العدد خمسة وأربعون
تاريخ الإصدار: 2 – تموز – 2022م
www.ajsp.net
ISSN: 2663-5798

“An Overview of Post-Pandemic Housing: Through Stay-at-Home Experience”

Researcher:

Mahmoud Omar Mohammed Al-Qaisi

Architectural Engineering

Greater Ma'an Municipality

1. Introduction

As of the writing of this paper, 6.3 million people are dead around the world as a result of the recent pandemic COVID-19 (UNCHR). Although the scare is less now, the history has recorded many pandemics that have happened in human history(Novianto, Nuffida, and Gao 2021) , which means that pandemics are a continuous phenomenon or a crisis (Fasano et al. 2020), that effects different sectors of life (Novianto, Nuffida, and Gao 2021) and creates a post-pandemic lifestyle that is reflected in the built environment (Barbarossa, 2020), which became adapted in countries that deal with the pandemic's catastrophe (Coccia, 2022), by Professionals in the fields of architecture, urban planning, and the built environment who are interested to investigate a wide variety of social and spatial consequences in order to produce new patterns and configurations of usage (Paital, 2020),to confront existing or future emergency health crises (L. Liu, 2020). The built environment is one the of the most key part in managing pandemics (Hercules et al., 2020), and one of the solutions to reduce the impact before making any vaccines (Megahed & Ghoneim, 2020). Residential construction as part of and a core component of human civilization, is critical to any pandemic response strategy. Meanwhile, the COVID-19 epidemic is influencing people's homes.

The built environment in different disciplines including urbanism and architecture is highly transformed by epidemics (Wilcox & Colwell, 2005). it always displayed the potential to develop after the crises (Dreessen, 2020), which is observed in many of the current tendencies in architecture and urbanism, developed from comparable steps taken in the past to protect the health, cleanliness, and comfort of the dwellers (Hercules et al., 2020). As architecture responds to events in almost any way, whether via the use of space or ideas, this indicates a change that has taken place in the environment that is around it (Kadhim & Ubaid, 2021).

Architecture has already provided tangible proof of how humans have redesigned our physical environments in response to the spread of contagious illnesses (Hercules et al., 2020). Residential architecture with new reality that covid-19 will not be the last pandemic called to use such a characteristic of architecture (Spennemann, 2021), as the world notice that Due to worries of spreading the illness, Covid-19 compelled individuals to stay at home most of the time(Maggies, 2020), make the need of rethinking of the housing design. This paper is to explore the post -pandemic Housings' designs characteristics in the literature.

2. Epidemics Impact on Architecture

Architectural creations are human settlement spaces that filter both the outside world and the actions of the people who live within(Broadbent, 1975). Architectural creations physically manage microclimate, light, noise, smell, smoke, bugs, vermin, animals, and radioactive materials (Haddad, 2010)(Schulz & others, 1985) . These roles have changed the architectural components as well as the new needs of human existence, such as sanitation and contagious illnesses.

2.1 The History of architecture and pandemics.

The concern of deadly illnesses has historically influenced the architecture of buildings and towns (Novianto et al., 2021). Lazaretto was the name given to quarantine structures at the time (London, 2013), Figure (1) and (2). For fresh immigrants from plague-infested areas, Lazaretto operates as both a medical treatment center and a quarantine facility (Broadbent, 1975). Not only does cholera introduce the notion of quarantine, but it also promotes a more efficient waste disposal system, which necessitates straight and broad highways. At the time, there was a protocol in place to avoid congestion (Wainwright, 2020). During the tuberculosis pandemic, the quarantine buildings was known as a Sanatorium (Kyle, 2020). At the time, one method of treating tuberculosis was to increase airflow and expose oneself to sunshine. This resulted in significant modifications in building design throughout that time period (Pinheiro & Luís, 2020). Humans create a new environment because of the artificial environment's findings. The industrial revolution coincided with the tuberculosis epidemic. Fabricated materials enabled the Sanatorium to be erected with long walls and huge windows that filled the front, allowing for appropriate sunshine and air flow (Dejtiar, 2020).

Figure (1) Lazaretto in Menorca

Figure (2) Lazaretto in Malta

2.2 Epidemics Advantages for Better Design quality

Cholera and typhoid fever affected health reform efforts throughout the industrial revolution (Byrne, 2008). These pandemics also aided the development of pathogen-resistant water and sanitation systems, resulting in hygienic advancements that made them more inexpensive, slower, and broader for streets to establish subterranean drainage networks (Shehzad et al., 2013). Furthermore, many parts of built environment design and planning were altered by the epidemic in 1855, including pipe networks, doorway designs, and foundations (Klaus, 2020). Planners and architects attempted to design and construct healing environments free of disease and pollution. Apart from their aesthetic appeal, these works mirrored modernist ideals about the medicinal advantages of the sun, air, and nature. Large walls, balconies, dust-free flat surfaces, and white paint emphasized cleanliness in the designs (Budds, 2020; Chang, 2020) . To raise safety standards and prevent illness and infection transmission, planners and architects must build new health models (Megahed & Ghoneim, 2020).

2.3 Covid-19 Reflections

Covid-19 has highlighted how valuable our house is. People need homes that efficiently provide social separation as well as virus and illness prevention (Dejtiar, 2020). Even after the quarantine period, more individuals are expected to work from home and the future of house design may be (AlKhateeb & Peterson, 2021). Several studies have shown a link between overcrowding and negative health effects (Bethesda et al., 2007). The World Health Organization (WHO) identified several features of healthy housing. High population density may result in unsanitary circumstances and the development of several infectious illnesses (WHO, 1988). The risk of volatile infections and droplet-transmitted diseases rises as a result of overcrowding (Capolongo et al., 2020). Covid-19, offers a compelling argument for entirely separate dwelling with a great proportion of surrounding garden space, improving greater capabilities for social separation and food production, as well as the therapeutic powers of light, air, and nature (Kashdan, 2020). Even in the case of multi-story buildings, quarantine may be the greatest time to learn more about indoor gardening (Wainwright, 2020)(Makhno, 2020). Contact with other occupants in common spaces is inevitable in multi-story structures. As a result, the future should concentrate on the touchless experience from the front entrance to the apartment door (Capolongo et al., 2020).

Because of the fear of spreading the illness, Covid-19 caused individuals to spend most of their time at home. Thus, when infected, it is necessary to self-isolate for a period (Maggies, 2020). Covid-19 isn't only a health concern; it's also a design issue. Many things have altered as a result of Covid-19, particularly house design. The mansion is now used as an office, a school, a restaurant, a playground, a sports facility, a quarantine facility, and many other things (Hizra et al., 2021). Every time and every day, home is supposed to be a location that supports a variety of activities. Unexpected developments during the Covid-19 epidemic not only provide individuals with obstacles, but also provide a chance to reconsider every decision and goal (Caligiuri et al., 2020). Infectious illnesses influence the physical environment. The planning process and design adjustments are also influenced by human requirements. Technological advancements exacerbate the difficulties in this process, but they may also bring creative solutions to support new surroundings.

3. Post-pandemics Housing.

3.1 The Healthy Housing

Housing conditions may have an influence on residents' health and the transmission of illnesses. The transmission of rhinoviruses, other picornaviruses, and adenoviruses is accelerated by increased humidity and lower temperature, according to (Karim et al., 1985). The survival and spread of parainfluenza virus and influenza virus A are aided by lower humidity.(Lowen et al., 2007) came to a same conclusion. Coronavirus is transmitted by droplets and contact transmission, according to an increasing number of studies (Xu et al., 2020), with droplet transmission being the most common method. Both broadcasts take place over very small distances (WHO, 2009). Airborne infection features are linked to the ventilation systems present within buildings because droplet infection depends on small particle aerosols and large-particle droplet aerosols. Following a comparison of experimental and control groups, (Maggies, 2020) concluded that medical masks do have a protective impact on the mouth and nose. Furthermore, virus-carrying surfaces are involved in contact transmission. In general, the surface of hard material is more porous, making it easier for the virus to survive and propagate (Bean et al., 1982). As a result, the infectiousness of COVID-19 is determined by the contact point, material, and amount of disinfection and sterilization inside a structure.

COVID-19 may also be transmitted via the feces of patients. The presence of the virus in patient feces has been established in studies (World Health Organization, 2021). As a result, transmission via wastewater and feces in homes or buildings is a potential (Liao et al., 2011). The prospect of long-distance droplet or airborne transmission has yet to be established. Similar infectious illnesses like influenza, SARS, and smallpox, on the other hand, have been proved to be airborne (Pitlik, 2020).

As a result, buildings' interior ventilation systems should be regularly monitored. Engineering control techniques include, among others, ventilation and air distribution type, air exchange rate, environmental parameters (humidity and temperature), and engineering disinfection (filter or UV irradiation) (Aliabadi et al., 2011).

3.2Post-Pandemic Housing Characteristics.

Houses were previously mainly utilized as a place to relax after exhausting activities outdoors, but the epidemic has once again elevated the home to a particular status and brought it back into the spotlight (wiley, 2020). The larger the home with all its items and residents, the higher the risk of introducing the virus into the house (Saadat et al., 2020). As a result, the key elements of a healthy home are required, which include a house with exceptional indoor air, water, and lighting quality, as well as a house that is energy and resource efficient, affordable, and environmentally responsible (Sarkar & Bardhan, 2020).

3.2.1 Space & Density

According to several housing indicators found in the U.S. housing market, it was observed that that the pandemic had caused a shift in housing demand from high population density regions to low population density areas (S. Liu & Su, 2021). The last found that:

1.Dense areas are more likely to be near employment hubs, which have a higher percentage of telework-compatible occupations.

With the advent of distant arrangements, the necessity for people to live in these areas may dwindle.

2. Consumption amenities are more plentiful in densely populated areas. Because of the decrease in visits to facilities during the pandemic, the value of residing near high-end destinations may decrease.

3. Because housing supply elasticities are lower in dense communities, housing prices are greater (Baum-Snow & Han, 2019). The benefit of incurring such high housing prices to live in these regions may decline when the demand for living in these locations decreases.

Although the above research from marketing discipline perspective, it indicates the future development of the residential projects.

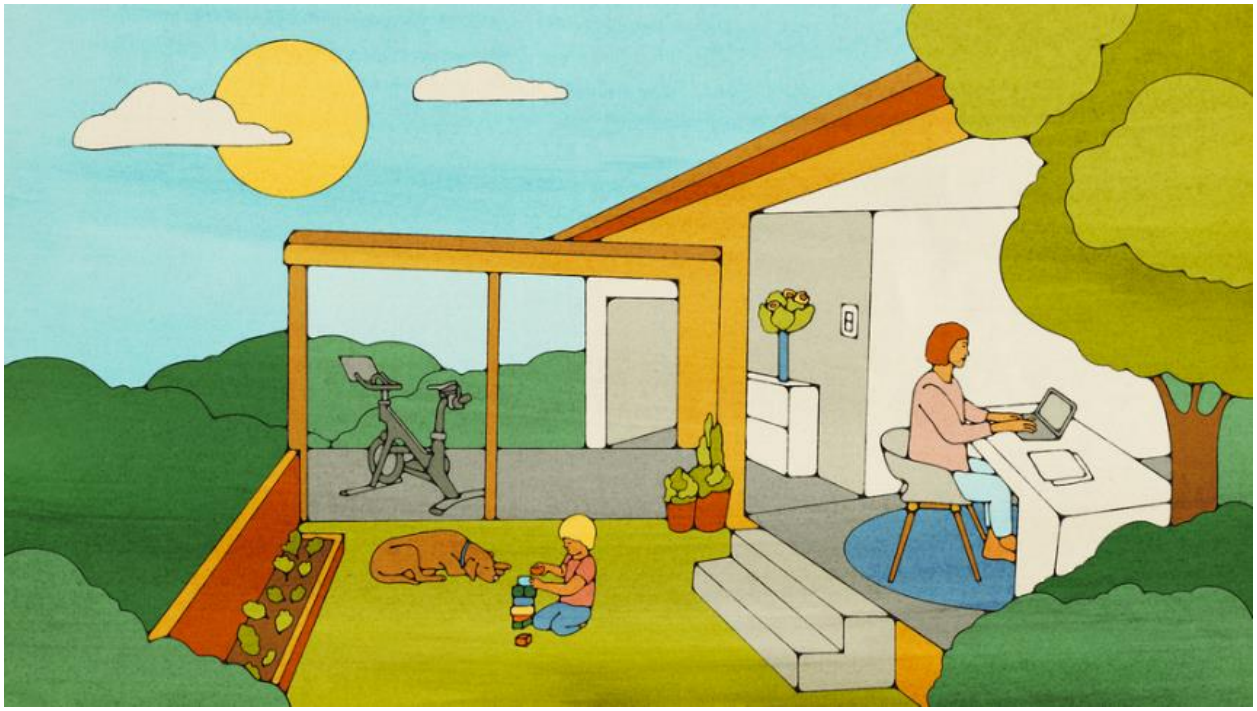
3.2.2 House Layout

The COVID-19 epidemic confined the majority of the people in their houses, forcing them to work hard to change their rooms to meet several demands at once: leisure, work, physical exercise, study, and soon. Our houses were unintentionally put to the test in terms of flexibility, pliability, and adaptation(di Lavoro, 2020). High speed internet access is critical in the design and construction of smart homes, since it provides the required living comfort. It meets a variety of new household demands, including the capacity to work and study from home while being isolated for a prolonged amount of time (D'Alessandro & Raffo, 2011).

Staying organized, time management, teamwork, and social contact were the key problems experienced when being locked down and working from home (Stephens, 2020). The proper layout of workstations in homes will be given greater thought and care. The way rooms are organized and how dwellings are laid up will alter. Comfortable seats, huge windows, and blackout curtains will be provided in the work area. Technical equipment and strong sound isolation will be essential features of a pleasant home office (Allam & Jones, 2020; Capolongo et al., 2020).

The social aspect of design places a premium on intimacy and the ability to locate a private area. In recent years, open plan living has been popular, providing a single, big open area for multipurpose uses, such as kitchens that are linked to living rooms. When the entire family was at home, however, many individuals found it difficult to locate some private space (Hipwood, 2020). Because of their flexibility to change the layout of the home for varied uses, certain flexible construction systems, such as Woods Bagot's AD-APT system, may acquire popularity. Removable walls and screens, which are part of such systems, enable the open space to be divided into smaller rooms, such as a home office, entertainment area, exercise space, or even a bedroom (Bahadursingh, 2020). Furthermore, the housing arrangement, which has modest apartments linked to the larger area by twisting corridors, will provide residents with some privacy while still allowing them to feel

connected to the rest of the building's community. Because one sort of layout design cannot please everyone, architectural designs that enable the space to be changed in a variety of ways might be popular (Tokazhanov et al., 2020). Figure (3) & (4) post-Pandemic housing.



Figuare (3) Post-Pandemic House (Kate Dehler, 2021)

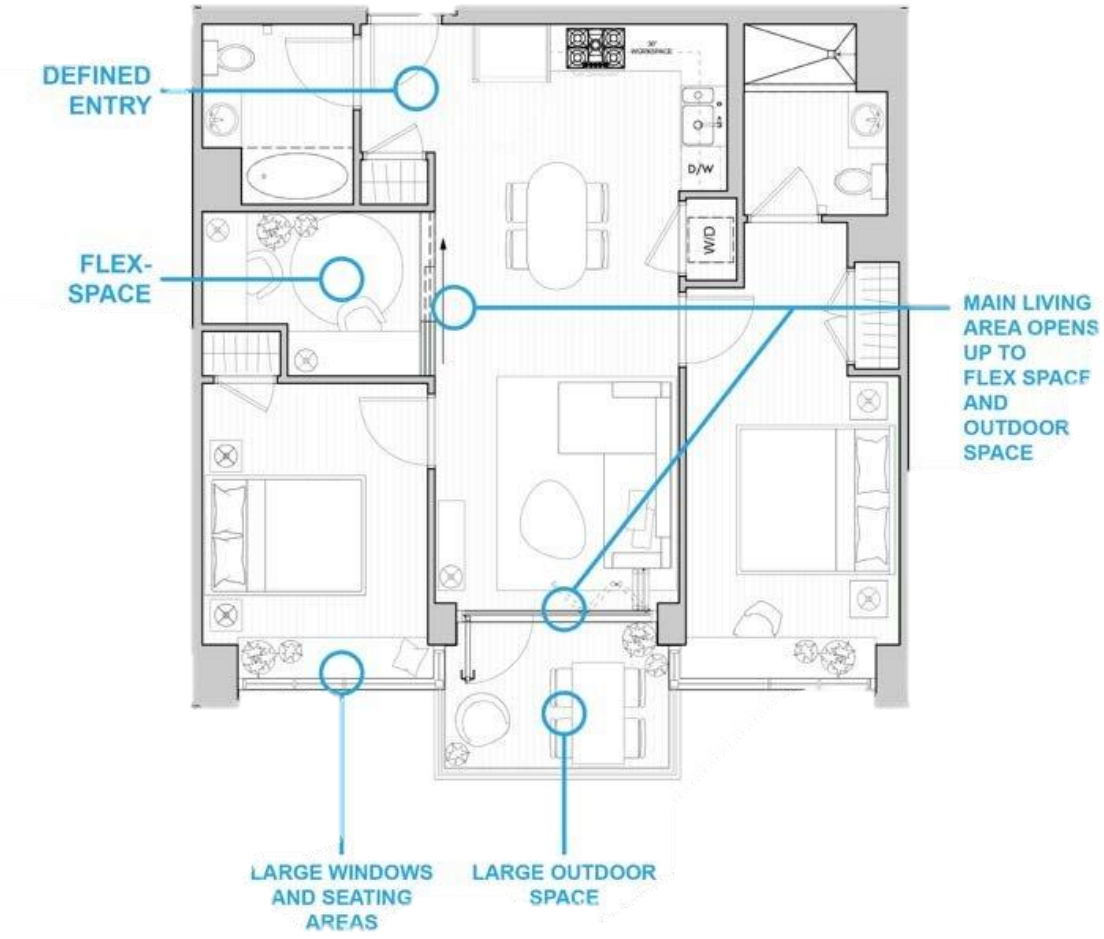


Figure (4) Post-Pandemic layout By (Guerra, 2022)

3.2.3 Comfort

Indoor Air Quality

The self-isolation and spending more time indoors, an approach for improving health through strategies such as greater natural light, improved ventilation, fewer toxic substances, and incorporating plants and other natural materials is necessary (Abouleish, 2021). In this context, it is critical to design buildings with skylights, large windows, rooftop terraces, balconies, and courtyards to avoid sick-building syndrome and enhance air quality (Ahmad, 2010).

Along with thermal comfort, lighting, and acoustics, indoor air quality is acknowledged as one of the key factors of indoor environmental quality (Sullivan et al., 2012). Particulate matter (PM), volatile organic compounds (VOCs), carbon monoxide (CO), carbon dioxide (CO2), nitrogen oxides (NOx), and formaldehyde are the most prevalent types of pollutants that are taken into consideration in the context of indoor air quality (Steinemann et al., 2017). the last is differentiated from indoor chemistry, which is a subfield of chemistry that covers the primary chemical processes that take place in indoor air, by the fact that one of the primaries focuses of indoor air quality is on the health and comfort of humans (Sundell, 2017). Several academic fields, including as environmental health and epidemiology, engineering, architecture, environmental and atmospheric sciences, psychology, and sociology, investigate different elements of indoor air quality, resulting in the production of a diverse and extensive body of written material (Sundell, 2017).

Many Indoor air quality problems have been predominantly ascribed to architectural attributes and inadequate construction standards, particularly among the community of building science and engineering professionals (Steinemann et al., 2017). For instance, construction that began in the 1970s and placed a higher priority on energy efficiency than fresh air exchange led to a large population of buildings being diagnosed with sick building syndrome and exposing occupants to toxic black mold, volatile organic compounds, and excessive ozone. (Straus, 2009) While the trade-off between energy efficiency and indoor air quality continues to be a challenge for design and operation, more attention is being paid to the relevance of additional characteristics and factors that affect Indoor air quality. These include outdoor conditions, the properties and concentrations of ambient pollutants, as well as the behaviors of indoor occupants. (Adamkiewicz et al., 2011) As a consequence of this, there has been an increase in the number of field studies conducted to disentangle the relative effect of the different Indoor air quality components and to enhance Indoor air quality in settings that are more representative of the real world (Sundell, 2017) Figure (6) improvement techniques.

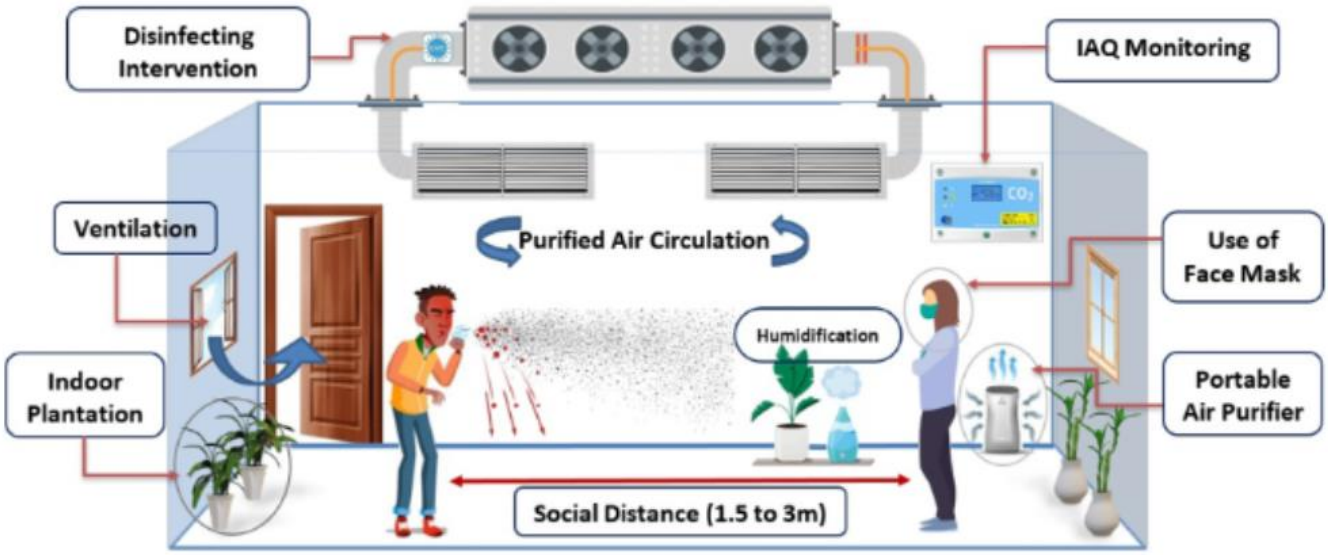


Figure (6) IAQ Improvement Techniques by (Agarwal et al., 2021).

Ventilation

Humanity is dealing with concerns associated to the continuing pandemic that may have a significant impact on quality of life, such as the necessity of ventilation in air distribution, assessing comfort and health in interior spaces, and so on (Hamdy & Mauro, 2019). Contagion is caused by aerosol exposure, which spreads the virus throughout the environment (Zoran et al., 2020), according to various studies (de España, 2020). It is helpful to one's health to live in a well-ventilated house. The air circulation provides for oxygenation, which aids in the expulsion of dust particles and mites, maintains the environment's humidity, and removes foul odors. Furthermore, UV rays may kill certain bacteria, thus allowing sunshine to fill the home is advantageous if at all feasible. On the other hand, when a home is poorly ventilated, residents may have energy dips, frequent headaches, sleep problems, and respiratory problems, not to mention the danger of infection during pandemics like the one we are now experiencing. Furthermore, insufficient ventilation encourages the spread of germs, particularly in enclosed and humid conditions(de España, 2020). Figure (7) The impact of well-ventilated houses.

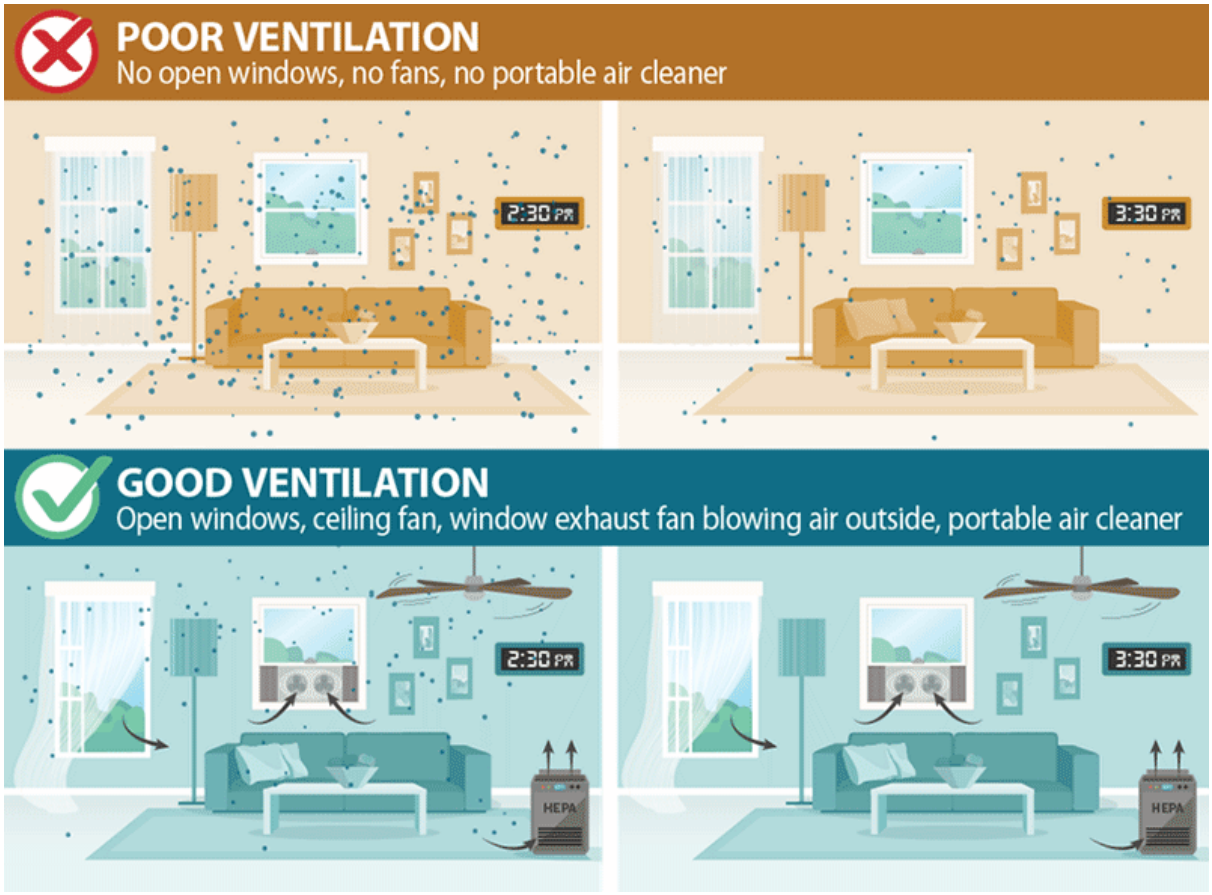


Figure (7) The impact of well-ventilated houses by (CDC, 2021)

According to the study that has been conducted on the topic of the impact of indoor ventilation on the health of building occupants in (Sarkar & Bardhan, 2020), it has been shown that smaller buildings with less ventilation tend to fall short of meeting the necessary standards. These criteria are necessary in order to remove indoor pollutants as quickly as possible. Existing low-income urban single-family and multipurpose tenements in metropolises of emerging countries lack suitable internal design and ventilation concerns. The best possible option for the design of the in order to lessen the likelihood of adverse health effects, it is necessary to use the best possible ventilation system in the building's architectural design.

Thermal comfort

In a study of the thermal comfort founded that, the level of general comfort and thermal comfort, which together provide the foundation for the health conditions that exist inside an indoor environment, should have a significant impact on how we should build and remodel homes in the future (Jia et al., 2021).

The state of mind that manifests itself as contentment with one's current thermal surroundings is referred to as thermal comfort (Standard, 2017). The adaptive model of thermal comfort is based on the principle that, if a change occurs in such a way as to produce discomfort, occupants will react in ways that try to restore their comfort. This principle underpins the idea that occupants will try to restore their comfort if a change causes discomfort (Nicol & Humphreys, 2002). The offered methods are often used by the subjects in order to improve their level of comfort. This range of available adaptive measures is restricted in a workplace that is restrictive because it creates limits related to dress code, activity level, and the capacity to move freely from one's work location, such as in the case of institutional buildings or offices (Brager & de Dear, 1998). However, in the case of residential buildings, subjects frequently use one or all the measures available to them in order to make themselves more comfortable (Singh et al., 2017). These include adjusting their position, the level of clothing they are wearing, whether they have access to windows or fresh air, and whether they move to warmer or cooler areas. Previous studies have shown that, when the weather is cold, people tend to seek out sunny regions in order to sunbathe, but in the

summertime, when it's scorching outside, they hunt for places to find shade (Gillie, 2006). However, a continued and forced indoor lockdown can have physiological and psychological impacts (Cavazza et al., 2021), which ultimately affect the degree of comfort and overall satisfaction of the indoor environment. This is the case even though residential houses may offer a higher degree of adaptability to the occupants in comparison to offices and institutional buildings. As a result, the mandatory lockdown that has been imposed by several governments around the world to combat the spread of the COVID-19 pandemic, as well as the restrictions that have been placed on residents, requiring them to remain inside their homes, can place limitations on the adaptability of the occupants. The thermal comfort of a person is eventually impacted as a result of this.

4. **Post-Pandemic-House: Case Study Malaga by (**Segura & Jiméne, 2022)

The potential of housing to handle a full program characteristic of the city and its public space was emphasized during the COVID-19 lockdown period.

Numerous media appraisals of the housing stock's problems mirrored the experience of not just a large portion of the Spanish population, but also of people all over the globe.

On the one hand, housing units under 60 m2 and without views of green areas, as their households are more prone to depression, and, on the other hand, those located in community blocks and with aligned façades, due to the difficulty of carrying out extensions or alterations (Amerio et al., 2020).

Their paper emphasizes three aspects of this type of housing: the importance of considering the orientation of the housing to improve the quality of the indoor and outdoor space; the need for public housing policies that allow for a greater number of rooms to allow for remote working; and, finally, the importance of functional terraces overlooking green areas.

In summary, the research found that:

In flats under 60 m2, they used the living room as a pop-up office (Table 1). In residences above 60 m2 or with the same or more people, bedrooms were utilised as pop-up offices, as previously. In housing units with just 1 bedroom for 2 working people, the living-dining area had to be shared, limiting its usage for video conferences, leisure (viewing TV), or meals. Small apartments are best for remote workers who live alone or when just one works from home. Same goes with 2-bed accommodation, which is better for 2 people. Lack of a large enough patio (A, B, C) required converting a dining room or bedroom into a gym. Case D users utilized the dining room to exercise if they didn't have a big enough patio.

AJSP
المجلة العربية للنشر العلمي
العدد خمسة وأربعون
تاريخ الإصدار: 2 – تموز – 2022م
www.ajsp.net
ISSN: 2663-5798

Table 1. Objective indicators.

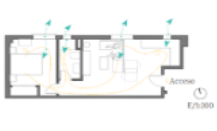
Study case	A	C	D	B
				
Neighbourhood Height	Haza del Campillo B+4	Molinillo B+5	Torre del Mar B+6	Los Viveros B+2
Orientation	North	North	Northeast	East
S_i (m2) Indoor surface area	40	48	67	70
Number of rooms (N)	1	2	2	3
S_o (m2) Outdoor surface area	-	8	15	2.7
Number of balconies Number of terraces	- -	- 2	1 -	- 1
Number of residents (R)	2	3	2	2
S_i/R (m2)	20	16	33	35
N/R	0.50	0.66	1.00	1.50
S_o/R	0.00	2.66	7.50	1.35
Resident age	26 – 27	49 – 51 – 23	34 – 27	24 – 27
Number of residents in WFM	2	1	0	1
Pop-up office	Living room	Living room	-	Bedroom
Number of residents exercising	2	1	2	1
Exercise space	Living room	Bedroom	Terrace / Bedroom	Living room

Table (1)

As for indoor environmental conditions, the results in table 2 indicate a greater need for natural light and less thermal comfort for north-facing buildings (A, C, D), while there was a greater sense of light in dual-aspect Case B; furthermore, the users were aware of very little noise due to lack of mobility during the pandemic. Concerning outdoor environmental conditions, the owners' comments emphasized the need for a functioning terrace, greater than the 6 m2 recommended by (Bettaieb & Alsabban,2020), and of a design that makes activities simpler, according to (Gupta,2019). Avoiding captivity is virtually a psychological necessity. Existing balconies are utilized for washing and storage. In Case C, there are terraces big enough for furniture, but they face north and get little sunshine, therefore they were not utilized. Case D's spacious patio was utilized to house furnishings. Despite facing north, it boasts sea vistas, making it a nice position.

ISSN: 2663-5798

Table 2. Subjective indicators.

QUESTIONS		A	C	D	B
Positive characteristics of current home	Indoor	All rooms with openings outside	The large and well-lit main bedroom	Good surface and distribution	A great deal of light
	Outdoor	-	Has terrace	Enjoyable outdoor space	-
Negative characteristics of current home	Indoor	Small home: all activities in one single room	The temperature is not very comfortable, particularly in the kitchen	Lack of light. Bathrooms do not have windows	Temperature not very comfortable year-round
	Outdoor	No outdoor space	-	-	-
What aspects would you change of your home to make lockdown more bearable?	Indoor	Would add another room or extend the existing one, to create another workspace (currently, both work in the same space and it is very inconvenient). A larger kitchen	More natural light, to avoid feeling locked in	Bathrooms with natural ventilation. Combine the kitchen and living room to have one larger room	-
	Outdoor	Include an outdoor space to avoid feeling locked in	Larger outdoor space on the terrace or on the roof of the building, large enough to exercise	Better distribution of the outdoor space for better use	More outdoor space, to be able to get fresh air or exercise outside

Table (2)

5. Conclusion

During the Covid-19 People who were forced to remain inside and had restricted access to outside areas for their daily physical activities, social lives, and recreational pursuits were the ones who were most affected by the repercussions. It should be mentioned that the circumstances of our interior dwelling played a significant role in our daily lives, as well as our overall health and our level of contentment. Extensive research was conducted on the circumstances of the living settings and the effects such factors had on human health. The purpose of this research was to investigate the effect that the epidemic had on the homes by looking at different aspects of the epidemic's influence that had been studied in previous academic research; however, we did not want to duplicate any discourse that has already been presented. but rather crucial for presenting a comprehensive report that covers every aspect of house design that is affected, which is vital for architects in the post pandemic housing and any further study that may be done in the future.

References:

Abouleish, M. Y. Z. (2021). Indoor air quality and COVID-19. Public Health, 191, 1.

Adamkiewicz, G., Zota, A. R., Fabian, M. P., Chahine, T., Julien, R., Spengler, J. D., & Levy, J. I. (2011). Moving environmental justice indoors: understanding structural influences on residential exposure patterns in low-income communities. American Journal of Public Health, 101 Suppl 1(Suppl 1), S238-45. https://doi.org/10.2105/AJPH.2011.300119

Agarwal, N., Meena, C. S., Raj, B. P., Saini, L., Kumar, A., Gopalakrishnan, N., Kumar, A., Balam, N. B., Alam, T., Kapoor, N. R., & Aggarwal, V. (2021). Indoor air quality improvement in COVID-19 pandemic: Review. Sustainable Cities and Society, 70, 102942. https://doi.org/https://doi.org/10.1016/j.scs.2021.102942

Ahmad, B. (2010). The failure of modern buildings. Adapting Buildings and Cities for Climate Change. In Journal of the

American Medical Association (Vol. 279, Issue 12). https://doi.org/10.1001/jama.279.12.906

Aliabadi, A. A., Rogak, S. N., Bartlett, K. H., & Green, S. I. (2011). Preventing Airborne Disease Transmission: Review of Methods for Ventilation Design in Health Care Facilities. Advances in Preventive Medicine, 2011, 1–21. https://doi.org/10.4061/2011/124064

AlKhateeb, M., & Peterson, H. P. (2021). The impact of covid-19 on perceptions of home and house design in saudi arabia. Strategic Design Research Journal, 14(1), 327–338. https://doi.org/10.4013/sdrj.2021.141.27

Allam, Z., & Jones, D. S. (2020). Pandemic stricken cities on lockdown. Where are our planning and design professionals [now, then and into the future]? Land Use Policy, 97, 104805.

Amerio, A., Brambilla, A., Morganti, A., Aguglia, A., Bianchi, D., Santi, F., Costantini, L., Odone, A., Costanza, A., Signorelli, C., Serafini, G., Amore, M., & Capolongo, S. (2020). COVID-19 Lockdown: Housing Built Environment's Effects on Mental Health. International journal of environmental research and public health, 17(16), 5973. https://doi.org/10.3390/ijerph17165973

Bahadursingh, N. (2020). Ways COVID-19 Will Change Home Design. Architizer.

Barbarossa, L. (2020). The post pandemic city: Challenges and opportunities for a non-motorized urban environment. An overview of Italian cases. Sustainability (Switzerland), 12(17). https://doi.org/10.3390/su12177172

Baum-Snow, N., & Han, L. (2019). The microgeography of housing supply. Work in Progress, University of Toronto.

Bean, B., Moore, B. M., Sterner, B., Peterson, L. R., Gerding, D. N., & Balfour Jr, H. H. (1982). Survival of influenza viruses on environmental surfaces. Journal of Infectious Diseases, 146(1), 47–51.

Bethesda, M., Blake, K. S., Kellerson, R. L., & Simic, A. (2007). Measuring overcrowding in housing. Office of Policy Development and Research, 38.

Brager, G. S., & de Dear, R. J. (1998). Thermal adaptation in the built environment: a literature review. Energy and Buildings, 27(1), 83–96. https://doi.org/https://doi.org/10.1016/S0378-7788(97)00053-4

Broadbent, G. (1975). Design in architecture: architecture and the human sciences.

Budds, D. (2020). Design in the age of pandemics. Curbed, 2, 233–240.

Byrne, J. P. (2008). Encyclopedia of pestilence, pandemics, and plagues. Greenwood Press Westport, Connecticut, London.

Caligiuri, P., De Cieri, H., Minbaeva, D., Verbeke, A., & Zimmermann, A. (2020). International HRM insights for navigating the COVID-19 pandemic: Implications for future research and practice. Journal of International Business Studies, 51(5), 697–713. https://doi.org/10.1057/s41267-020-00335-9

Capolongo, S., Rebecchi, A., Buffoli, M., Appolloni, L., Signorelli, C., Fara, G. M., & D'Alessandro, D. (2020). COVID-19 and Cities: from Urban Health strategies to the pandemic challenge. A Decalogue of Public Health opportunities. Acta Bio-Medica : Atenei Parmensis, 91(2), 13–22. https://doi.org/10.23750/abm.v91i2.9615

Cavazza, N., Russo, S., Colloca, P., & Roccato, M. (2021). Household crowding can have political effects: An empirical study on support for anti-democratic political systems during the COVID-19 lockdown in Italy. Journal of Environmental Psychology, 76, 101628. https://doi.org/https://doi.org/10.1016/j.jenvp.2021.101628

CDC. (2021). Ventlation for Resedential building importance in epdimics. https://www.cdc.gov/coronavirus/2019-ncov/community/ventilation.html

Chang, V. (2020). The post-pandemic style. Slate. Https://Slate. Com/Business/2020/04/Coronavirus-Architecture-1918-Flu-Cholera-Modernism. Html.

Coccia, M. (2022). Preparedness of countries to face COVID-19 pandemic crisis: Strategic positioning and factors supporting effective strategies of prevention of pandemic threats. Environmental Research, 203, 111678. https://doi.org/https://doi.org/10.1016/j.envres.2021.111678

D'Alessandro, D., & Raffo, M. (2011). Adapting the answers to new problems of living in a changing society. Annali Di Igiene: Medicina Preventiva e Di Comunita, 23(3), 267–274.

de España, G. (2020). Secretar{\'\i}a General de Sanidad y Consumo. Dirección General de Salud Pública, Calidad e innovación. Centro de Coordinación de Alertas y Emergencias Sanitarias. Información cient{\'\i}fica-técnica. Enfermedad por coronavirus, COVID-19

Actualización 12 de noviembre, 2020.

Dejtiar, F. (2020). Is coronavirus pandemic accelerating the digitalization and automation of cities. ArchDaily,[S. L.], 27.

di Lavoro, I. S. S. (2020). Indicazioni ad interim per la prevenzione e gestione degli ambienti indoor in relazione alla trasmissione dell'infezione da virus SARS-CoV-2.

Dreessen, T. (2020). How COVID-19 will change the design of our cities. Ottowa Business Journal, Accessed August, 21, 2020.

Gillie, O. (2006). A new government policy is needed for sunlight and vitamin D. British Journal of Dermatology, 154(6), 1052–1061. https://doi.org/10.1111/j.1365-2133.2006.07261.x

Guerra, T. (2022). Designing Post-COVID Housing for Urban Life. https://www.gkvarchitects.com/news/designing-post-covid-housing-for-urban-life

Haddad, E. (2010). Christian norberg-schulz's phenomenological project in architecture. Architectural Theory Review, 15(1), 88–101.

Hamdy, M., & Mauro, G. M. (2019). Optimizing Hybrid Ventilation Control Strategies Toward Zero-Cooling Energy Building. Frontiers in Built Environment, 5(August), 1–15. https://doi.org/10.3389/fbuil.2019.00097

Hercules, W. J., Anderson, D. C., & Sansom, M. (2020). Architecture—A Critical Ingredient of Pandemic Medicine: An Open Letter to Policy Makers. Health Environments Research and Design Journal, 13(3), 247–252. https://doi.org/10.1177/1937586720928432

Hipwood, T. (2020). The end of open-plan living. How Covid-19 Is Changing Our Homes. Available Online: Https://Www. Fastcompany. Com/90515499/the-End-of-Open-Plan-Living-How-Covid-19-Is-Changingour-Homes (Accessed on 24 September 2020).

Hizra, F., Dewi, C., & others. (2021). Houses amid COVID-19: Environmental challenges and design adaptation. IOP Conference Series: Earth and Environmental Science, 881(1), 12033.

J, W. (2020). Design in architecture: architecture and the human sciences. Journal of Chemical Information and Modeling, 21(1), 1–9. https://doi.org/10.1016/j.tmaid.2020.101607%0Ahttps://doi.org/10.1016/j.ijsu.2020.02.034%0Ahttps://onlinelibrary.wiley.com/doi/abs/10.1111/cjag.12228%0Ahttps://doi.org/10.1016/j.ssci.2020.104773%0Ahttps://doi.org/10.1016/j.jinf.2020.04.011%0Ahttps://doi.o

Jia, L.-R., Han, J., Chen, X., Li, Q.-Y., Lee, C.-C., & Fung, Y.-H. (2021). Interaction between Thermal Comfort, Indoor Air Quality and Ventilation Energy Consumption of Educational Buildings: A Comprehensive Review. Buildings, 11(12). https://doi.org/10.3390/buildings11120591

Kadhim, I. J., & Ubaid, W. J. (2021). Perception Of Architectural Output: The Presence Of Architecture In The Presence Of a Pandemic. IOP Conference Series: Materials Science and Engineering, 1067(1), 012025. https://doi.org/10.1088/1757-899x/1067/1/012025

Karim, Y. G., Ijaz, M. K., Sattar, S. A., & Johnson-Lussenburg, C. M. (1985). Effect of relative humidity on the airborne survival of rhinovirus-14. Canadian Journal of Microbiology, 31(11), 1058–1061. https://doi.org/10.1139/m85-199

Kashdan, R. (2020). Six ways urban spaces may change because of coronavirus. Tersedia Di: Https://Www. Bostonmagazine. Com/Property/2020/04/30/Urban Spaces-Coronavirus/(Diakses 3 November 2020).

Kate Dehler. (2021). post pandamic housing. Atlantic Magazine.

Klaus, I. (2020). The post-pandemic urban future is already here. CityLab. Available Online: Https://Www. Bloomberg. Com/News/Articles/2020-04-06/How-Will-the-Pandemic-Transform-Urban-Space (Accessed on 25 April 2020).

Kyle, C. (2020). How The Coronavirus Will Reshape Architecture. The New Yorker.

Liao, W. J., Mui, K. W., Cheng, C. L., Wong, L. T., & He, K. C. (2011). Air pressure fluctuations of drainage stacks at a high-rise office building. Indoor and Built Environment, 20(4), 412–419.

Liu, L. (2020). Emerging study on the transmission of the Novel Coronavirus (COVID-19) from urban perspective: Evidence from China. Cities, 103, 102759. https://doi.org/https://doi.org/10.1016/j.cities.2020.102759

Liu, S., & Su, Y. (2021). The impact of the COVID-19 pandemic on the demand for density: Evidence from the U.S. housing market. Economics Letters, 207, 110010. https://doi.org/10.1016/j.econlet.2021.110010

London, J. (2013). The Scarlet Plague and the Fear of Pandemic. Emerging Infectious Diseases, 19(2), 254–255. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3559034/pdf/12-0312.pdf

Lowen, A. C., Mubareka, S., Steel, J., & Palese, P. (2007). Influenza Virus Transmission Is Dependent on Relative Humidity and Temperature. PLOS Pathogens, 3(10), 1–7. https://doi.org/10.1371/journal.ppat.0030151

Maggies, A. (2020). How to Recover From Covid-19 at Home. NEwYork Times. https://www.nytimes.com/2020/05/27/smarter-living/how-to-recover-from-Covid-19-at-home.html Accessed on 13 july 2020

Makhno, S. (2020). Life after coronavirus: how will the pandemic affect our homes. Tersedia Di: Https://Www. Dezeen. Com/2020/03/25/Life-after-Coronavirus-Impact-Homes-Designarchitecture/(Diakses 11 Desember 2020).

Megahed, N. A., & Ghoneim, E. M. (2020). Antivirus-built environment: Lessons learned from Covid-19 pandemic. Sustainable Cities and Society, 61, 102350. https://doi.org/10.1016/j.scs.2020.102350

Nicol, J. F., & Humphreys, M. A. (2002). Adaptive thermal comfort and sustainable thermal standards for buildings. Energy and Buildings, 34(6), 563–572. https://doi.org/10.1016/S0378-7788(02)00006-3

Novianto, D., Nuffida, N. E., & Gao, W. (2021). A Review of Architecture Response to the Pandemic towards New Normal Behavior (International Conference and Workshop : Re-thinking the HIBIKINO Campus 2001-2021 : Kitakyushu (Japan)) -- (Architectural Design). Jailcd, March, 13–18. https://ci.nii.ac.jp/naid/40022525217

Paital, B. (2020). Nurture to nature via COVID-19, a self-regenerating environmental strategy of environment in global context. The Science of the Total Environment, 729, 139088. https://doi.org/10.1016/j.scitotenv.2020.139088

Pinheiro, M. D., & Luís, N. C. (2020). COVID-19 could leverage a sustainable built environment. Sustainability (Switzerland), 12(14). https://doi.org/10.3390/su12145863

Pitlik, S. D. (2020). COVID-19 Compared to Other Pandemic Diseases. Rambam Maimonides Medical Journal, 11(3), e0027. https://doi.org/10.5041/RMMJ.10418

Rosa-Jimenez, C., & Jaime-Segura, C. (2022). Living Space Needs of Small Housing in the Post-Pandemic Era: Malaga as a case study. Journal of Contemporary Urban Affairs, 6(1), 51-58.

Saadat, S., Rawtani, D., & Hussain, C. M. (2020). Environmental perspective of COVID-19. The Science of the Total Environment, 728, 138870. https://doi.org/10.1016/j.scitotenv.2020.138870

Sarkar, A., & Bardhan, R. (2020). Improved indoor environment through optimised ventilator and furniture positioning: A case of slum rehabilitation housing, Mumbai, India. Frontiers of Architectural Research, 9(2), 350–369. https://doi.org/https://doi.org/10.1016/j.foar.2019.12.001

Schulz, C. N., & others. (1985). The concept of dwelling: On the way to figurative architecture. New York: Rozolli.

Shehzad, A., Rehman, G., Ul-Islam, M., Khattak, W. A., & Lee, Y. S. (2013). Challenges in the development of drugs for the treatment of tuberculosis. Brazilian Journal of Infectious Diseases, 17(1), 74–81. https://doi.org/10.1016/j.bjid.2012.10.009

Singh, M., Ooka, R., Rijal, H., & Takasu, M. (2017). Adaptive thermal comfort in the offices of North-East India in autumn season. Building and Environment, 124. https://doi.org/10.1016/j.buildenv.2017.07.037

Spennemann, D. H. R. (2021). RESIDENTIAL ARCHITECTURE IN A POST-PANDEMIC WORLD: IMPLICATIONS OF COVID-19 FOR NEW CONSTRUCTION AND FOR ADAPTING HERITAGE BUILDINGS. Heritage, 4(3), 2140–2162.

Standard, A. (2017). Standard 55--2017 thermal environmental conditions for human occupancy. Ashrae: Atlanta, GA, USA.

Steinemann, A., Wargocki, P., & Rismanchi, B. (2017). Ten questions concerning green buildings and indoor air quality. Building and Environment, 112, 351–358.

Stephens, N. (2020). Biggest Challenges of Working from Home.

Straus, D. C. (2009). Molds, mycotoxins, and sick building syndrome. Toxicology and Industrial Health, 25(9–10), 617–635.

Sullivan, J. B., Van Ert, M. D., Krieger, G. R., & Peterson, M. E. (2012). Indoor Environmental Quality and Health. In Small Animal

Toxicology, Third Edition (Third Edition). Elsevier Inc. https://doi.org/10.1016/B978-1-4557-0717-1.00014-4

Sundell, J. (2017). Reflections on the history of indoor air science, focusing on the last 50 years. Indoor Air, 27(4), 708–724. https://doi.org/10.1111/ina.12368

Tokazhanov, G., Tleuken, A., Guney, M., Turkyilmaz, A., & Karaca, F. (2020). How is COVID-19 experience transforming sustainability requirements of residential buildings? A review. Sustainability, 12(20), 8732.

Wainwright, O. (2020). Smart lifts, lonely workers, no towers or tourists: Architecture after coronavirus. The Guardian, 13.

WHO. (1988). Guidelines for healthy housing. WHO Regional Office for Europe.

Wilcox, B. A., & Colwell, R. R. (2005). Emerging and reemerging infectious diseases: Biocomplexity as an interdisciplinary paradigm. EcoHealth, 2(4), 244–257. https://doi.org/10.1007/s10393-005-8961-3

World Health Organization. (2009). Infection prevention and control during health care for confirmed, probable, or suspected cases of pandemic (H1N1) 2009 virus infection and influenza-like illnesses.

World Health Organization. (2021). Report of the WHO-China Joint Mission on Coronavirus Disease. In who web page.

Xu, C., Luo, X., Yu, C., & Cao, S. J. (2020). The 2019-nCoV epidemic control strategies and future challenges of building healthy smart cities. Indoor and Built Environment, 29(5), 639–644. https://doi.org/10.1177/1420326X20910408

Zoran, M. A., Savastru, R. S., Savastru, D. M., & Tautan, M. N. (2020). Assessing the relationship between ground level

of ozone (O(3)) and nitrogen dioxide (NO(2)) with coronavirus (COVID-19) in Milan, Italy. The Science of the Total Environment, 740, 140005. https://doi.org/10.1016/j.scitotenv.2020.140005