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## **ARCHITECTURE AND PANDEMICS; WHERE LIES THE NEXUS**

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### **ABSTRACT**

*The negative consequences of the global pandemic COVID-19 were recognized as the occasion for the initiative in the form of the online student workshop. Throughout history, the global society faced various crises, which had negative consequences for society, politics, and the economy. Some of these negative consequences are still to be felt even today. Global crises such as economic, climate change and global warming, poverty, terrorism, have a continuous and longer course of negative impacts, and their consequences are timely perceived. There are already globally established strategies for overcoming or mitigating them. However, the specificity of the current COVID-19 crisis is manifested in a much shorter time frame, which makes the consequences immediately visible. Therefore a rapid response regarding professional action is needed to reduce the risk of spreading the virus. On the other hand, such specific crises, which can often be unpredictable, show the lack of an adequate spatial-programming framework for the prevention and suppression of the pandemic spread, or mitigation of its consequences. In this sense, the practical and theoretical research of the appropriate responses during the emergency is one of the leading challenges in light of the COVID-19 pandemic. Creating new spatial and programming scenarios that will enable the daily activities to be carried out safely and effectively is a fundamental task of professionals in the field of architecture. This study imagines what the post pandemic-built environment looks like based on the lessons learned and the importance of designing a healthy and sustainable built environment. The architecture of post-pandemic housing will be an interdisciplinary collaboration between architect and specialists such as medical doctor, biologist, psychologist, engineers. Value:*

*The paper highlights the importance of the need for an interdisciplinary approach in the design of housing, a new aspect catalysed by the pandemic with COVID-19.*

**Keywords:** *Design, Architecture, Pandemics, Housing, Nexus*

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## INTRODUCTION

The pandemic with COVID-19 that we have been experiencing globally for 9 months now brings continuous challenges on many levels, the built environment being an important one. Social distancing has meant that during this period housing has been requested differently, at first as a shelter, now as a space in which we have to work or learn. Objectives: The research aims to identify dwellings parameters that need reconsideration from the pandemic experience with COVID-19, how they can be adjusted to meet safety and comfort requirements to ultimately maintain well-being. Prior work: The paper investigates the latest written documents on the influence of the pandemic with COVID-19 on the built environment, including published articles, peer-reviewed articles, digital blog posts, expert opinions. Approach: The research is of systematic review type and interdisciplinary investigation of the specialized literature but at the same time it is also a reflection of the personal experience of the authors. The following parameters of the home are analyzed: surfaces, dimensions, functions, finishes, accesses, lighting, relationship with the outdoor. Results: Health, safety and comfort are 3 aspects that were tested during the quarantine period and are essential when we talk about housing and pandemic dwellings. It is estimated that there will be changes in the design of new homes, collective and individual. Homes will need versatility, more generous spaces, functional expansions so as to cover both living areas and work or learning areas. There is talk of a living architecture but at the same time of touchless technology. The post-pandemic COVID-19 architecture will emphasize the user's well-being, but with much more emphasis on safety issues. Implications: The challenges of the pandemic will influence the design process with possible changes in regulations, with an impact on architects, verification requirements, contractors but also costs for the beneficiary.

## **HISTORICAL BACKGROUND: DRAMATIC CHANGE DEVELOPMENTS**

During pandemics, the form has always followed the fear of infection, just as much as the function (Ellin, 1999). From interiors to city planning, our built environment is shaped by diseases. Previously, to minimize the risk of infectious diseases, people redesigned interior design, architecture, cities, and infrastructure. Considering historical events of the last two centuries, the architecture and urban story includes several developments.

### **Urban Renewal**

In the 14th century, the bubonic plague motivated the fundamental urban improvements of the Renaissance. Cities cleared overcrowded living quarters, expanded their margins, developed early quarantine facilities, and opened large public spaces. In the 20th century, infectious disease was one of the drivers of urban renewal. Modernist architects saw design as a cure to the sickness of overcrowded cities, where tuberculosis, typhoid, polio, and Spanish flu breakouts encouraged urban planning, slum clearance, tenement reform, and waste management (Chang, 2020; Lubell, 2020).

### **Sanitary Reform**

During the industrial era, cholera and typhoid influenced the sanitary reform movement. These epidemics contributed to developing water and sewage systems to fight the pathogens, eventually leading to a sanitary innovation and required the streets to be straighter, smoother, and wider to install underground pipe systems. Furthermore, the third plague pandemic in 1855 changed the design of everything from drainpipes to door thresholds and building foundations (Budds, 2020; Klaus, 2020; Wainwright, 2020).

### **Building and Housing Reform**

The wipe-clean esthetic of modernism can be partially attributed to tuberculosis. The modern architectural designs were inspired by an era of purity of form, strict geometries, modern materials, and a rejection of ornamentation. Modernist architects designed these curative environments as cleansed (physically and symbolically) from disease and pollution. Beyond their esthetic appeal, these features embodied modernist preoccupations with the healing

effects of light, air, and nature. These buildings included large windows, balconies, flat surfaces that would not collect dust, and white paint, emphasizing the appearance of cleanliness (Budds, 2020; Chang, 2020). Against this background, the current health crisis should develop our built environment to increase the security layers that help to prevent the spread of infections and diseases. In this context, there are multiple areas of research needed regarding COVID-19.

### **SOCIAL DISTANCING AND QUARANTINE AS A DESIGN PROBLEM**

In the absence of a specific vaccine to of the coronavirus, physical distancing and the lockdown of the population are among the most immediate and precautionary measures to be taken. The WHO introduced these measures, which were practiced at both institutional and individual levels to become a universal mainstream strategy (Hishan et al., 2020; Salama, 2020).

### **Potential Transmission Dynamics Of COVID-19**

Since most humans spend most of their daily lives inside the built environment, it is essential to understand the potential transmission dynamics of infection. As individuals move through the built environment, COVID-19 can be transmitted both by air and via direct and indirect contact. Viral particles can be directly deposited on surfaces or suspended due to natural and mechanical airflow patterns, or other sources of turbulence in the indoor environment (Dietz et al., 2020; Horve et al., 2020). The WHO has prescribed maintaining an interpersonal distance of 1.5 or 2 m (about 6 feet) to minimize the risk of infection. However, more recently published studies support the hypothesis of virus transmission over 2 m from an infected person (Bourouiba, 2020; Setti et al., 2020). In addition, Oklahoma State University researchers simulated different environmental and movement conditions to see if a six-foot social distancing policy is enough. Their results indicate this policy is enough if the ambient air is static (Oklahoma State University, 2020). Other factors and wearing protective clothes affect the transmission dynamics of infection. However, WHO is continuously changing and updating all the mentioned distances based on the latest information and researches conducted by professionals.

## Design Problem and Challenges

Based on the potential transmission dynamics of COVID-19 and the required measures, several competitions, conferences, and leagues have been cancelled or postponed. The coronavirus has motivated authorities to restrict access to most public spaces and large shopping areas. This pandemic could fundamentally change the way they operate in the future and requires further analysis (HoneyRoses et al., 2020). Architects, planners, and built environment professionals are keen to examine many social and spatial implications to generate new patterns and configurations of use (Paital, 2020; Salama, 2020). Architectural and urban spaces, as they relate to infectious disease epidemics, are not only about quarantine based on immediate and precautionary measures but also refer to design and planning problems and challenges in all building types and urban spaces as illustrated in Figure 1. The pandemic of COVID-19 has caused serious consequences that can be an opportunity to review individual and collective choices and priorities. Most architecture today shows evidence of how humans have responded to infectious diseases by redesigning our physical spaces. Thus, social distancing could change the design and planning process (Budds, 2020; Chang, 2020), specifically with the increased acceptance of distance learning, online shopping, and the cultural connection of online entertainment. The use of media for information sharing, and webinars for sharing knowledge and expertise have seen widespread adoption during the COVID19 pandemic (Chick et al., 2020; Goniewicz et al., 2020). Although new technologies can create additional difficulties, opportunities have emerged to apply innovative solutions to more smart and virtual world applications in the built environment. When we increasingly work from a remote location, learn and upgrade skills online and shop for necessities from e-commerce sites, we reduce the need of traditional physical spaces by virtual digital ones which can be accessed from smart devices (Goniewicz et al., 2020; Hishan et al., 2020; Papu and Pal, 2020). According to the affected lifestyles, the increased reliance on digital channels in the built environment may endure long after the pandemic and affect in every design and urban aspects. Humanity is facing a global crisis, perhaps the greatest of our generation. Many measures adopted during the emergency will become part of daily life, changing habits, and behaviors, they may be a positive or negative intervention in architecture and urban planning approaches.

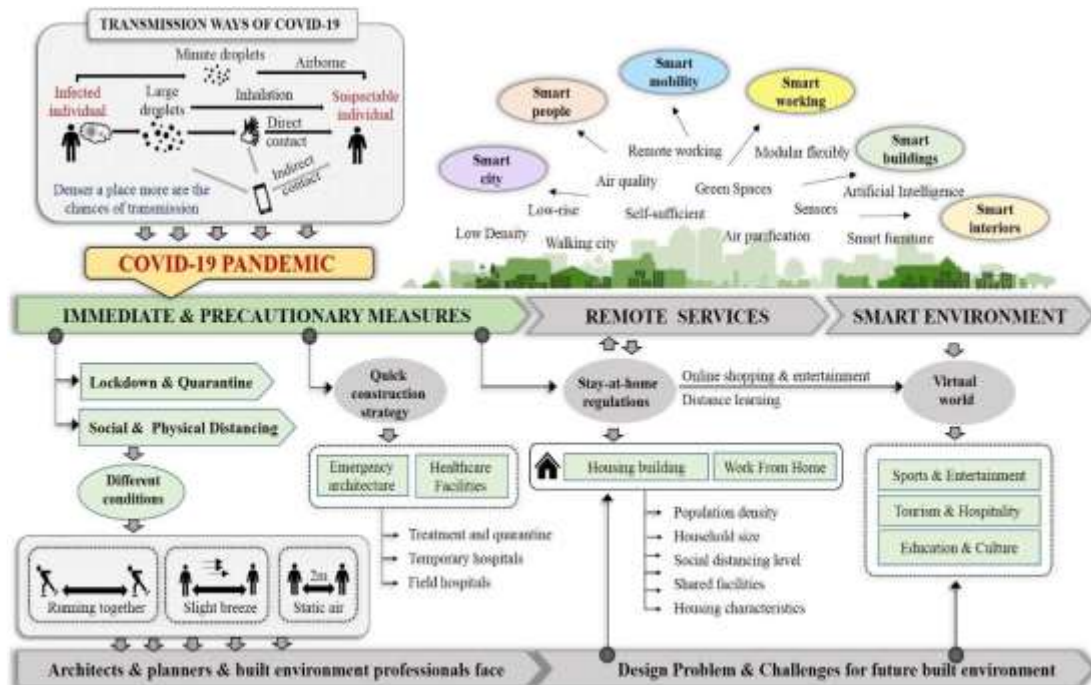


Figure 1: Social distancing and lockdown reflections and their links to the variables under research. While there are many potential impacts of COVID-19 on built environment, our focus in the following points is on how post-architecture may change. Although social distancing and quarantine measures are extensively adopted as the first preventive measure, other factors increase the risk of contracting the virus, as discussed below.

*Population density.* In our current health crisis, certain densely populated cities have proved to be particularly vulnerable to the risk of infection (Chang, 2020).

*Household size.* A big household, large, or extended families will have a higher chance to bring the virus home (Saadat et al., 2020). This will need special consideration in design solutions to prevent infection. *Social distancing level.* Working from home might reduce social contact but is only available to some people focused on jobs linked to a higher socioeconomic status. Moreover, stay-at-home regulations would be more than a challenge for those who live in smaller and crowded houses or without outside spaces (Saadat et al., 2020).

*Shared facilities.* Shared housing includes a broad range of settings with special considerations. People living and working in this type of building might have challenges with social distancing to prevent the spread of COVID-19 (CDC, 2020).

*Housing characteristics.* With a stay-at-home attitude essential to the COVID-19 response, housing characteristics take on added importance in people's lives (Schellenberg and Fonberg, 2020). Extended time indoors could raise various challenges in the design of post-pandemic housing. Because we are forced to stay and work from home, post-pandemic house and office spaces will witness a great transformation because we will be more aware of the functionality of our homes and workspaces in an interestingly new approach. Some of these transformations are reviewed in following sections.

### **Post-pandemic housing**

The pandemic has brought a greater sense of appreciation for our homes. People need houses that can effectively provide social isolation and offer protection from viruses and infections. The expectation is that even after the quarantine period, more people will work from home. Consequently, the future of home design might change (Dejtiar, 2020; Kashdan, 2020; Priday, 2020). Several studies have reported a direct association between crowding and adverse health outcomes. The WHO suggested the characteristics of healthy housing. High density could lead to unhygienic conditions and the spread of several communicable diseases. Crowding increases the risk of volatile infections and droplettransmitted infections (Capolongo et al., 2020; WHO, 1988). If possible, the current pandemic makes a strong case for completely detached housing with a reasonable amount of surrounding garden space, enhancing better facilities for social distancing and producing food, and the healing effects of light, air, and nature. Perhaps, quarantine is the best time to get to know more about indoor gardens, even in the case of multi-story buildings (Makhno, 2020; Wainwright, 2020). For multi-story buildings, contact with other residents in shared areas is unavoidable. The future should, therefore, focus on the touchless experience from the front door to the apartment door itself (Kashdan, 2020; Priday, 2020). Regarding layout and design solutions, post-pandemic housing might introduce more partitions between departments and could be the end of open-plan spaces. The building might have wider corridors and doorways, and many more staircases, leading to changes in the building code and design strategies. Ensuring flexible and adaptable spaces for all users can make housing more sustainable, able to adapt to changing needs and to changing lifestyles (Capolongo et al., 2020; Wainwright, 2020).

### **Post-pandemic office space**

Remote working consists of a relatively new mode of alternative work arrangements developed in the 1970s. Several companies have been adapting their measures as the spread of Covid-19 increases (Belzunegui-Eraso and Erro-Garcés, 2020; Papu and Pal, 2020). Even firms that were resistant to the concept of remote working have been forced to allow working from home. However, working from home all the time is not for everyone; many will want to return to their physical offices. As the pandemic continues or remote working becomes the new norm, office space might have to be altered to create greater spacing and fewer seating options (Marr, 2020; Molla, 2020). Based on this transformation, the density in offices might probably change and firms will not need more space because of work from home policies. Consequently, high-rise buildings would become more expensive to build and become less efficient. Depending on how productive remote work proves to be in this pandemic, it is hastening the shift from structured office environments to more flexible, virtual, and home-based work arrangements, which could mean a reversal of the open-office trend and the search for better other natural ventilation and healthy design options (Alter, 2020; Muggah and Ermacora, 2020). Regarding cleaning policies, certain firms could even use ultraviolet germicidal irradiation to deeply disinfect offices at night or meeting rooms between uses; a practice that is increasingly common in hospitals to combat the spread of infection (Beggs et al., 2000; Kovach et al., 2017; Molla, 2020).

### **Indoor environment and occupant health**

The impact of indoor environment quality on occupant health has long been one of the focus of architecture and public health research. Recent findings partially support the hypothesis that air pollution can increase susceptibility to SARS-CoV-2 infection (Zhao et al., 2019). Previous studies have identified various indicators of indoor environment quality, including IAQ, thermal comfort, and visual and acoustic conditions. It is hypothesized that the quality of the indoor environment mediates the impact of the built environment on residents' health. Accumulation of indoor air pollutants appears to contribute significantly to sick building syndrome. Thus, occupants of buildings in a greener and a healthy environment are more likely to live in a better health condition (WHO, 2010). Fig. 2 shows the intertwined relationship between environmental health and the



expected outcomes and impacts. As shown in the figure, many approaches work together for a common output regarding the occupant's health.

The current pandemic focuses on the adverse health effects of the built environment, primarily due to poor air quality caused by inefficient ventilation. Since people spend around 90% of their time indoors, the IAQ continues to be an important issue affecting occupants' health, comfort, satisfaction, and productivity. Accordingly, the IAQ has long been a critical factor in assessing the performance of different buildings and can be determined by the concentration of various air pollutants in the indoor environment (WHO, 2010; Yuan et al., 2019).

Instead of integrating sound IAQ strategies into the design of a building, complex heating, ventilation, and air conditioning (HVAC) systems can increase the spread of infection throughout the building. The COVID-19 pandemic emphasizes the need to prioritize design strategies to improve IAQ. However, the success of these approaches must be supported by targeted policy changes across the public health, urban planning, and architectural design sectors. As poor IAQ is exacerbated by inadequate ventilation, lack of air filtration, and air recirculation in confined spaces, air quality can be improved in three ways, including source controlling, designing ventilation systems, and air cleaning (Brittain et al., 2020; Cui et al., 2003; Guo et al., 2003; Li et al., 2020; Kumar and Morawska, 2019).

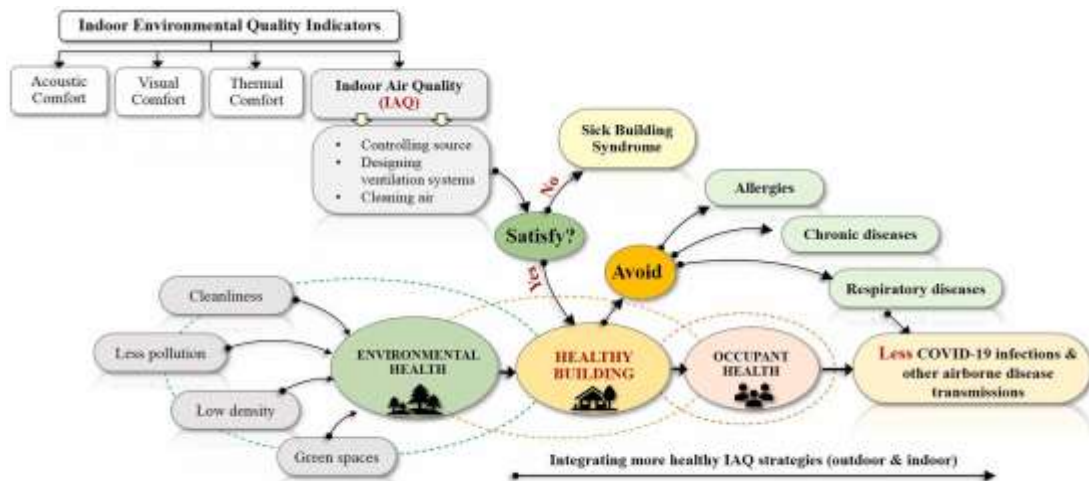


Fig. 2. The intertwined relationships between environmental health and the expected impacts on human health.

## Conclusion

It is difficult for the architects and planners to come to a compromise, regarding the need to have ever-more compact and dense built environments, one of the suggestions for green and eco-friendly cities, which conflicts with the need to have large open spaces, which allow for social distancing, and for the occupants to spread out, to reduce proximity. As always, architects, who are problem solvers, will have to arrive at informed compromises, equitably serving these diverse requirements, while providing safe and healthy environment for all.

Training and education will have to be moulded to include these new realizations. Architecture education will need to modify its current curriculum – instilling the new learning into the future practitioner – for responsible reactions to this crisis. The awareness of these issues must also be generated to the general public and policy makers – and those responsible for creating the built environment, namely building professionals, will need to play a leading role, to bring to the notice of all, the dangers of having unhealthy surrounds in our lives, how much of our past complacency regarding the built environment needs to be rethought, and even at the cost of some additional expenses, the environment must be made ready to confront a repeat of such pandemics.

Finally, we must realize that no single profession can address all the emerging issues from this pandemic. While the role of doctors cannot be shared, the issue of providing a suitable environment for the public is a participatory exercise. It will require multi-disciplinary inputs and its success can only be achieved when all the stakeholders, from policy-makers to designers, to manufacturers, to users and innovators, understand and participate in responsible interactions.

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