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Aéraulique et COVID-19

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Google Scholar, Lens et WoS

Love, C., Street, A., Riddell, E., Goudie, R. J. B., Brock, R. C., Thaxter, R.*, et al.*
Acceptability of Air Cleaning Units on Inpatient Wards: help for infection control or hindrance for ward occupants?
The Journal of hospital infection, (2024)

Hospital-acquired infections place patients and healthcare workers at risk. Since the emergence of SARS-CoV-2, greater emphasis has been placed on understanding the ventilation of hospitals and spread of infectious diseases through the air [1]. Air Cleaning Units (ACUs) can improve ventilation and potentially reduce hospital-acquired infections [2,3]. However, compliance is sometimes low [3] and acceptability of ACUs in clinical settings is poorly understood.

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Katz, A., Li, T., James, L., Buhariwala, P., Osei-Twum, J.-A., Siegel, J.*, et al.*
Emergency Knowledge Translation, COVID-19 and indoor air: evaluating a virtual ventilation and filtration consultation program for community spaces in Ontario.
BMC Public Health, Vol. **24** n°(1), (2024)

An October, 2021 review of Public Health Ontario's COVID-19 guidance for congregate settings such as shelters and long-term care homes demonstrated that this guidance did not include references to ventilation or filtration. In April 2022, an interdisciplinary team with expertise in indoor air quality (IAQ), engineering, epidemiology, community programming and knowledge translation launched a virtual ventilation and filtration consultation program for community spaces in Toronto, Ontario. The program gives people working in community spaces direct access to IAQ experts through 25-min online appointments. The program aims to help reduce the risk of COVID-19 transmission in community spaces, and was designed to help compensate for gaps in public health guidance and action.

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Hussein, N. A., Al Jubori, A. M., Abdul-Zahra, A. S.
Enhancing the performance of air conditioning systems by integrating phase change materials: A comprehensive review.
Journal of Energy Storage, Vol. **101**, (2024)

Energy conservation is an important aspect of the modern industry. The need for heating, ventilation, and air conditioning (HVAC) systems is on the rise due to global warming, population growth, and the need for good air quality to prevent airborne illnesses like COVID-19. Since air conditioning (AC) systems use a significant amount of energy, it's crucial to try to lower the energy consumed by these systems. There are many ways to reduce the energy consumed by AC systems, but using phase change materials (PCMs) is a simple and convenient way to achieve that purpose. In this paper, a comprehensive review of different AC systems that integrate PCMs is presented. The AC systems were divided into active AC systems, free cooling AC systems, PCM as thermal energy storage (TES) for cold air applications, and heating systems. This review presents the results of the enhancements that the PCM added to these systems in terms of lowering power consumption and an increasing efficiency. The review paper discusses the different methods that the researchers used to enhance the properties of the PCMs and an increase their thermal conductivity, as well as the aspects that affect the PCM performance as a TES, such as the type of PCM, the encapsulation type, the geometry of the TES, and the phase change temperature that should be selected according to the application. Significant

results were achieved by integrating PCM with AC systems: a reduction in electrical power of 13.84 % in winter and 16.13 % in summer was achieved in split unit AC, an electricity consumption reduction reaching up to 73 % in a free cooling system, a notable 30 % reduction in CO2 emissions in a PCM as TES application, and the integration of PCM with heating systems can reduce the adverse impacts of weather volatility and maximize the use of solar energy.

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Xu, R., Wu, F., Shen, L., Fan, Z., Yu, J., Huang, Z.
Experimental study on bioaerosols behavior and purification measures in a subway compartment.
Scientific Reports, Vol. **14** n°(1), (2024)

Bioaerosols in public transportation systems raise critical environmental concerns, seriously threatening passenger health and safety. In this study, we investigate the spread characteristics of bioaerosols in a standard type-B subway compartment using both air sampling and sediment sampling methods. Additionally, without compromising indoor passenger comfort, two self-designed air purification devices, based on intense field dielectric (IFD) and dielectric barrier discharge (DBD) technologies, respectively, are successfully applied for the improvement of the subway air quality. The results show that bioaerosols can propagate rapidly throughout the entire compartment in 5 min via airborne transmission. Under the effect of the symmetric air ducts and compartment structure, the difference in bioaerosol concentration in the air is less than 10% between both ends of the compartment. Concurrent substantial bioaerosol deposition on the ground, seats, and windows underscores the risk of contact transmission. Furthermore, the real-time purification rates of the two devices integrated into the air conditioning system reach 59.40% and 44.98%, respectively. With their demonstrated high efficiency in purifying bioaerosols and modular design featuring low energy consumption, easy cleaning, and reusability, these devices stand out as viable long-term solutions for large traffic vehicles. These research findings provide practical equipment recommendations and installation strategies for optimizing indoor air quality in subways and are applicable to other similar transportation systems.

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Psomas, T., Sullivan, P. O., Kolias, P., Donovan, A. O., Wargocki, P.
Gender Differences in the Perception of the Indoor Environment: Findings from Residential Buildings in a Nordic Climate.
Indoor Environments, (2024)

Current research suggests gender (“sex assigned at birth”) differences with respect to indoor environmental conditions, indicating females are more critical and demanding towards satisfaction and preferences. The present paper analyzes the results of a subsample of a national survey completed in 375 representative dwellings in Sweden. The survey collected information on twelve comfort factors and satisfaction aspects concerning thermal comfort, indoor air quality, acoustic comfort, satisfaction with daylight, size, standard, layout, appearance, well-being, cost, and neighborhood. Advanced statistical analyses were used to investigate whether the responses of occupants experiencing similar indoor conditions (cohabitation) were different with respect to gender. The analysis did not observe any significant gender differences with respect to the ratings of indoor environments in dwellings. Males reported slightly higher satisfaction, while thermal and acoustic comfort exhibited the highest gender variability. Satisfaction aspects were generally very high, with the costs and acoustic comfort registering the highest levels of dissatisfaction. Additional analyses across various building characteristics and individual attributes (variables levels) confirmed no differences. Several hypotheses were put up to explain these results, including the extreme climatic conditions and the collaborative use of dwellings. The findings suggest that Swedish dwelling designs can provide some best practice guidance for stakeholders and practitioners elsewhere in similar climatic conditions. Future studies should confirm the present observations and the social and cultural aspects of the findings.

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Samborski, T., Zbrowski, A., Kozioł, S.

Horizontal laminar flow cabinet with a low background and clean air.

Technologia i Automatyzacja Montażu (Assembly Techniques and Technologies), Vol. **125** n°(3), (2024), 12-20 p.

The publication presents the design, construction of a prototype, and the course of verification tests of a special horizontal laminar flow cabinet made entirely of plastics. In the cabinet design process, numerical simulations and airflow analyses were used to achieve a laminar, uniform flow in the device's workspace. A prototype was built and subjected to verification tests regarding the intensity and nature of airflow as well as air cleanliness. The cabinet is equipped with its own filtration-ventilation module providing clean air to the workspace and removing used air to the external ventilation system. It ensures an increased level of protection for workers dealing with microorganisms and hazardous airborne chemicals, as well as complete corrosion resistance inside the workspace. A particular area of application for the cabinet is research involving radionuclides, volatile, toxic chemical compounds for which air-recirculating devices cannot be used in the room where they are placed. The developed solution has been protected by industrial property rights and used to implement a contract for the supply of a set of equipment to the laboratory of the Institute of Nuclear Physics of the Polish Academy of Sciences.

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Peerless, K., Ullman, E., Cummings, K. J., Stoltey, J., Epson, E., Kim, J. J.*, et al.*

Indoor Air Quality Assessments in 10 Long-Term Care Facilities during the COVID-19 Pandemic, California, 2021-2023.

Journal of the American Medical Directors Association, Vol. **25** n°(10), (2024)

Objectives: This study aimed to assess indoor air quality (IAQ) in long-term care facilities (LTCFs) in California during the COVID-19 pandemic and evaluate their implementation of IAQ best practices described by public health authorities to control respiratory pathogen transmission via inhalation. Design: This observational study conducted IAQ assessments in a convenience sample of LTCFs to gather qualitative data on the implementation of IAQ best practices. The design included 5 pilot visits to develop a standardized method of data collection and then systematic data collection at 10 facilities. Setting and Participants: The study focused on 10 LTCFs across California, chosen from facilities that responded to flyers advertising free IAQ assessments. Some of the facilities had previously experienced COVID-19 outbreaks affecting residents and staff. Methods: State health department industrial hygienists performed site visits to collect data on each facility's heating, ventilation, and air-conditioning (HVAC) system operation, outdoor air introduction, recirculated air filtration, use of portable air cleaners, and directional airflow in isolation areas to evaluate implementation of IAQ best practices in each of these areas. Qualitative data were obtained through visual inspections and interviews with maintenance personnel. Results: Findings indicated suboptimal implementation of IAQ best practices across the assessed facilities: no facility operated HVAC systems continuously, 40% had all outdoor air dampers open, 20% used MERV13 or higher rated filters, 20% used portable air cleaners, and 20% performed directional airflow assessment and management for isolating COVID-19 cases. Conclusions and Implications: Most LTCFs assessed were not adhering to IAQ best practices, highlighting a significant opportunity for improvement. IAQ best practices described in this study are achievable with existing systems and are critical for reducing virus transmission through the air in LTCFs. The findings underscore the need for more systematic assessments and improvements in IAQ within LTCFs to protect staff and residents. (c) 2024 AMDA- The Society for Post-Acute and Long-Term Care Medicine.

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Cassini, A., Yin, M., Simniceanu, A., Gon, G., Cowling, B. J., Allegranzi, B.*, et al.*

Infection prevention and control risk factors for SARS-CoV-2 infection in health workers: a global, multicentre case-control study.
Journal of Hospital Infection, (2024)

Summary Background Health workers were at higher risk for SARS-CoV-2 infection during the COVID-19 pandemic due to occupational risk factors. As part of the WHO Unity Studies initiative, we aimed to characterise these risk factors. Methods This global, multicentre, nested, case-control study was conducted in 121 healthcare facilities in 21 countries. Cases were health workers who tested positive for SARS-CoV-2 infection with a documented occupational exposure to COVID-19 patients in the 14 days pre-enrolment. Controls were enrolled from the same facility with a similar exposure but negative serology. Case and control status was confirmed with serological testing at baseline and after 3-4 weeks. Demographic and infection risk factor data were collected using structured questionnaires. Findings Between June 2020 and December 2021, data were obtained for 1213 cases and 1844 controls. SARS-CoV-2 infection risk was associated with non-adherence to personal protective equipment (PPE) guidelines (aOR 1·67 [95% CI 1·32-2·12]) and not consistently performing hand hygiene after patient contact (aOR 2·52 [1·72-3·68]). Direct close contact with COVID-19 patients was also associated with an increased risk, particularly during prolonged contact (>15 min.). Items associated with a lower risk were respirators during aerosol-generating procedures and gloves, gowns or coveralls during contact with contaminated materials/surfaces. No difference was observed among health workers using respirators versus surgical masks for routine care. Conclusion Appropriate implementation of infection prevention and control measures and PPE use remain a priority to protect health workers from SARS-CoV-2 infection.

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Liu, Y., Lin, Z., Lin, G., Lian, W., Tian, J., Li, G.*, et al.*
Intelligent Forest Hospital as a New Management System for Hospital-Acquired Infection Control.
China CDC Weekly, Vol. **6** n°(37), (2024), 972-974 p.

Hospital-acquired infection (HAI) is a significant global health concern, elevating the risks of morbidity and imposing a substantial socioeconomic burden. To enhance the management of HAI, particularly in the aftermath of the coronavirus disease 2019 (COVID-19) pandemic, the Guangdong Second Provincial General Hospital (GD2H) has launched a new system called Intelligent Forest Hospital (IFH). Leveraging advancements in artificial intelligence, 5G technology, and cloud networking, the IFH implements customized indoor air quality (IAQ) control strategies tailored to different medical settings. It utilizes various intelligent disinfection devices and air purification systems. The IFH features a dynamic 3D hospital model with real-time monitoring of crucial IAQ parameters and a risk assessment ranking for clinical departments, providing timely risk alerts, communication prompts, and automatic disinfection processes. The IFH aims to effectively mitigate HAI post-COVID-19 and other future pandemics, ensuring a safe and pleasant environment for patients, hospital staff, and visitors.

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Imami, A. D., Azizah, R. N., Marpaung, T. K., Awfa, D.
Investigation of microbiological quality of indoor air in university campus due to students returning after COVID-19 restriction.
IOP Conference Series: Earth and Environmental Science, Vol. **1388** n°(1), (2024)

COVID-19 has opened the world's eyes to microbiological indoor air quality, which is essential to know the disease's behaviour and spread. COVID-19 has caused several campuses to restrict campus activities to minimize the virus's transmission among students. As students return to campus, microbiological indoor air quality can deteriorate. Therefore, understanding related to this matter needs to be improved. This study aims to give a glimpse to investigate the impact of a student returning to microbiological indoor air quality

and determine the main contributing factors influencing it. This study measured two microbial air pollutants, total bacteria, and fungi, in a different indoor environment at the Sumatra Institute of Technology in Lampung, Indonesia. Simultaneously, the main factor, (the number of occupants/students) and several environmental factors that could potentially influence microbial air pollutants such as room temperature, relative humidity, light intensity, ventilation area, and the direction of wind movement were also measured. Compared to measurements taken during the pandemic, the intensified number of averaged total bacteria and total fungi reached 248% and 63%, respectively. The total bacteria measured at the sampling locations were higher than the total fungi of 799.27 CFU/m3 compared to 552.99 CFU/m3. The number of bacteria also exceeds the Indonesian Bacteria Indoor Air Quality parameters standard. Based on the regression linier analysis, different significant variables influence each parameter. In general, the return of students after COVID-19 restrictions has significantly affected indoor microbiological air quality. In addition, the environmental factors that affect the parameters of bacteria and fungi are different, so further attention shall be addressed by the campus.

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Khanal, N., Brazell, L. R., Juel, M. A., Gibas, C., Schlueter, J., Munir, M.
Investigation of SARS-CoV-2 Contamination of Indoor Air and Highly Touched Surfaces On-Campus Buildings.
Appl Microbiol, Vol. **4** n°(3), (2024), 1384-1395 p.

Severe acute respiratory syndrome coronavirus-2 (SARS-CoV-2) spreads primarily through respiratory droplets, aerosols, and contaminated surfaces. While high-traffic locations like hospitals and airports have been studied extensively, detecting significant virus levels in aerosols and on environmental surfaces, campus settings remain underexplored. This study focused on two crowded buildings at the University of North Carolina at Charlotte (UNCC). From December 2021 to March 2022, we collected 16 indoor air samples and 201 samples from high-touch surfaces. During the sampling timeframe, 44.82% of surface samples from the Student Union and 28% from the University Recreational Center (UREC) tested positive for the presence of SARS-CoV-2 RNA. Median and average viral RNA copies per swab were higher in UREC (273 and 475) than in Student Union (92 and 269). However, all air samples tested negative. Surface positivity in these high-traffic campus locations was directly correlated with COVID-19 clinical cases in Mecklenburg County. The campus COVID-19 cases, driven by the Omicron wave, peaked a week before the peak detection of surface contamination. These findings underscore the importance of surface hygiene measures and highlight environmental conditions as potential contributors to COVID-19 spread on campuses.

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Chan, K.-T., Yang, J. X.
Management Issues in Healthcare and Social Work: Lessons We've Learned from COVID-19 in the Past 3 Years (2019–2022).
In: Interdisciplinary Research on Healthcare and Social Service: Chinese and Cross-Cultural Perspectives. Springer Nature Switzerland; 2024. 21-32 p.

Our world has withstood the COVID-19 challenge for 3 years. As one of the countries strongly affected by the pandemic, China can provide the world with valuable lessons with its profound experiences dealing with COVID-19 from 2019 to 2022. This chapter briefly summarizes China's critical COVID-19 events in the past 3 years, examines the end of the zero-COVID policy, and investigates the "passive mindset" against COVID that once prevailed in China. To formulate a sensible COVID-19 risk management plan for China in exiting the stringent pandemic control policies and preparing for the future, this chapter also looks into a few selected countries' post-pandemic plans and probes into the proactive and reactive models in crisis management. Finally, a proposed COVID-19 crisis management plan for China and an advocate for tripartite partnership in a post-pandemic setting are demonstrated.

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Rhodes, S., Beale, S., Daniels, S., Gittins, M., Mueller, W., Mcelvenny, D.*, et al.*

Occupation and SARS-CoV-2 in Europe: a review.

European Respiratory Review, Vol. **33** n°(173), (2024)

Introduction Workplace features such as ventilation, temperature and the extent of contact are all likely to relate to personal risk of severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2). Occupations relating to healthcare, social care, education, transport and food production and retail are thought to have increased risks, but the extent to which these risks are elevated and how they have varied over time is unclear.Methods We searched for population cohort studies conducted in Europe that compared coronavirus disease 2019 (COVID-19) outcomes between two or more different occupational groups. Data were extracted on relative differences between occupational groups, split into four time-periods corresponding to pandemic waves.Results We included data from 17 studies. 11 studies used SARS-CoV-2 as their outcome measure and six used COVID-19 hospitalisation and mortality. During waves one and two, the majority of studies saw elevated risks in the five groups that we looked at. Only seven studies used data from wave three onwards. Elevated risks were observed in waves three and four for social care and education workers in some studies.Conclusions Evidence relating to occupational differences in COVID-19 outcomes in Europe largely focuses on the early part of the pandemic. There is consistent evidence that the direction and magnitude of differences varied with time. Workers in the healthcare, transport and food production sectors saw highly elevated risks in the early part of the pandemic in the majority of studies but this did not appear to continue. There was evidence that elevated risks of infection in the education and social care sectors may have persisted.Workers in healthcare, social care, education, transport and food production sectors saw elevated risks of SARS-CoV-2- and COVID-19-related hospitalisation and death compared to others early in the COVID-19 pandemic but this did not necessarily persist.

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Shang, W., Zhao, T., Sun, H., Liu, J.

Optimization design method for components parameter in space station ventilation system based on Flowmaster simulation.

Building Simulation, (2024)

Due to the challenges of adjustment after installation and the elevated failure rate associated with the use of electric valves, which contributes to increased weight among other issues, single-hole restrictors (SHRs) are commonly employed within the ventilation system of the manned space station. These restrictors are pre-configured with parameters to ensure that the airflow at the termination of the ventilation system meets the designated requirements. However, given their inability to be modified post-installation, a preliminary optimization design process becomes imperative. Past solutions relying solely on experience are insufficient in precise and optimal outcomes. While computational fluid dynamics (CFD) simulations offer accurate results, they encounter difficulties in modeling larger systems and are time-intensive due to multiple iterative simulations. Hence, an optimizing design method through quicker Flowmaster simulations is proposed in this study. Utilizing the Functional Mock-up Interface (FMI) protocol, the ventilation system model established in Flowmaster could be exported as FMU files and fine-tuned within Python using a genetic algorithm (GA), swiftly achieving a well-balanced ventilation system design by adjusting the parameters of the SHRs. The findings from CFD calculations can corroborate the simulations conducted in Flowmaster. The vents' unbalanced factor and the pressure drops of the system are used as optimization objectives. After optimization, the system unbalanced factor and total pressure drop were 5.51% and 5.99 Pa, respectively, both of which are better than the results obtained using CFD through empirical and trial-and-error methods, and the computation time was reduced by 99.16%.

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Moustafa, S., Yousef, T. A., Taha, R. H.

Preparing and Assessment of Biocidal La Nano-complex Treated Filter Capacity against Isolated Microbes from Air Conditioning Systems in COVID-19 Rehabilitation Rooms.

J Pure Appl Microbiol, Vol. **18** n°(3), (2024)

Mucormycosis is a severe fungal infection which mainly caused by filamentous fungi of the Absidia sp., Rhizopus sp., Cunninghamella sp, Mucor sp., and Rhizomucor sp. Moreover, the pandemic of the SARS-CoV-2 virus expands the need to interfere with spread of the airborne respiratory infections. Accordingly, developing cutting-edge solutions to restrict and/or prevent air contamination by infectious microbes are very warranted. The current work aims to prepare biocidal La-nano complex treated filters and assess their anti-fungal capacity against 20 Rhizopus oryzae, 10 Candida albicans, and 11 Aspergillus fumigatus. These fungi were isolated from the inside parts of the air conditioning systems in the rehabilitation rooms for COVID-19 patients. The obtained results demonstrated that the prepared were able to significantly decrease the invading microbes and eradicate Rhizopus, Aspergillus, Mucor, Candida albicans isolates at 0.64 mg/ml concentration. DFT study compares the electronic properties and reactivity of a ligand in its uncoordinated form with its lanthanum complex. The ligand exhibits lower binding energy, ionization potential, electron affinity, absolute electronegativity, and chemical potential when coordinated with lanthanum. In contrast, the lanthanum complex has a smaller energy gap, absolute hardness, and global softness.

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Giri, A., García-Sánchez, C., Bluyssen, P. M.

Quantifying airborne transmission in ventilated settings: A review.

Building and Environment, Vol. **266**, (2024)

As mandatory masking and social distancing measures decrease post-COVID-19, the risk of airborne pathogen transmission in crowded indoor spaces remains a significant public health concern. The pandemic highlighted the critical role of indoor air quality and ventilation in mitigating the spread of infectious diseases, underscoring the urgent need to improve our understanding and prediction of indoor airflow to minimise airborne transmission. In this review, studies on airborne transmission in indoor settings were systematically reviewed to identify research gaps and recommend changes in approach. The analysis is categorised into indoor airflow, dynamics of infectious respiratory particles (IRPs), and investigation methodologies. Findings reveal that almost 40% of the reviewed literature does not specify the type of indoor setting, with only 3% focusing on restaurant environments. Additionally, indoor air conditions are typically assumed to be constant, and respiratory activities are often limited to coughing and breathing. The review identifies the challenge of replicating the complex behaviour of IRPs in experiments and the computational expense of predicting turbulent indoor flows. Recommendations for future research include: i) focusing on social settings like restaurants, ii) considering varying air temperatures and humidity, iii) examining speech-related respiratory flows, and iv) employing visual and accurate tools to investigate particle-laden airflow. These insights aim to enhance public health guidelines and building designs to reduce the risk of airborne diseases.

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Joseph Marcello, M. B. A., Theresa Rogovin, M. B. A.

Sustainability and Cost Containment in the Hotel Industry: A Review of the Literature.

THE CONSORTIUM, (2024), 33 p.

This research aims to gain insight into various facets of energy cost containment, specific to the hotel industry. Mixed sources were reviewed to compare themes, methods, controversies, and conclusions within the hospitality and tourism sector of sustainability. The research revealed that several types of cost containment strategies and their effectiveness, as well as perceptions of managers and customers regarding the more

common practices, emerged throughout the literature. Although “green” initiatives are frequently used for marketing purposes to attract environmentally savvy customers, many of these strategies prove to reduce costs as well. Data analysis of linen reuse, LED lighting, energy management systems, and modern technologies/ environmentally friendly initiatives will be introduced.

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