Rapport de veille n° 95

Aéraulique et COVID-19

19/06/2024

Les bulletins de veille sont disponibles pour le personnel de l'INRS sur le portail documentaire de l'INRS.
Pour les lecteurs externes, merci de les consulter sur le portail documentaire public.
L'abonnement vous permet de recevoir une alerte mail lors de la publication d'un nouveau bulletin (bouton « M'abonner »).

Google Scholar, Lens et WoS

Padma, K. R., Don, K. R.
11 Dentistry 4.0's Role in COVID-19.
In: Handbook of Intelligent and Sustainable Smart Dentistry: Nature and Bio-Inspired Approaches, Processes, Materials, and Manufacturing. CRC Press; 2024. 236 p.

A global pandemic was caused by the coronavirus illness, which had its origins in Wuhan, China. Dental professionals are an underutilized resource to fight the pandemic given the rising demand for medical healthcare. Since most dental colleges and universities around the globe have shuttered due to the COVID-19 epidemic, dental education has been disrupted on a global scale. A telemedicine branch called teledentistry uses tools like video conferencing to deliver instructional materials, counsel, and treatment diagnoses to patients far away. With the use of cutting-edge technologies in dentistry, Dentistry 4.0 is progressing. To boost productivity and encourage innovation in dentistry in the face of this pandemic, we came up with the concept of Dentistry 4.0. Consequently, a fourth dental revolution is just being started on a global level. We are aware that this revolution will change dental trends subsequently on outbreak of the current pandemic COVID-19. Therefore, our article has emphasized significant obstacles, some of which have never been faced before, confronting dental education today. The outcomes of the present inquiry can be a beneficial instrument for identifying the essential issues that must be addressed in subsequent research to overcome the challenges.

****

Ko, S., Park, K. H., Lee, J.-Y., Kim, Y. B.
Accessing of Viable Bacteria Captured by Antimicrobial Filters in a Metropolitan Subway of South Korea.
Korean J Chem Eng, (2024)

In subway stations, where passengers are crowed in enclosed spaces with restricted ventilation, airborne microorganisms have been detected, potentially contributing to the spread of infectious aerosols. In South Korea's metropolitan subways, air purifiers are installed on platforms to reduce particulate matter. Efficiency particulate air (EPA) filters in air purifiers lack disinfection capabilities and can serve as a source of airborne pathogens during filter replacement. In this field study, antimicrobial filters were applied to air purifiers installed on a subway platform to assess their ability to reduce the captured microorganisms. After 1 week of operation, the microbiomes were collected from both the control and test filters, followed by microbial identification. Additionally, the composition of metal elements was analyzed using particulate matter collected by the EPA filters. While 19 types of bacterial species were detected in control filters, the antimicrobial filters showed the presence of 15 bacterial species, with overall 64.71% of antibacterial efficacy. Specifically, the antimicrobial filter exhibited 100% reduction in Micrococcus and 93.75% reduction in Staphylococcus genus, related to anthropogenic sources.

****

Mekapothula, S., Chrysanthou, E., Hall, J., Nekkalapudi, P. D., Mclean, S., Cave, G. W. V.
Antipathogenic Applications of Copper Nanoparticles in Air Filtration Systems.
Materials, Vol. **17** n°(11), (2024)

The COVID-19 pandemic has underscored the critical need for effective air filtration systems in healthcare environments to mitigate the spread of viral and bacterial pathogens. This study explores the utilization of copper nanoparticle-coated materials for air filtration, offering both antiviral and antimicrobial properties. Highly uniform spherical copper oxide nanoparticles (~10 nm) were synthesized via a spinning disc reactor and

subsequently functionalized with carboxylated ligands to ensure colloidal stability in aqueous solutions. The functionalized copper oxide nanoparticles were applied as antipathogenic coatings on extruded polyethylene and melt-blown polypropylene fibers to assess their efficacy in air filtration applications. Notably, Type IIR medical facemasks incorporating the copper nanoparticle-coated polyethylene fibers demonstrated a >90% reduction in influenza virus and SARS-CoV-2 within 2 h of exposure. Similarly, heating, ventilation, and air conditioning (HVAC) filtration pre- (polyester) and post (polypropylene)-filtration media were functionalised with the copper nanoparticles and exhibited a 99% reduction in various viral and bacterial strains, including SARS-CoV-2, Pseudomonas aeruginosa, Acinetobacter baumannii, Salmonella enterica, and Escherichia coli. In both cases, this mitigates not only the immediate threat from these pathogens but also the risk of biofouling and secondary risk factors. The assessment of leaching properties confirmed that the copper nanoparticle coatings remained intact on the polymeric fiber surfaces without releasing nanoparticles into the solution or airflow. These findings highlight the potential of nanoparticle-coated materials in developing biocompatible and environmentally friendly air filtration systems for healthcare settings, crucial in combating current and future pandemic threats.

****

Past, V., Naderi, M., Saremi, G., Azizi, P., Javadzadeh, M., Shahveh, S.*, et al.*
The Application of Ozone Gas in Inactivation of Surface and Airborne SARS-CoV-2 in Hospitals: A Systematic Review.
Ozone: Science & Engineering, 1-21 p.

The outbreak of COVID-19 caused by the novel coronavirus SARS-CoV-2 is a global public health threat. As high-risk environments for transmission, hospitals require effective methods to inactivate the virus on surfaces and in the air to prevent further spread among hospitals. The aim of this systematic review was to evaluate the use of ozone gas to inactivate surface and airborne SARS-CoV-2 in hospital settings. A systematic literature search was performed in databases including PubMed, Scopus and Web of Science from 2019 to 2024. Studies that assessed the use of ozone gas to inactivate SARS-CoV-2 in hospital settings were included. The quality assessment of the studies was done using the Critical Appraisal Skills Program (CASP) tool. A total of 10 studies met the inclusion criteria and were included in the review. Studies have reported that ozone effectively inactivates SARS-CoV-2 on surfaces and air in hospital environments. However, there were variations in ozone concentration, exposure time, and relative humidity (RH) used in each study. Ozone demonstrates promise as an effective disinfectant for inactivating SARS-CoV-2 on surfaces and air in hospital environments. It should be focused on determining the optimal conditions for maximum efficiency and establishing relevant protocols in terms of human health.

****

Hernandez-Mejia, G., Scheithauer, S., Blaschke, S., Kucheryava, N., Schwarz, K., Moellmann, J.*, et al.*
Architectural interventions to mitigate the spread of SARS-CoV-2 in emergency departments.
Journal of Hospital Infection, (2024)

Introduction
Emergency departments (EDs) are a critical entry gate for infectious agents into hospitals. In this interdisciplinary study, we explore how infection prevention and control (IPC) architectural interventions mitigate the spread of emerging respiratory pathogens using the example of SARS-CoV-2 in a prototypical ED.
Methods
Using an agent-based approach, we integrate data on patients' and healthcare workers' (HCWs) routines and the architectural characteristics of key ED areas. We estimate the number of transmissions in the ED by modelling the interactions between and among patients and HCWs. Architectural interventions are guided towards the gradual separation of pathogen carriers, compliance with a minimum interpersonal distance, and

deconcentrating airborne pathogens (higher air exchange rates (AERs)). Interventions are epidemiologically evaluated for their mitigation effects on diverse endpoints.
Results
Simulation results indicate that higher AERs in the ED (compared to baseline) may provide a moderate level of infection mitigation (incidence rate ratio (IRR) of 0.95 (95% CI 0.93 - 0.98)) while the overall burden decreases more when separating rooms in examination areas (IRR of 0.78 (95% CI 0.76 - 0.81)) or when increasing the size of the ED base (IRR of 0.79 (95% CI 0.78 - 0.81)). The reduction in SARS-CoV-2-associated nosocomial transmissions is largest when combining architectural interventions (IRR of 0.61 (95% CI 0.59 - 0.63)).
Conclusions
These modelling results highlight the importance of IPC architectural interventions; they can be devised independently of profound knowledge of an emerging pathogen, focusing on technical, constructive, and functional components. These results may inform public health decision-makers and hospital architects on how IPC architectural interventions can be optimally used in healthcare premises.

****

Narouei, F., Tang, Z., Wang, S., Hashmi, R., Welch, D., Sethuraman, S.*, et al.*
Effects of Germicidal Far-UVC on Indoor Air Quality in an Office Setting.
ChemRxiv, (2024)

The application of 222 nm light from KrCl excimer lamps (GUV222 or Far-UVC) is a promising approach to reduce the indoor transmission of airborne pathogens, including the SARS-CoV-2 virus. GUV222 inactivates airborne pathogens and is believed to be relatively safe for human skin and eye exposure. However, UV light initiates photochemical reactions which may negatively impact indoor air quality. We conducted a series of experiments to assess the formation of ozone (O3) and secondary organic aerosols (SOA) induced by commercial far-UVC devices in an office environment with an air exchange rate of 1.3 h-1. We studied scenarios with a single far-UVC lamp, corresponding to the manufacturer's recommendations, and with four far-UVC lamps, which exceeded both the manufacturer's and regulatory recommendations. The single far-UVC lamp did not significantly impact O3 or fine particulate matter levels. Consistent with previous studies in the literature, the higher far-UVC fluences lead to increases in O3 of 5 to 10 ppb above background, and minor increases in particulate matter. The use of far-UVC at intensities consistent with regulatory / manufacturer's recommendations, and in conjunction with normal ventilation, may reduce airborne pathogen levels while minimizing the formation of air pollutants.

****

Liu, Z., Lin, C., Shi, J., Ding, M., Liu, H., Chu, J.*, et al.*
Evaluation of upper-room ultraviolet germicidal irradiation system for air disinfection and energy conservation in multi-patient ward.
Journal of Building Engineering, Vol. **93**, (2024)

High occupancy rates significantly increase the risk of airborne transmission of respiratory infectious diseases in multi-patient wards. While increasing air supply can effectively reduce airborne transmission, it also substantially raises energy consumption. Therefore, developing low-energy methods in multi-patient wards to suppress airborne transmission is essential. This study aims to evaluate the inactivation performance of upper-room ultraviolet germicidal irradiation (UVGI) against SARS-CoV-2 virus aerosols in a typical multi-patient ward using computational fluid dynamics at different ventilation rates, as well as its energy-saving effects. Upper-room UVGI reduced the virus aerosol concentrations, with a maximum decrease of up to 159 copies/m3 in the occupied zone (zone less than 2.1 m in height) observed at 8 ACH. However, increased ventilation rates limited the inactivation performance of upper-room UVGI. Two parameters of UVGI, irradiation height and irradiation flux, had been detailly evaluated. Elevating the irradiation height of upper-room UVGI could significantly enhance the inactivation performance. Increasing irradiation height from 0.3 to

0.6 m reduced the concentrations in the occupied zone by up to 11 copies/m3, while a further increase to 0.9 m decreased the concentrations by up to 55 copies/m3. However, increasing irradiation flux could only approximately linearly enhance the virus aerosol inactivation performance of upper-room UVGI. The energy consumption evaluation of upper-room UVGI shows that UVGI activation could conserve 100 kWh per year in one multi-patient ward, with a maximum saving of 333.7 kWh. These findings provide insights into the setups strategies and the energy-saving performance of upper-room UVGI systems in multi-patient wards.

****

Voccio, J., Zenouzi, M., Seredinski, A., Khabari, A., Young, S., Reddick, T.*, et al.*
Experimental study of aerosol behavior in ambient electric and magnetic fields at low indoor relative humidity.
Journal of Electrostatics, Vol. **130**, (2024)

The tendency of aerosols to carry viral particles featured significantly in public discourse during the SARS Covid-19 pandemic. In this research, the potential significance of the aerosol electric charge, especially as it relates to indoor relative humidity (RH) is considered. While electrostatic interactions may occur at any level of humidity, the level of humidity has a strong influence on these interactions. Above 55 % RH, there is sufficient moisture in the air to facilitate neutralization of the electric charges of particles and surfaces, whereas, at lower humidity levels, less moisture and higher surface resistivities enable increasingly stronger electrostatic interactions. Experiments were designed and conducted to study the behavior of electrically charged aerosols in fields emanating from capacitive touchscreens and permanent magnets. These preliminary experimental results suggest that operating indoor environments closer to the 55–60 % RH range could reduce interactions between these charged aerosols and capacitive touchscreens. This relative humidity range is within the acceptable ranges of humidity recommended by ASHRAE standard 55 which defines thermal environmental conditions for human occupancy.

****

World Health, O.
Global technical consultation report on proposed terminology for pathogens that transmit through the air.
World Health Organization; 2024

Terminology used to describe the transmission of pathogens through the air varies across scientific disciplines, organizations and the general public. While this has been the case for decades, during the coronavirus disease (COVID-19) pandemic, the terms ‘airborne’, ‘airborne transmission’ and ‘aerosol transmission’ were used in different ways by stakeholders in different scientific disciplines, which may have contributed to misleading information and confusion about how pathogens are transmitted in human populations.
This global technical consultation report brings together viewpoints from experts spanning a range of disciplines with the key objective of seeking consensus regarding the terminology used to describe the transmission of pathogens through the air that can potentially cause infection in humans.
This consultation aimed to identify terminology that could be understood and accepted by different technical disciplines. The agreed process was to develop a consensus document that could be endorsed by global agencies and entities. Despite the complex discussions and challenges, significant progress was made during the consultation process, particularly the consensus on a set of descriptors to describe how pathogens are transmitted through the air and the related modes of transmission. WHO recognizes the important areas where consensus was not achieved and will continue to address these areas in follow-up consultations.

****

Young, A. S., Parikh, S., Dedesko, S., Bliss, M., Xu, J., Zanobetti, A.*, et al.*
Home indoor air quality and cognitive function over one year for people working remotely during COVID-19.

Building and Environment, Vol. **257**, (2024)

The coronavirus disease 2019 (COVID-19) pandemic triggered an increase in remote work-from-home for office workers. Given that many homes now function as offices despite not being designed to support office work, it is critical to research the impact of indoor air quality (IAQ) in homes on the cognitive performance of people working from home. In this study, we followed 206 office workers across the U.S. over one year under remote or hybrid-remote settings during 2021 - 2022. Participants placed two real-time, consumer-grade indoor environmental monitors in their home workstation area and bedroom. Using a custom smartphone application geofenced to their residential address, participants responded to surveys and periodic cognitive function tests, including the Stroop color - word interference test, Arithmetic two-digit addition/subtraction test, and Compound Remote Associates Task (cRAT). Exposures assessed included carbon dioxide (CO 2) and thermal conditions (indoor heat index: a combination of temperature and relative humidity) averaged over 30 min prior to each cognitive test. In fully adjusted longitudinal mixed models (n <= 121), we found that indoor thermal conditions at home were associated with cognitive function outcomes non-linearly (p < 0.05), with poorer cognitive performance on the Stroop test and poorer creative problem-solving on the cRAT when conditions were either too warm or too cool. Most indoor CO2 levels were <640 ppm, but there was still a slight association between higher CO2 and poorer cognitive performance on Stroop (p = 0.09). Our findings highlight the need to enhance home indoor environmental quality for optimal cognitive function during remote work, with benefits for both employees and employers.

****

Tsang, T.-W., Mui, K.-W., Wong, L.-T.
Indoor Air Quality (IAQ) Management in Hong Kong: The Way Forward.
Atmosphere, Vol. **15** n°(5), (2024)

There has been an increasing awareness of indoor air quality (IAQ) management in green building designs, driven by the need to mitigate potential health risks and create sustainable and healthy indoor environments. The COVID-19 pandemic has further highlighted the critical role of ventilation and IAQ in reducing the risk of indoor airborne transmission. Governments and organisations worldwide have responded to this growing concern by implementing ventilation requirements and updating IAQ standards and guidelines. In the case of Hong Kong, a developed and densely populated city characterised by high-rise buildings, this study aims to provide a strategic framework for non-governmental agencies to address IAQ issues effectively. A comprehensive review of policies, regulations, and guidelines by international bodies and individual governments, along with an examination of the current IAQ management scheme in Hong Kong, has been conducted. Drawing inspiration from successful IAQ management strategies, the study aims to identify insights and potential pathways for the city's future development of IAQ management strategies. Overall, this research highlights the importance of proactive IAQ management for buildings and offers a roadmap for Hong Kong's pursuit of healthier indoor environments.

****

Subirana, M., Sunyer, J., Colom-Cadena, A., Bordas, A., Casabona, J., Gascon, M.
Monitoring and assessment of CO2 and NO2 in schools within the Sentinel Schools Network of Catalonia during the COVID-19 era.
Chemosphere, Vol. **362**, (2024)

In response to the global impact of the COVID-19 pandemic, international and national authorities, including those in Catalonia (Spain), recognized the crucial need to ensure proper ventilation in classrooms, emphasizing the importance of safe and healthy indoor environments for face-to-face learning. The present work, conducted within the COVID-19 Sentinel Schools Network of Catalonia (CSSNC) framework, aimed to monitor carbon dioxide (CO2) and nitrogen dioxide (NO2) concentrations in 23 schools, ensuring a

comprehensive sample regarding educational levels, daily scholar schedules, and classroom typologies distributed across the four provinces of Catalonia. The research spanned three study periods: March and April 2021, October 2021 to January 2022, and March to June 2022. Briefly, 28%, 25%, and 37% of classrooms surpassed the 700 parts per million (ppm) CO2 limit in each study period, respectively. Generally, CO2 averages were lower in preschool classrooms (mean ± SD = 486 ± 106 ppm), while high school classrooms displayed the highest CO2 concentrations (mean ± SD = 710 ± 253 ppm). Moreover, classrooms in towns (<30000 inhabitants) exhibited higher CO2 levels as compared to classrooms from schools located in cities. As for NO2, the highest averages were obtained in urban areas, particularly in the Barcelona metropolitan area (e.g. mean indoor levels of 24.56 µg m−3 as compared to 11.05 µg m−3 in towns). In addition, the Indoor/Outdoor ratio (I/O ratio) in towns was the lowest (0.60). These results, together with the higher concentration of CO2 indoors, could indicate poorer ventilation in town schools. The results of this study are anticipated to contribute to implementing evidence-based measures to improve indoor air quality (IAQ) in educational settings.

****

D'agostino, D., Di Mascolo, M., Minelli, F., Minichiello, F.
A New Tailored Approach to Calculate the Optimal Number of Outdoor Air Changes in School Building HVAC Systems in the Post-COVID-19 Era.
Energies, Vol. **17** n°(11), (2024)

Air conditioning systems can play a positive or negative role in the spread of COVID-19 infection. The importance of sufficient outdoor air changes in buildings was highlighted by the World Health Organization, therefore these should be guaranteed by mechanical ventilation systems or adequate air conditioning systems. The proposed case study concerns the optimal number of outdoor air changes to limit COVID-19 contagion for a school building in Central Italy. The Wells–Riley model is used to assess the risk of airborne infection, while energy consumption is calculated by a dynamic energy simulation software. The scope of the paper offers an innovative method to define the optimal ventilation strategy for the building's HVAC system design to reduce the risk of infection with limited increases in energy consumption and greenhouse gas emissions. Results show that the desirable approach is the one in which the same low value of contagion risk is set in all rooms. This new approach results in significant energy savings, compared to the most common ones (setting the same high outdoor air rates for all rooms) to counteract the risk of infection. Finally, the zero-emission building target is verified by introducing a suitable photovoltaic system to offset pollutant emissions.

****

Tang, C. Y., Gao, C., Prasai, K., Li, T., Dash, S., Mcelroy, J. A.*, et al.*
Prediction models for COVID-19 disease outcomes.
Emerging Microbes & Infections, Vol. **13** n°(1), (2024)

SARS-CoV-2 has caused over 6.9 million deaths and continues to produce lasting health consequences. COVID-19 manifests broadly from no symptoms to death. In a retrospective cross-sectional study, we developed personalized risk assessment models that predict clinical outcomes for individuals with COVID-19 and inform targeted interventions. We sequenced viruses from SARS-CoV-2-positive nasopharyngeal swab samples between July 2020 and July 2022 from 4450 individuals in Missouri and retrieved associated disease courses, clinical history, and urban-rural classification. We integrated this data to develop machine learning-based predictive models to predict hospitalization, ICU admission, and long COVID. The mean age was 38.3 years (standard deviation=21.4) with 55.2% (N=2 453) females and 44.8% (N=1 994) males (not reported, N=4). Our analyses revealed a comprehensive set of predictors for each outcome, encompassing human, environment, and virus genome-wide genetic markers. Immunosuppression, cardiovascular disease, older age, cardiac, gastrointestinal, and constitutional symptoms, rural residence, and specific amino acid substitutions were

associated with hospitalization. ICU admission was associated with acute respiratory distress syndrome, ventilation, bacterial co-infection, rural residence, and non-wild type SARS-CoV-2 variants. Finally, long COVID was associated with hospital admission, ventilation, and female sex. Overall, we developed risk assessment models that offer the capability to identify patients with COVID-19 necessitating enhanced monitoring or early interventions. Of importance, we demonstrate the value of including key elements of virus, host, and environmental factors to predict patient outcomes, serving as a valuable platform in the field of personalized medicine with the potential for adaptation to other infectious diseases. Model summary and motivation. Individuals infected with SARS-CoV-2 experience a wide spectrum of clinical manifestations ranging from no symptoms to death. Using the Virus-Human Outcomes Prediction (ViHOP) algorithm, we aim to utilize the individual's clinical characteristics, the individual's location, and the infecting SARS-CoV-2 virus characteristics obtained by whole genome sequencing to determine their likelihood of admission to the hospital, admission to the intensive care unit (ICU), or experiencing long COVID. This model allows clinicians to identify at-risk patients for further monitoring and/or early treatment.

****

Liu, T., Wang, J., Zhou, D., Meng, X., Luo, X., Wang, Y.
Research on Optimization Design Strategies for Natural Ventilation in Living Units of Institutional Elderly Care Facilities Based on Computational Fluid Dynamics Simulation.
Buildings, Vol. **14** n°(6), (2024)

As China transitions into a deeply aging society, the elderly population’s growth has driven a rapid increase in elderly care institutions and facilities during the “13th Five-Year Plan” period, rising by over 235% compared to the “12th Five-Year Plan”. The ongoing normalization of COVID-19 prevention measures has underscored the urgent need to improve natural ventilation in elderly care residential facilities. This study conducted empirical surveys to assess the current state of natural ventilation in typical elderly care facilities and analyzed the architectural elements influencing it. By examining the needs and preferences of the elderly for natural ventilation, two basic living space layout types were identified through typological analysis. Suitable CFD simulation software was then employed to model key elements, and effective methods to enhance ventilation were summarized. This study found that modifying the floor plan to reduce the depth of south-facing rooms to 8.4 m, relocating external openings to the center of the rooms, adjusting the ratio of ventilation openings to room area to greater than 1/12, and adding 0.5 m high windows facing internal traffic roads can significantly improve indoor ventilation while maintaining privacy. Furthermore, placing the main activity and resting areas of the elderly in well-ventilated zones with minimal drafts can enhance both comfort and ventilation effectiveness. The research provides a scientific basis and methodological guidance for the construction and renovation of elderly care residential facilities.

****

Farah Adibah Che, I., Kang Sing, S., Nor Amalin Sahiira Mohd, F., Muhamad Shahrim Ab, K., Siti Fatimah, M.
Restoring Restaurant Design and Layout: Towards Safer Dining Out Experience.
Journal of Advanced Research Design, Vol. **116** n°(1), (2024), 1-12 p.

An explosion of COVID-19 virus has engulfed the world unsparingly and various industries were affected by this pandemic at different levels. The restaurant industry in Malaysia has faced huge obstacles in applying the COVID-19 safety guidelines while maintaining its business operations. However, these guidelines have influenced restaurants’ business and forced restaurants to modify their design and layout to comply with the SOPs. In addition, restauranteurs were found to creatively implement SOPs and take extra precautions to prevent deadly virus infection within their restaurants' environments. Hence, this study aimed to 1) Identify the impact of COVID-19 on restaurants' design and layout and 2) Explore the implementation of safe dining features in restaurants. Semi-structured interviews were conducted among 10 owners and managers of casual dining restaurants in Johor Bahru, Malaysia. The interview sessions were recorded and transcribed, whereas

the data collected were analyzed using thematic analysis. The findings of this research concluded that the impact of COVID-19 on the restaurants' design and layout were found most in the reduced number of customers, influence on restaurant design and alteration of restaurant layout. Moreover, the safe dining features implemented in restaurants were the basic SOPs practices, including wearing masks, restaurant sanitation, social distancing and making good use of heating, ventilation and air-conditioning (HVAC) systems. This research filled the study gaps by extending the impact of COVID-19 on restaurant businesses and restaurant designs and layouts. This research also helped the restaurateurs to improve their establishments and create an environment that is least susceptible to diseases. Moreover, the significant findings from this study will be able to help flatten the curve of coronavirus disease and protect the public from the infection.

****

Brazier, J. F., White, E. M., Meehan, A., Shield, R. R., Grabowski, D. C., Rahman, M.*, et al.*
Rethinking Infection Control: Nursing Home Administrator Experiences during the COVID-19 Pandemic.
Journal of the American Medical Directors Association, Vol. **25** n°(8), (2024)

Objective To examine nursing home administrator perspectives of infection control practices in nursing homes at the height of the COVID-19 pandemic and characterize lessons learned. Design Descriptive qualitative study. Setting and Participants Administrators from 40 nursing homes across 8 diverse health care markets in the United States. Methods Semistructured interviews were conducted via telephone or Zoom with nursing home administrators. Interviews were repeated at 3-month intervals, for a total of 4 interviews per participant between July 2020 and December 2021 (n = 156). Qualitative analysis of interview transcripts used modified grounded theory and thematic analysis to identify overarching themes. Results Three major themes emerged reflecting administrator experiences managing infection control practices and nursing home operations at the height of the COVID-19 pandemic. First, administrators reported that the more stringent infection control protocols implemented to manage and mitigate COVID-19 at their facilities increased awareness and understanding of the importance of infection control; second, administrators reported incorporating higher standards of infection control practices into facility-level policies, emergency preparedness plans, and staff training; and third, administrators said they and their executive leadership were reevaluating and upgrading their facilities' physical structures and operational processes for better infection control infrastructure in preparation for future pandemics or other public health crises. Conclusions and Implications Insights from this study's findings suggest important next steps for restructuring and improving nursing home infection control protocols and practices in preparation for future pandemics and public health emergencies. Nursing homes need comprehensive, standardized infection control training and upgrading of physical structures to improve ventilation and facilitate isolation practices when needed. Furthermore, nursing home emergency preparedness plans need better integration with local, state, and federal agencies to ensure effective communication, proper resource tracking and allocation, and coordinated, rapid response during future public health crises.

****

Alfaro, C., Porru, S., Barberá-Riera, M., Esplugues, A., Galindo, N., Carrasco, P.*, et al.*
SARS-CoV-2 detection in aerosol from community indoor environments.
Building and Environment, Vol. **261**, (2024)

Since its emergence, the COVID-19 pandemic has profoundly and extensively affected global health and society. Numerous studies have focused on detecting SARS-CoV-2 in air samples collected in healthcare indoor spaces, but few have analysed its presence in air samples from other public community spaces. In addition, limited studies have surveyed indoor spaces where it was not known if individuals with COVID-19 were present or had been present at the time of sampling. This study aimed to determine the SARS-CoV-2 genetic load in aerosol samples collected in public community indoor environments where prior knowledge of the presence of infected individuals with COVID-19 cases is not available at the time of sampling. Air samples

(N = 497) were collected from healthcare settings, elderly care homes, and educational settings in the Valencian Community, Spain. RNA was extracted and the N1, N2, and E gene fragments of SARS-CoV-2 were quantified using RT-qPCR. SARS-CoV-2 RNA was detected in 8.9 % of air samples. The highest positivity rates were observed in hospitals (16.2 %), elderly care homes (15.3 %), and primary care centres (12.7 %). Concentration of the N1 gene in positive samples ranged 4.3–504 gc/m3 (n = 10), 6.2–77 gc/m3 (n = 8) and 5.1–14 gc/m3 (n = 7), respectively. The genes N2 and E were less frequently detected and generally reported lower concentrations. The frequency of detection of SARS-CoV-2 in aerosols increased at the same time that the population COVID-19 cumulative incidence increased.

****

Zohra, C. F.
Strategies des systèmes HVAC pour prévenir la transmission de Covid-19.
Fabriques Urbaines, Vol. **3** n°(2), (2023), 27-36 p.

L'objectif du présent manuscrit est de mettre la lumière sur les différents types de systèmes HVAC qui contribuent à la transmission du virus et qui peuvent être en même temps, une mesure de prévention efficace. Tout milieu intérieur doit disposer d'une ventilation adéquate; mesure susceptible de diminuer la concentration des aérosols en suspension dans l'air, ce qui pourrait contribuer à réduire les risques de propagation de la COVID-19. Cette question relève des instances gouvernementales, il est impératif d'adopter, outre que les mesures sanitaires, sociales et administratives, des mesures d'ingénierie qui comprennent des changements à la structure physique, à l'équipement ou à la disposition d'un espace pour réduire le risque de transmission. Il peut s'agir, en premier lieu, de changements à l'utilisation des systèmes CVC du bâtiment, Chauffage, de Ventilation et de Climatisation.

****

Deng, Y., Xie, D., Zeng, J., Liang, R., Zhang, Y., Fan, J.*, et al.*
Towards Deploying ML-based Load Forecasting Models for Building HVAC System: an AI Evaluation Platform.
e-Energy '24: Proceedings of the 15th ACM International Conference on Future and Sustainable Energy Systems. Singapore. June 4 - 7, 2024

Recently, machine learning (ML) models have been widely developed for building HVAC systems. Practitioners, however, have difficulties in understanding how an ML model behaves in practice, in terms of such metrics as maintainability, reliability, etc. This restricts wide adoption of AI in buildings. Intrinsically, there is a lack of a methodology for building ML model evaluation, i.e., what to evaluate; and a platform for ML model evaluation to release the evaluation burden in recreating appropriate benchmarks, setting up experimental pipelines, etc. In this project, we propose BaiTest (Building AI Test), a new evaluation methodology for the ML models in buildings and an evaluation platform to materialize our methodology. BaiTest can be used by building operators and AI developers to compare and select appropriate ML models through the interactive visualization services. Our preliminary experiments shows the model recommended by the BaiTest platform can show 3%-10% more accuracy improvement against a model with the highest snap-shot accuracy. BaiTest can allow the effective use of a large number of ML models and accelerate ML model deployment without extra programming work.

****

Lafay, E., Sampson, P.
Ventilation and Public Health: A Fraught History.
Am J Public Health, (2024), e1-e7 p.

Since the beginning of the COVID-19 pandemic, a vigorous public health discussion has arisen over indoor air quality and ventilation. In popular press articles, bestselling books, and the US Environmental Protection Agency's recently announced Clean Air in Buildings Challenge, scholars and policy experts have claimed that improved ventilation systems can lead to better productivity and performance. By reevaluating those claims in light of the history of public health in Great Britain and the United States, we found that better ventilation has frequently been proposed as a cost-effective and nonintrusive means of improving health in institutions experiencing structural and environmental public health problems. Furthermore, our examination of efforts to provide ventilation for enslaved people, incarcerated people, and the urban poor revealed a consistent lack of government regulation and a disassociation of air quality concerns from broader environmental, social, and economic realities. By continuing to ignore these broader contexts, current ventilation efforts risk repeating this pattern.

****