposal Summary for inclusion in This project will seek to address how to balance ventilation system energy consumption w. [...] The project will be undertaken in collaboration with local industrial partner companies in the Ringaskiddy area, primary and secondary schools in the Cork area and within University settings both in Ireland, the UK and the USA.

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Yao, F., Liu, X.
The effect of opening window position on aerosol transmission in an enclosed bus under windless environment.
Physics of fluids (Woodbury, N.Y. : 1994), Vol. **33** n°(12), (2021)

The potential risk of spreading a virus during bus transportation motivates us to understand the aerosol transmission of SARS-CoV-2 and seek effective ways to protect passengers in a bus. In this paper, a typical scenario in which the virus spreads in a bus under a windless environment is numerically studied for further understanding of the spreading characteristics of aerosol transmission in an enclosed space. The air flow in the bus and the spreading processes of droplets with different open windows configurations are obtained and analyzed. The variations of droplet concentration in the air with time are examined and analyzed. In addition, the transient droplet concentration deposited on the passengers is also counted to analyze the potential contact transmission. The results indicate that opening a window next to an infected person shows an unsatisfactory performance in limiting droplet spreading range and reducing droplet concentration, eventually leading to a high risk of infection by aerosol transmission following contact transmission. In addition, opening multiple windows also shows an unsatisfactory result for removing droplets in a bus since the turbulence flow accelerates the spreading speed and expands the spreading range. In contrast, the droplets are removed from the indoor space of the bus quickly if a window is opened in the row in front of the infected person, which is beneficial for reducing aerosol and contact transmission in the bus. Furthermore, it is strongly recommended to avoid sitting in the row in front of the infected person where the highest droplet concentration can be observed.

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Cadnum, J. L., Bolomey, A., Jencson, A. L., Wilson, B. M., Donskey, C. J.
Effectiveness of commercial portable air cleaners and a do-it-yourself minimum efficiency reporting value (MERV)-13 filter box fan air cleaner in reducing aerosolized bacteriophage MS2.
Infection Control and Hospital Epidemiology, (2022)

In an unventilated room, 2 commercial portable air cleaners with high efficiency particulate air (HEPA) filters and a do-it-yourself box fan air cleaner with minimum efficiency reporting value (MERV)-13 filters significantly reduced aerosolized bacteriophage MS2. Increasing airflow and addition of ultraviolet-C light plus titanium dioxide-generated photocatalytic oxidation enhanced viral clearance.

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Pöschl, U., Cheng, Y., Helleis, F., Klimach, T., Su, H.
Efficiency and synergy of simple protective measures against COVID-19: Masks, ventilation and more.
EGU General Assembly 2022, Vienna, Austria, 23–27 May 2022

The public and scientific discourse on how to mitigate the COVID-19 pandemic is often focused on the impact of individual protective measures, in particular on vaccination. In view of changing virus variants and conditions, however, it seems not clear if vaccination or any other protective measure alone may suffice to contain the transmission of SARS-CoV-2. Accounting for both droplet and aerosol transmission, we investigated the effectiveness and synergies of vaccination and non-pharmaceutical interventions like masking, distancing & ventilation, testing & isolation, and contact reduction as a function of compliance in the population. For realistic conditions, we find that it would be difficult to contain highly contagious SARS-CoV-2 variants by any individual measure. Instead, we show how multiple synergetic measures have to be combined to reduce the effective reproduction number (Re) below unity for different basic reproduction numbers ranging from the SARS-CoV-2 ancestral strain up to measles-like values (R0 = 3 to 18).
Face masks are well-established and effective preventive measures against the transmission of respiratory viruses and diseases, but their effectiveness for mitigating SARS-CoV-2 transmission is still under debate. We show that variations in mask efficacy can be explained by different regimes of virus abundance (virus-limited vs. virus-rich) and are related to population-average infection probability and reproduction number. Under virus-limited conditions, both surgical and FFP2/N95 masks are effective at reducing the virus spread, and universal masking with correctly applied FFP2/N95 masks can reduce infection probabilities by factors up to 100 or more (source control and wearer protection).
Masks are particularly effective in combination with synergetic measures like ventilation and distancing, which can reduce the viral load in breathing air by factors up to 10 or more and help maintaining virus-limited conditions. Extensive experimental studies, measurement data, numerical calculations, and practical experience show that window ventilation supported by exhaust fans (i.e. mechanical extract ventilation) is a simple and highly effective measure to increase air quality in classrooms. This approach can be used against the aerosol transmission of SARS-CoV-2. Mechanical extract ventilation (MEV) is very well suited not only for combating the COVID19 pandemic but also for sustainably ventilating schools in an energy-saving, resource-efficient, and climate-friendly manner. Distributed extract ducts or hoods can be flexibly reused, removed and stored, or combined with other devices (e.g. CO2 sensors), which is easy due to the modular approach and low-cost materials (www.ventilationmainz.de).
The scientific findings and approaches outlined above can be used to design, communicate, and implement efficient strategies for mitigating the COVID-19 pandemic.

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Nabirova, D., Taubayeva, R., Maratova, A., Henderson, A., Nassyrova, S., Kalkanbayeva, M.*, et al.*
Factors Associated with an Outbreak of COVID-19 in Oilfield Workers, Kazakhstan, 2020.
International journal of environmental research and public health, Vol. **19** n°(6), (2022)

From March to May 2020, 1306 oilfield workers in Kazakhstan tested positive for SARS-CoV-2. We conducted a case-control study to assess factors associated with SARS-CoV-2 transmission. The cases were PCR-positive for SARS-CoV-2 during June-September 2020. Controls lived at the same camp and were randomly selected from the workers who were PCR-negative for SARS-CoV-2. Data was collected telephonically by interviewing

the oil workers. The study had 296 cases and 536 controls with 627 (75%) men, and 527 (63%) were below 40 years of age. Individual factors were the main drivers of transmission, with little contribution by environmental factors. Of the twenty individual factors, rare hand sanitizer use, travel before shift work, and social interactions outside of work increased SARS-CoV-2 transmission. Of the twenty-two environmental factors, only working in air-conditioned spaces was associated with SARS-CoV-2 transmission. Communication messages may enhance workers' individual responsibility and responsibility for the safety of others to reduce SARS-CoV-2 transmission.

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Cadnum, J. L., Donskey, C. J.
If you can't measure it, you can't improve it: Practical tools to assess ventilation and airflow patterns to reduce the risk for transmission of severe acute respiratory syndrome coronavirus 2 and other airborne pathogens.
Infection Control & Hospital Epidemiology, Vol., 1-11 p.

One limitation of the coronavirus disease 2019 (COVID-19) pandemic response has been the lack of widely available, practical tools to measure factors such as ventilation and airflow that can impact transmission risk. The Centers for Disease Control and Prevention (CDC) has recommended that steps be taken to improve ventilation in healthcare facilities, schools, businesses, and households. However, limited guidance has been provided on how to evaluate the adequacy of ventilation. To be useful in real-world settings, tools to assess ventilation must be inexpensive, safe, and easy to use. An ideal tool would provide rapid and easy to interpret results that could be used to identify areas with inadequate ventilation and assess the impact of interventions.

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Raja, S., Anil, D.
Implementation of the Right to Healthy Environment: Regulations for running air conditioners in public buildings and recognition of biological pollutants.
Research Square, (2022)

The Indian Supreme Court has declared the right to healthy environment a fundamental right available to citizens of India. This in contrast to Indian executive's abstention from voting on the resolution for the right to healthy environment at United Nations Human Rights Council. Indian citizens may now be forced move courts for basic rights like clean and healthy air instead of a stronger executive action. This study uses an example of nine public buildings in New Delhi to show that air conditioners have an impact on the indoor air quality of congregational. This impact is all the more severe as it has a relation to the spread of airborne infections like COVID-19. The study highlights the paradox of fresh air intake for infection control and how it brings in polluted air due to ill equipped air conditioning systems. It also highlights biological contaminants' non recognition as pollutants. The data was gathered by the use of the Right to Information Act, 2005 and was studied to reinforce the evidence-based lack of regulations and implementation in New Delhi. The focus today must be on making regulations so that people in India realise their right to breathable air and a healthy environment.

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Corlan, R. V., Ionel, I., Boatca, M. E., Draghici, A., Balogh, R. M., Bisorca, D.
Indoor air quality research within a furniture factory.
International Conference on Applied Sciences (ICAS 2021) 12/05/2021 - 14/05/2021 Online,

Improving conditions and quality of life depends, among others, on the environment. People spend most of their time in a day inside buildings to work, sleep, eat, rest, and do sports and other activities. The article refers to a case study based on research on indoor environment within a furniture factory; the research is

achieved via instruments for collecting diverse indoor parameters, such as temperature, CO2, PM (particulate matter) concentrations, noise, and humidity levels. All data recorded are needed to evaluate the conditions of the indoor climate in which the workers are activating. The measuring methods are shortly introduced and the IAQ (indoor air quality) index is expressed. The personnel activating in this factory is working intensely, standing up, and having to wear a mask considering the Covid-19 context. Thus, it is important to depict each aspect that might trigger a concern if IAQ limits are over passed, not mentioning the synergetic context of the diverse effects. Through revealing the IAQ, and the comfort/discomfort level PMV/PPD (predicted mean vote and predicted percentage dissatisfied) employees and company management can benefit from this awareness and enhance the behaviour in such a way that one might improve the indoor condition. The rapid and irreversible climate changes, mostly due to increasing pollution level and exhaust of greenhouse gases should push humanity to make more studies of this kind and, accordingly, realize the need of improvement and development of new solutions whereby one can sustain the indoor environment as proper as possible, in addition to the outdoor climate.

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Mirza, S., Niwalkar, A., Gupta, A., Gautam, S., Anshul, A., Bherwani, H.*, et al.*
Is safe distance enough to prevent COVID-19 ? Dispersion and tracking of aerosols in various artificial ventilation conditions using OpenFOAM.
Gondwana Research, (2022)

The current COVID-19 pandemic has underlined the importance of learning more about aerosols and particles that migrate through the airways when the person sneezes, cough andspeak. The coronavirus transmission is influenced by particle movement, which contributes to the emergence of regulations on social distance, use ofmasks and face shield, crowded assemblies, and daily social activity in domestic, public,and corporate areas. Understanding the transmission of aerosols under differentmicro-environmental conditions, closed, or ventilated, has become extremely important to regulate safe social distances. The present work attempts to simulate the airborne transmission of coronavirus-laden particles under different respiratory-related activities, i.e., coughing and speaking using CFD modelling through OpenFOAM v8. The dispersion coupled with Discrete Phase Method (DPM) has been simulated to develop a better understanding of virus carrier particles transmission processes and their path trailing under different ventilation scenarios. The preliminary results of this study were found with respect to flow fields were found to be in close agreement with published literature, which was then extended under varied ventilation scenarios and respiratory-related activities. The study observed that improper wearing of mask leads to escape of SARS-CoV-2 aerosol having a smaller aerodynamic diameter from the gap between face mask and face and infect different surfaces on the environments in the vicinity. It is also observed that the aerosol propagation infecting the area through coughing is a faster phenomenon compared to the propagation of coronavirus-laden particles during speaking. The study's findings will help decision-makers formulate common but differentiated guidelines for safe distancing under different micro-environmental conditions.

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Nursd, E. T. C.
Maintaining Safe Office Spaces to Minimise Risks of SARS-CoV-2 Transmission.
Infection, Disease & Health, (2022)

Background
SARS-CoV-2 can be transmitted within offices. Traditional respiratory transmission modes have undergone reassessment and a new paradigm has emerged. This paradigm needs examining prior to identifying control measures to prevent office acquired infections (OAI).
Aim

To consider the current modes of transmission for SARS-CoV-2 and produce standard office control measures to prevent OAI.
Methods
An ongoing assessment of the SARS-CoV-2 transmission literature, including international public health guidance, began 30/1/2020 and continued to submission 7/2/2022. The evidence for the established respiratory transmission paradigm (either droplet or aerosols) and that of a newly emerging paradigm (aerosol and/or droplets) were explored. Based on the new paradigm control measures needed to minimise OAI were produced.
Findings
The old paradigm of respiratory transmission of being either droplet or airborne cannot be evidenced. SARS-CoV-2 is emitted in virus laden particles that can be inhaled and/or sprayed on facial mucous membranes. (Airborne being the dominant route). Office hygiene measures include: minimising the opportunities for the virus to enter the building. Reducing the susceptibility of people to the virus. Minimising exposure risks within offices, and optimising success in deployment.
Conclusions
Standard office hygiene precautions are needed to reduce OAI risks from SARS-CoV-2. Efforts should focus on enabling the smooth functioning of the office whilst minimising risks that the virus will transmit therein. This includes: local risk assessments as transmission risks vary based on building design, ventilation, capacity, and ways of working. Additionally, using experts to optimise ventilation systems.

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Economopoulos, K. P., Fearis, P., Simmons, W. N., Richardson, E. S., Montgomery, S. P.
A Portable Negative Pressure Isolation System as a Solution to Minimize Exposure of Health Care Providers to Infectious Pathogens.
The American surgeon, (2022)

The COVID-19 pandemic has resulted in the exposure of many surgeons and healthcare providers (HCPs) to disease given high patient loads and limited availability of negative pressure rooms. For these reasons we pursued the development of a portable patient isolation system (COVIAGE by iSolace, Inc.) that can be used to contain patients with respiratory illness and minimize the exposure of HCPs. COVIAGE is comprised of a reusable aluminum frame, a disposable thermoplastic polyurethane tent and a HEPA filtration/ventilation system (HVAC) utilizing two inline filters. The efficacy of filtration was tested by comparing particulate concentration inside and outside of the device by an independent third party. Additionally, physician, nursing, and respiratory tasks were performed initially on simulated patients and then on intubated patients in the ICU. The system attained a verified filtration efficiency greater than 99.999% for an average 0.3-mum size particulates. Simulation testing revealed that most common physician, nursing, and respiratory tasks could be completed in the device, including endotracheal intubation. Emergency removal of the device can be accomplished in 8.8 ± 2.8seconds. The reusable aluminum frame allows for simple attachment to the bed, and adaptability to different types and sizes of beds/stretchers. An emergency use authorization was granted by the FDA. The device created results in a portable negative pressure isolation system that can be placed over the patient's bed to contain aerosols during high aerosol generating procedures, transportation of patients or for total patient care in environments where negative pressure rooms are not available.

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Navarro, P.
Risk to healthcare workers from aerosol generating procedures during omicron.
CHRSP: Newfoundland & Labrador Centre for Applied Health Research 2022

The significance of the airborne transmission of SARS-CoV-2 through the exhalation of small micro-droplets has been the object of extensive discussion within the International scientific community[2]. [...] Given that

most of the documented spread of the disease has happened in indoor environments [3], control of indoor air is essential to reduce the risk of airborne pathogens [4]. [...] Thus, the challenge that this project will seek to address how to balance ventilation system energy consumption with the prevention of infection risk in the indoor environment. [...] As Europe embarks on its twin transition towards climate neutrality and digital leadership [12], the uptake of digital solutions and the use of data will help in the transition to a climate neutral, circular and more resilient economy [13] Project Call for 2022 ERBE Cohort PhD Proposal Summary for inclusion in This project will seek to address how to balance ventilation system energy consumption w. [...] The project will be undertaken in collaboration with local industrial partner companies in the Ringaskiddy area, primary and secondary schools in the Cork area and within University settings both in Ireland, the UK and the USA.

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Nguyen, T. T., Johnson, G. R., Bell, S. C., Knibbs, L. D.
A Systematic Literature Review of Indoor Air Disinfection Techniques for Airborne Bacterial Respiratory Pathogens.
International Journal of Environmental Research and Public Health, Vol. **19** n°(3), (2022)

Interrupting the transmission of airborne (<≈5 µm) respiratory pathogens indoors is not a new challenge, but it has attracted unprecedented interest due to the COVID-19 pandemic during 2020–2021. However, bacterial respiratory pathogens with known or potential airborne transmission account for an appreciable proportion of the communicable disease burden globally. We aimed to systematically review quantitative, laboratory-based studies of air disinfection techniques for airborne respiratory bacteria. Three databases (PubMed, Web of Science, Scopus) were searched, following PRISMA guidelines. A total of 9596 articles were identified, of which 517 were assessed in detail and of which 26 met the inclusion and quality assessment criteria. Seven air disinfection techniques, including UV-C light, filtration, and face masks, among others, were applied to 13 different bacterial pathogens. More than 80% of studies suggested that air disinfection techniques were more effective at inactivating or killing bacteria than the comparator or baseline condition. However, it was not possible to compare these techniques because of methodological heterogeneity and the relatively small number of the studies. Laboratory studies are useful for demonstrating proof-of-concept and performance under controlled conditions. However, the generalisability of their findings to person-to-person transmission in real-world settings is unclear for most of the pathogens and techniques we assessed.

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Linge, K., Palmer, J., Downey, A., Soukos, K., Cailes, J., Walker, M.*, et al.*
A tracer gas study of ventilation and air movement to inform potential SARS-CoV-2 airborne transmission.
ChemRvix, Cambridge University Press, (2022)

Tracer gas studies were carried out to investigate the potential for airborne transmission of SARS-CoV-2 variants, and to inform work practises to reduce COVID-19 exposure and transmission. The air exchange of a meeting room was determined in accordance with ASTM E741-11 using sulfur hexafluoride (SF6), a colourless, odorless, non-flammable, and non-toxic tracer gas. Air was generally well mixed in the room, and very little tracer gas escaped through the closed door. The calculated air changes per hour (ACH) of the meeting room (5.8 h-1) was higher than the value recommended for offices (2-3 h-1) and used to assess potential COVID-19 infection risk and calculate maximum occupancy rates using the Airborne Infection Risk Calculator (AIRC) V3 Beta. Results showed that the previous guidance for maximum occupancy rates provided by many Australian States and Territories (the 2 or 4 square meters rule) provides a conservative estimate of the maximum number of occupants within a room for exposure events of up to 2 hours. However, for longer periods, such as a full working day (7.5 hours), and for more infectious strains of SARS-CoV-2, the 2 or 4 square meter rule did not adequately address infection risk. Use of two additional controls, mask wearing and ensuring that all occupants had received a third boosted vaccine dose, was estimated to reduce the probability of infection by

3.75-fold assuming infection with the Omicron variant. Including both controls increased the predicted maximum occupancy to values greater than the 2 and 4 square meter rule for most scenarios. Air movement outside the meeting room was investigated by filling the room with tracer gas and allowing the air to move freely by keeping the door open. Airflow was most influenced by the ventilation system of the laboratories in the north wing of building, rather than laboratories in the south wing. The plug of tracer gas was largely removed from the building within 30 minutes, although detectable concentrations were measured in some areas with lower air flow at the end of the 2-hour experiment. High concentrations were also noted in front of the elevators, however tracer gas concentrations were below detection on other floors. The techniques employed in this study are suitable for measuring air movement and ventilation in other buildings where aerosol transmission of COVID-19 is of concern.

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Reinhardt, É. L.
Transmission of COVID-19: a brief review of droplet and aerosol transmission routes.
Revista Brasileira de Saúde Ocupacional, Vol. **47**, (2022)

The rapid advance of the COVID-19 pandemic in the year 2020 has spurred researchers to try to understand quickly the behavior of the virus and the disease, and to propose solutions in order to attempt containing it as soon as possible. One of the core questions to be answered is whether the virus can also be transmitted by aerosols, since the mode of transmission determines the speed and conditions under which the disease can spread through the population. The search for this answer has rekindled a decades-long discussion about the relevance of this transmission route, as well as the different concepts and control and prevention measures currently used to block the transmission of infectious diseases in human healthcare. This essay aims to contribute to this debate and, more specifically, to support programs for the protection of workers and patients in healthcare services regarding COVID-19 and other infectious diseases.

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Wang, F., Permana, I., Chaerasari, C., Lee, K., Chang, T., Rakshit, D.
Ventilation Performance Evaluation of a Negative-Pressurized Isolation Room for Emergency Departments.
Healthcare, Vol. **10** n°(2), (2022)

Due to the emergence of COVID-19 becoming a significant pandemic worldwide, hospitals are expected to be capable and flexible in responding to the pandemic situation. Moreover, as frontline healthcare staff, emergency department (ED) staff have a high possibility of exposure risk to infectious airborne. The ED isolation room will possibly and effectively isolate the infected patient, therefore safekeeping frontline healthcare staff and controlling the outbreak. However, there is still limited knowledge available regarding isolation room facilities specifically for the emergency department. In this study, field measurement is conducted in an ED isolation room located in Taiwan. CFD simulation is employed to simulate and investigate the airflow and airborne contaminant distribution. Instead of high air-change rates (ACH) that purposes for dilution, this study proposes the arrangement of exhaust air grilles to improve the contaminant removal. The results reveal that the exhaust air grille placed behind the patient’s head is optimized to dilute airborne contaminants.

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