Nigerian Research Journal of Engineering and Environmental Sciences 8(2) 2023 pp. 447-457
p ISSN: 2635-3342; e ISSN: 2635-3350

Nigerian Research Journal of Engineering and Environmental Sciences
Journal homepage: www.rjees.com

Review Article

Architectural Response Towards the Coronavirus Disease (COVID-19) as a Catalyst for National Security in Nigeria

***[1]Okonta, E.D., [2]Okonta, E.M. and [3]Okonta, U.G.**

[1]School of Computing and Digital Technologies, Teesside University, Middlesbrough, UK.
[2]Department of Anatomy, Bingham University, Karu, Nassarawa State, Nigeria.
[3]Department of Community Health, Obafemi Awolowo University, Osun State, Nigeria.
*d.okonta@tees.ac.uk

http://doi.org/10.5281/zenodo.10441971

ARTICLE INFORMATION

Article history:
Received 18 Jul. 2023
Revised 23 Oct. 2023
Accepted 11 Nov. 2023
Available online 30 Dec. 2023

Keywords:
Epidemics
Coronavirus (COVID-19)
Smart Cities
Sustainability
National Security
Healthcare

ABSTRACT

Epidemics either occur naturally, for example, the coronavirus or in the form of intentionally released agents (e.g., biological warfare or bioterrorism). Research has demonstrated that acute and chronic changes in health status have direct and indirect impacts on security and that epidemics may lead to destabilization, political unrest, civil disorder, or long-term deterioration of the economic viability of a country or region. This study focuses on the COVID-19 global pandemic and its effects on national security. It explores how architects can shape cities through responsive designs and strategic planning to effectively contain and treat the virus. Key architectural considerations identified through literature review include modular constructions for adaptable healthcare needs, adaptive reuse of existing structures, energy-efficient measures for sustainable infrastructure, and integration of smart technologies for public safety. Implementing these architectural responses in Nigeria contributes to containing infectious diseases and safeguarding national security. The need for increased discussions between various stakeholders (e.g., in the health sector, military, governmental and non-governmental organizations, professionals in the building industry) as it pertains to providing higher livability in our cities will help to combat future epidemics if they occur.

1. INTRODUCTION

1.1. Background

Individuals, government, and non-governmental organizations are always concerned about an outbreak of epidemics and its impact on National security, but few are always prepared for this, 'unseen enemy'. Often the responses from individuals and organizations are during or after the pandemic. Studies have shown this to be true in the way pandemics have shaped civilizations, cultures, and the built environment (Alavi et al. 2019; Kirsh 2019). It has affected how we design interior spaces, urban centres and the environment. For

example, the city planning, and developmental strides of the Renaissance can be traced to the lessons learned from the Bubonic plague that occurred in the 14th Century (Tokazhanov et al., 2020). Cholera and typhoid outbreaks during the industrial era affected the way streets were planned for underground pipe system installation, streets were done in such a way they were wide, smooth and straight (Megahed and Ghoneim, 2020). Other such reforms include the changes that affected the clearance of slums, reforms for tenements and waste management, all of which were in response to overcrowded cities with tuberculosis and different flu types (Tokazhanov et al., 2020).

COVID-19 and its devastating effects on national security in Nigeria need to be tackled headlong and perceived as a national security threat to the sovereignty of Nigeria. As the UN Secretary-General describes it as, *'the greatest test that we have faced together since the formation of the United Nations'* (BBC News, 2020) and further said that, 'the pandemic also poses a significant threat to the maintenance of international peace and security- that has the potential to cause an increase in social unrest and violence that can weaken our ability to fight the disease' (Besheer, 2020). Consequently, having the right perspective towards this pandemic as a nation is critically fundamental to maintaining one nation that is bound to freedom, peace and unity. Critical here is that ultimately COVID-19 will be contained using vaccines and the reality of achieving herd immunity when 70% of the population is vaccinated (Kwok et al., 2020) is not achievable. This percentage may be difficult to achieve in Nigeria due to economic constraints (Wong et al., 2020), general skepticism (Thunstrom et al., 2021) and outright antagonism as it pertains to vaccinations (Hensher et al., 2020). There is no denying that we are a long way away from containing the virus, thus, professionals especially architects in the built environment need to begin to explore responsive design measures and construction techniques as tools for both the virus containment and treatment. This study seeks to explore these measures architects would follow to respond to this global pandemic, Coronavirus within the context of its effect on national security.

1.2. Epidemics

An epidemic can be defined as the incidence of several cases of a disease, an illness, or other health-related behaviours including non-infectious diseases, in a country or region at a rate that is above normal expectancy (Hoffman, 2014; WHO, 2020). The etymological origin of the word is from the Greek word *epidemics*, which combines the preposition, 'epi' which means 'on' and the noun, 'demos' which means, 'people'. There is no doubt that since it has been in existence for over 2000 years it has been used by several people across the century and has undergone different semantical modifications while a Pandemic is a term used to describe an epidemic with a global spread. Epidemics may be a result of the multiplication of the causative agent or an increase in its virulence. It may also occur when the causative agent is newly introduced into a particular region where it had never existed, or an increase in the rate of exposure of susceptible persons due to advancement in its mode of transmission (CDC, 2012). Other reasons may be due to lifestyle patterns in the host that make it more susceptible to the causative agent, or the introduction of the agent through new entry portals. Epidemics have a far-reaching capability and potential to impact even the most remote villages of the world (Totten, 2015),

A special class of epidemic is known as Bioterrorism. This is the deliberate release of bacteria, or viruses, or other microbes that can cause infection, illness, or death to people, livestock, or crops in large proportions in a particular country, region, or population (CDC, 2020). Epidemics can be classified into; common sources propagated and mixed according to their pattern of spread through a population. When a group of people is exposed to an agent of infection from one source, it is said to be a common-source epidemic. A propagated outbreak is a result of the transmission of infection from one person to another. Most epidemics have been found to possess the characteristics of both common-source and propagated epidemics, these are referred to as mixed epidemics. COVID-19 is a classic example of this infection from a common source, followed by the spread from person to person (Radosavljevi, 2019; Oliveira, 2020)

1.3. COVID-19; Its nature and Ways of Spread

COVID-19 is defined as an illness caused by the acute respiratory syndrome coronavirus 2 SARS - CoV - 2. The first outbreak of this illness was documented in the Wuhan district of China. WHO first learned of

this new virus on 31 December 2019, this was after a report of a group of cases of 'viral pneumonia in Wuhan, China. Subsequently, the World Health Organisation declared it a disease of public health concern on the 30th of January 2020 (Cucinotta and Vanelli, 2020). The origin of Covid-19 has been a subject of debate amongst scientists and health experts. However, what is almost consistent with recorded findings is that the severe acute respiratory syndrome (SARS) virus strain known as SARS-CoV is an example of a coronavirus. The new strain of coronavirus is called severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2). This virus causes coronavirus disease 19 (COVID-19). The Covid-19 symptoms mimic that of the flu. Both are devastating and contagious respiratory illnesses. The Covid-19 spreads faster than the flu with more serious symptoms (Liu et al., 2020a). The human-to-human spreading of the virus is transmitted through respiratory droplets or aerosols and contact routes. These aerosols have the potential to penetrate the human lungs via inhalation through the nose or mouth (Chan, et al., 2019; Liu et al, 2020b) and currently, none is immune from being infected with the virus, anyone irrespective of age, race, and size is susceptible to the virus`s infection (Richardson et al., 2020). Persons can also be infected when they make contacts with surfaces contaminated with the virus and touching their face (e.g., eyes, nose, mouth). The COVID-19 virus may survive on surfaces for several hours, but when those surfaces are disinfected, it can mitigate the virus.

1.4. Impact of COVID-19 on National Security

Epidemics either occurring naturally, for example, the coronavirus or in the form of intentionally released agents (e.g., biological warfare or bioterrorism), research has demonstrated that acute and chronic changes in health status have direct and indirect impacts on security and that epidemics may lead to destabilization, political unrest, civil disorder or long-term deterioration of the economic viability of a country or region (Smith, 2002). National security has been viewed traditionally from a power and defence perspective (Ookeditse, 2020). The COVID-19 pandemic has proven that national security is not limited to safeguarding a country against terrorism, war, increase in crime, etc.; pandemics are also a determinant of national security especially with the upsurge of bioterrorism in some countries.

The former USA Secretary of Defence under President Jimmy Carter, Harold Brown, gave a broad definition of national security. He included environmental and economic issues. Brown observed that national security is "the ability to preserve the nation's physical integrity and territory; to maintain its economic relations with the rest of the world on reasonable terms; to preserve its nature, institution, and governance from disruption from outside; and to control its borders" (Brown, 2020).

With the confirmation of the first case of COVID-19 in Nigeria on 28 February 2020, the nation was confronted with two kinds of unusual challenges; the 'existing' security issues and the 'unseen' war with COVID-19. The existing security issues encircled the Boko Haram crisis in the North East and spread to other parts of the country, which according to the Global Conflict Tracker has led to more than 37, 500 deaths and caused the displacement of more than 2.5 million people within Nigeria and 244,000 refugees since 2009 (Council on Foreign Relations, 2020) and the war with banditry and criminal violence across the Northwest, North Central, Southeast and South-South, inter-communal crisis including ethnicity, livelihood (herder/farmer), separatist movements, kidnapping for ransom, etc. These 'existing' have resulted in the death of humans and the displacement of humans. Despite all these overwhelming challenges that threaten the unity, peace, security and stability of the country, COVID-19 is an irritating addition that Nigeria was not prepared for.

COVID-19 lockdowns, restrictions of movements, and border closures negatively impacted the economy, which brought a terrible blend of both income loss and reduced access to food and consumer goods across the states. These contributed to an increased level of violence, banditry, and kidnappings for ransom, the synchronized and consistent raids on warehouses where government palliatives were being stored (Agbedo et al 2020; Effoduh 2020; Ogunmodede 2020), breaking into homes to steal foodstuffs and money, extra-judicial killings (Olaiya, 20200. All of which contributed to a growing sense of insecurity and fear. The use of government security agents to enforce lockdowns hurt security, this changed the presence, movement and capacity of government security actors and left cities and rural centres vulnerable to attacks. Furthermore, the government's execution of the COVID-19 lockdown and palliative rollout deepened prevailing instruments linking online activism, youth political complaints, and protest activity which resulted in social

unrest. COVID-19 resulted in social disruption and instability in the country. When a state is unable to protect against disease, there is a tendency for an increase in social inequalities in access to healthcare, this threatens the functionality of a state, and authorities may not be able to cope with this, thus violence and disorder may ensue (Ceylan and Ozkan 2020). Thus, it is essential to note that, if this is not dealt with quickly, it would compound the issues and overwhelm the security architecture of Nigeria and cause devastating effects on the economy. Thus, all hands must be on deck to proffer solutions that would help control the spread through solutions driven by knowledge, understanding and courage.

2. METHODOLOGY

This research article employs a literature review methodology to explore the architectural response towards the Coronavirus Disease (COVID-19) as a catalyst for national security in Nigeria. The methodology involves a comprehensive analysis and synthesis of existing scholarly works, research articles, reports, and relevant literature related to the topic. The literature review process begins with the identification of key terms and concepts associated with the architectural response to the COVID-19 pandemic and national security. A systematic search is conducted in various academic databases, including but not limited to, PubMed, Google Scholar, and relevant architectural and construction journals. The search strategy incorporates keywords such as "architectural response," "COVID-19," "pandemic," "modular constructions," "adaptive reuse," "energy efficiency," "urban decentralization," "smart technologies," and "national security." The retrieved literature was then screened based on relevance to the research topic and inclusion criteria. Selected articles are critically reviewed and analyzed to identify key findings, trends, and insights related to the architectural response to the COVID-19 pandemic and its implications for national security in Nigeria. Through the analysis of the literature, key themes and concepts emerge, including modular constructions, adaptive reuse of existing structures, energy efficiency, urban decentralization, collaboration between stakeholders, and the integration of smart technologies. The findings from the literature are then organized and synthesized to form a comprehensive discussion on the architectural response to COVID-19 and its impact on national security. The use of a literature review methodology allows for a comprehensive and in-depth exploration of the architectural response to the COVID-19 pandemic within the context of national security in Nigeria. By synthesizing and analyzing existing literature, this research article provides valuable insights and recommendations for architects, policymakers, and other stakeholders involved in the built environment.

3. FINDINGS

The findings of this study highlight several key aspects of the architectural response towards the COVID-19 pandemic as a catalyst for national security in Nigeria. These findings are discussed below:

3.1. Modular Constructions

In the face of disease outbreaks such as the COVID-19 pandemic, architects have a crucial role to play in designing and constructing modular structures that facilitate rapid response and the establishment of healthcare facilities. Modular constructions, characterized using prefabricated components, offer numerous benefits in terms of quick and cost-effective construction of various types of buildings. This section elaborates on the importance of modular constructions in enhancing national security and combating the spread of diseases. Architects need to shift their focus towards the design and construction of modular structures that can be easily assembled and adapted to meet the urgent needs of healthcare facilities during quarantine periods. The utilization of prefabricated components allows for efficient and swift construction, enabling healthcare systems to respond promptly to the increasing demands during an outbreak (Smith and Quale, 2017). By employing modular constructions, architects can contribute to the effective containment and management of disease outbreaks, ultimately enhancing national security. The advantages of modular construction extend beyond the speed of construction. These structures offer flexibility and adaptability, allowing for the rapid transformation of spaces into healthcare facilities. The prefabricated components can be easily reconfigured and repurposed to meet specific healthcare requirements, providing the necessary

infrastructure for medical treatments, isolation units, testing centres, and quarantine facilities (Hatcher, 2020). This adaptability ensures that the built environment can swiftly respond to evolving situations and changing healthcare needs.

Furthermore, modular constructions offer cost-effective solutions for healthcare facilities. The prefabricated components are manufactured off-site, minimizing construction time and reducing labour costs. The controlled factory environment ensures precision and quality control, leading to efficient resource utilization and cost savings (Patwari, 2020). This cost-effectiveness is particularly vital in times of crisis when resources may be limited, allowing for the allocation of funds towards other essential aspects of healthcare provision. Architects must prioritize the design and construction of modular structures to enhance rapid response capabilities and healthcare facility establishment during disease outbreaks. The utilization of prefabricated components enables quick and cost-effective construction, adaptability to evolving healthcare needs, and efficient resource utilization. By embracing modular constructions, architects can significantly contribute to national security by effectively containing and managing disease outbreaks, ensuring the well-being of the population and the resilience of healthcare systems.

3.2. Adaptive Reuse of Existing Structures

It is expedient that going forward, buildings are designed in such a way they could be reused to meet the demands of an emergency facility during a pandemic. This is clearly shown in the way existing structures such as sports facilities, parking lots, etc., were adapted for reuse (converted into the provisional medical facility) during COVID-19. Architects need to begin to pursue future designs and construction techniques that are efficient, healthy, flexible and could be quickly transformed for immediate to serve as a medical facility or hospital (Lubell, 2020). COVID-19 made it possible for people to spend longer time at home, this was necessary to prevent the spread of the virus (Dietz et al., 2020), but this also placed a great demand on energy resource consumption. The bills of electricity and water skyrocketed because of the excessive demands for work from home, exercise, study, entertainment, and other essential services. Thus, residential buildings must be designed, retrofitted, and constructed to reduce energy consumption demands, reduce negative impacts on the environment, and help to maintain the comfort of users.

3.3. Decentralization of Urban Centres

Cities, with their high-density settlements and intricate networks of mobility and interactions, have long been the focus of architects and urban planners when it comes to disaster response and reconstruction. Disasters such as tsunamis, hurricanes, warfare, earthquakes, and bushfires have necessitated swift actions from these professionals to rebuild and restore ruined structures in urban areas. However, the COVID-19 pandemic has presented a unique challenge that requires a different approach. It has exposed the vulnerability of cities and highlighted the need for architects and urban planners to collaborate and implement innovative strategies to mitigate the spread of infectious diseases. The dynamics of urban environments, characterized by crowded public spaces, shared transportation systems, and proximity among residents, have facilitated the rapid transmission of COVID-19. The interwoven networks of mobility and interactions within cities have inadvertently encouraged the spread of the virus, posing significant threats to public health and national security. As architects and urban planners, it is essential to recognize these vulnerabilities and take proactive measures to address them. To effectively respond to pandemics, architects and urban planners must work hand in hand to reimagine urban landscapes and explore strategies that break up large cities into smaller, more decentralized towns. This approach aims to reduce automobile dependency, which has been a major contributing factor in the rapid spread of infectious diseases within densely populated areas. By decentralizing urban centres and promoting the development of widely dispersed small towns, the reliance on centralized transportation systems and crowded public spaces can be minimized, thus mitigating the risk of virus transmission (Barron et al., 2020).

Additionally, this collaborative effort between architects and urban planners should prioritize the creation of pedestrian-friendly environments, efficient public transportation systems, and mixed-use developments that promote local amenities and services. By fostering walkability, enhancing public transportation options, and

ensuring access to essential services within closer proximity to residential areas, the need for extensive travel and reliance on personal vehicles can be reduced. These measures not only contribute to curbing the spread of pandemics but also lead to sustainable and resilient urban environments (Barron et al., 2020). Furthermore, the concept of breaking up large cities into smaller towns aligns with the principles of community resilience. By creating smaller, self-sufficient communities, individuals and families can rely on local resources and support networks during times of crisis. These communities can effectively implement and enforce public health measures, such as social distancing and localized containment strategies, as they have a stronger sense of shared responsibility and connectivity. The COVID-19 pandemic has shed light on the vulnerabilities of cities and the need for architects and urban planners to adopt a collaborative approach to pandemic response. Breaking up large cities into smaller towns, reducing automobile dependency, and creating pedestrian-friendly environments are essential steps in mitigating the spread of infectious diseases. Through their combined efforts, architects and urban planners can design and shape urban landscapes that prioritize public health, community resilience, and sustainable development, ultimately contributing to national security and the well-being of urban populations.

3.4. Synchronization of Code and Policies

To achieve a robust, consistent, and effective discussion among health professionals and other allied built environmental professionals in the construction industry, it is necessary to establish a strong foundation for collaboration and synchronization of codes, standards, design ideals, and policies. This collaborative effort ensures that all stakeholders are involved in the decision-making process and that the resulting codes and standards reflect a multidisciplinary approach (Harrouk, 2020). One crucial aspect of these changes in the codes and standards of the built environment is the focus on creating greener spaces. This involves integrating sustainable practices into the design and construction process, such as incorporating renewable energy sources, utilizing environmentally friendly materials, and implementing energy-efficient systems (D'alessandro et al., 2020). By prioritizing sustainability, buildings can reduce their environmental footprint and contribute to a healthier and more resilient built environment. Another important consideration is improving air ventilation and intimacy within buildings. Proper ventilation plays a significant role in maintaining indoor air quality and reducing the spread of airborne pathogens. Design strategies that facilitate natural airflow, utilize advanced ventilation systems, and incorporate appropriate filtration mechanisms can enhance occupant health and well-being (Wintle, 2020).

Additionally, the adaptive reuse of existing structures is an effective approach to optimising resources and minimising waste. By repurposing buildings instead of constructing new ones, valuable materials and energy can be conserved. This not only contributes to sustainable development but also helps to preserve the architectural heritage and cultural identity (Dettori et al., 2020). Efficient water and effluent management is another crucial aspect of building design. Implementing technologies and systems that minimize water consumption, promote water reuse, and effectively treat wastewater are essential for sustainable water management (Dettori et al., 2020). By incorporating these practices, buildings can reduce their water footprint and contribute to the conservation of this vital resource. Furthermore, the introduction of touchless technologies and antimicrobial materials within buildings is becoming increasingly important considering the COVID-19 pandemic and other infectious diseases. Touchless systems, such as automated doors, faucets, and elevators, can help minimize contact and reduce the spread of pathogens. Antimicrobial materials, when integrated into surfaces, can inhibit the growth of bacteria and viruses, promoting a healthier indoor environment (Lippe-McGrow, 2020).

To ensure a healthier and more sustainable built environment, proper solid-waste management practices are crucial. Designing buildings with efficient waste segregation systems, recycling facilities, and appropriate disposal methods can help minimize environmental pollution and promote a circular economy (Zambrano-Monserrate et al., 2020). Considering the ongoing pandemic, incorporating social distancing techniques within housing design has gained significance. This involves reevaluating space utilization, considering the layout and arrangement of furniture, and implementing measures to ensure physical distancing while maintaining social connectedness (Capolongo et al., 2020). Designing flexible and adaptable spaces can

accommodate future changes in public health requirements and promote a safe and comfortable living environment.

Finally, lightweight architecture and flexible building design are essential for meeting evolving needs and promoting versatility. Designing structures that allow for easy modification and expansion can adapt to changing circumstances, whether it be for healthcare facilities, educational institutions, or residential buildings (Bahadursingh, 2020). This flexibility ensures that buildings can efficiently respond to emerging challenges and accommodate future developments.

However, it is not enough to establish new codes and standards. The implementation and enforcement of these guidelines are equally crucial. A well-defined structure, including regulatory bodies, compliance mechanisms, and regular assessments, must be in place to ensure that the codes and standards are effectively followed and integrated into the construction industry (Harrouk, 2020). Achieving a robust discussion, synchronization, and alignment of codes, standards, design ideals, and policies among health professionals and other built environmental professionals is essential for creating a healthier, more sustainable, and resilient built environment. By incorporating elements such as greener spaces, improved air ventilation, adaptive reuse, efficient water management, touchless technologies, solid-waste management, social distancing techniques, and flexible building design, we can shape cities to mitigate risks and enhance the well-being of occupants. Establishing a strong framework for the implementation and enforcement of these codes and standards is vital for ensuring their effectiveness and long-term impact.

3.5. Smart Cities and Technological-Driven Apartments

The COVID-19 pandemic has placed an unprecedented strain on the healthcare systems of advanced countries, and Nigeria, in particular, has faced significant challenges in managing the crisis (Cavallo, 2020). Despite these difficulties, it remains crucial to prioritize the concerns of citizens who are confined to their homes and unable to access traditional healthcare facilities. In this context, the integration of novel advanced technologies presents an opportunity to assist individuals in creating living spaces that are both healthy and safe (Megahed and Ghoneim, 2020; Okonta, 2023).

The application of advanced technologies, encompassing automotive systems, voice and face recognition, and various artificial intelligence-based smart technologies, can play a pivotal role in enhancing the living conditions of individuals during a pandemic. Recognizing the potential for virus transmission through contact with contaminated surfaces, touchless technologies emerge as a valuable solution (Marshall, 2020; van Doremalen et al., 2020). Keycard swiping, voice control, and face recognition technologies offer alternatives that enable people to avoid unnecessary physical contact with potentially infected surfaces, minimizing the risk of transmission (Lippe-McGrow, 2020).

In the context of residential and commercial buildings, advanced technologies can be employed to control various aspects of the living environment remotely. For instance, the use of smartphones can facilitate the control of elevators, blinds, and lighting systems, eliminating the need for direct physical interaction (Wainwright, 2020; Stambol, 2020). Furthermore, the implementation of motion sensors or face recognition systems can enable the automated unlocking of doors, reducing the need for individuals to touch potentially contaminated surfaces (Wainwright, 2020; Stambol, 2020). A particularly significant application of advanced technologies lies in the creation of self-cleaning spaces, specifically focusing on bathrooms in houses and public restrooms in commercial buildings. These spaces can be equipped with mechanisms that enable efficient disinfection without the need for human contact. Techniques such as spraying-down disinfection or the utilization of UV light can be employed to effectively eliminate pathogens, ensuring a hygienic environment for occupants (Stambol, 2020).

By integrating these advanced technologies into the design and operation of living spaces, individuals can enhance their safety and well-being during a pandemic. These technological advancements not only minimize the risk of virus transmission but also promote convenience and efficiency in everyday life. Moreover, they serve as proactive measures to safeguard the health of individuals who may face limitations in accessing traditional healthcare facilities.

The strain experienced by advanced countries' healthcare systems during the COVID-19 pandemic underscores the need for alternative approaches to support individuals confined to their homes. Advanced technologies offer a range of solutions to create healthy and safe living environments. By utilizing touchless technologies, remote control systems, and self-cleaning mechanisms, individuals can reduce their exposure to potentially contaminated surfaces and enhance their overall well-being. The integration of these technologies represents a significant step forward in pandemic response, ensuring the health and safety of individuals even in challenging circumstances

4. CONCLUSION

In conclusion, this research article emphasizes the importance of architectural response to the COVID-19 pandemic as a catalyst for national security in Nigeria. The findings and discussions highlight several key strategies that architects should adopt to combat the spread of diseases and enhance the resilience of the built environment. Firstly, architects should focus on modular constructions, utilizing prefabricated components that allow for the quick and cost-effective construction of healthcare facilities during quarantine periods. This approach ensures that healthcare building needs can be met promptly in response to outbreaks. Secondly, the adaptive reuse of existing structures should be prioritized. By designing buildings that can be easily repurposed as emergency facilities during a pandemic, architects can enhance the capacity of the healthcare system. The successful examples of converting sports facilities and parking lots into provisional medical facilities during COVID-19 demonstrate the potential of this approach.

Furthermore, residential buildings must be designed and retrofitted to reduce energy consumption and minimize negative impacts on the environment. The prolonged periods spent at home during the pandemic led to increased demands for energy resources, highlighting the need for sustainable and energy-efficient housing solutions. Decentralization of urban centres is another crucial aspect for architects and urban planners to consider. Breaking up large cities into smaller towns can reduce automobile dependency and limit the spread of diseases during a pandemic. By promoting more dispersed settlements, architects can help create more resilient and less vulnerable urban environments.

Collaboration and synchronization of codes, policies, and design ideas between health professionals and professionals in the construction industry are essential. A multidisciplinary approach is necessary to develop robust codes and standards for buildings that prioritize greener spaces, improved air ventilation, adaptive reuse, water and effluent management, touchless technologies, antimicrobial materials, solid-waste management, social distancing techniques, lightweight architecture, and flexible building design. However, the implementation of these codes and standards is equally important and should be supported by a well-structured framework. Additionally, the integration of smart city technologies and technological-driven apartments can minimize contact with individuals during a global pandemic. By leveraging advanced technologies such as automotive systems, voice and face recognition, and touchless interfaces, architects can create healthy and safe living environments. These technologies enable touchless control of various building features, such as elevators, doors, blinds, lighting, and self-cleaning spaces, reducing the risk of virus transmission through contaminated surfaces.

Finally, architects in Nigeria must embrace these strategies and collaborate with various stakeholders to respond effectively to public health crises like COVID-19. By implementing modular constructions, adaptive reuse, energy-efficient designs, decentralization, synchronized codes and policies, and smart technologies, architects can contribute significantly to national security by creating resilient and health-focused built environments.

5. CONFLICT OF INTEREST

There is no conflict of interest associated with this work.

REFERENCES

Agbedo, O., Thomas-Odia, I., Diamond, M., Eze, O., Adeowo, A., Akade, J., Njoku, L., Akpan, A., Afolabi, A., Ogugbuaja, C. and Akingboye, O. (2020). COVID-19 Palliative and its controversies: Interrogating the looting spree dimension. The Guardian-Nigeria. Retrieved 1st April, 2021 from https://guardian.ng/saturday-magazine/covid19-palliative-and-its-controversies-interrogating-thelooting-spree-dimension/

Alavi, H. S., Churchill, E. F., Wiberg, M., Lalanne, D., Dalsgaard, P., gen Schieck, A. and Rogers, Y. (2019). Human–building interaction: Sketches and grounds for a research program. Interactions, 26(4), pp. 58–61.

Kirsh, D. (2019). Do architects and designers think about interactivity differently? ACM Transactions on Computer–Human Interactions, 26(2), pp. 1-43

Bahadursingh, N (2020). 8 Ways COVID-19 Will Change Architecture. Retrieved 1st April 2021 from https://architizer.com/blog/inspiration/industry/covid19-city-design/

Baron, M. V., Santos, M. P., Isa, C. P. M., Santos, A. C., Marangoni, C., Werle, T. M., & Costa, B. E. P. (2020). Containment, mitigation, and suppression in the fight against the COVID-19 pandemic: survey and analysis. Saúde Coletiva, 54(10), 2657-2660.

BBC News (2020). Coronavirus: Greatest test since World War Two, says UN chief.

Retrieved 1st April 2021 from https://www.bbc.com/news/world-52114829

Besheer, M. (2020). UN Chief: Pandemic a threat to global peace, security. Voice of America (VOA), Retrieved 9th April 2021 from https://www.voanews.com/science-health/coronavirus-outbreak/un- 2021. chief-pandemic-threat-global-peace-security

Brown, H. (2020). Thinking about National Security: Defense and Foreign Policy in a Dangerous World. In: U.S. National Security: A Reference Handbook. Contemporary World Issues (2 revised) ed.), 1983, ed. Cynthia Ann Watson, 2008. ABC-CLIO.

Capolongo, S., Rebecchi, A., Bu_oli, M., Appolloni, L., Signorelli, C., Fara, G.M. and D'Alessandro, D. (2020). COVID-19 and cities: From urban health strategies to the pandemic challenge. A decalogue of public health opportunities. Acta Biomed. 91, pp. 13–22.

Cavallo, J. J., Donoho, D. A. and Forman, H. P. (2020). Hospital Capacity and Operations in the Coronavirus Disease 2019 (COVID-19) Pandemic-Planning for the Nth Patient. JAMA health forum, 1(3), e200345.

Cucinotta D. and Vanelli M. (2020). WHO Declares COVID-19 a Pandemic. Acta Biomed. 91(1), pp. 157-160.

Center for Diseases Control (CDC) (2012) Principles of Epidemiology in Public Health. U.S Department of Health and Human services. Retrieved 1st april, 2021 from https://www.cdc.gov/csels/dsepd/ss1978/ss1978.pdf

Center for Diseases Control (CDC). (2020). Anthrax as a weapon of bioterrorism. National Center for Emerging and Zoonotic Infectious Diseases (NCEZID) Retrieved 1st April, 2021 from https://www.cdc.gov/anthrax/bioterrorism/index.html

Ceylan, R. F., and Ozkan, B. (2020). The economic effects of epidemics: from SARS and MERS to COVID-19. Research Journal in Advanced Humanities, 1(2), 21-29.

Chan, J. F., Yuan, S., Kok, K. H., To, K. K., Chu, H., Yang, J., Xing, F., Liu, J., Yip, C. C., Poon, R. W., Tsoi, H. W., Lo, S. K., Chan, K. H., Poon, V. K., Chan, W. M., Ip, J. D., Cai, J. P., Cheng, V. C., Chen, H., Hui, C. K. and Yuen, K. Y. (2020). A familial cluster of pneumonia associated with the 2019 novel coronavirus indicating person-to-person transmission: a study of a family cluster. Lancet, 395(10223), pp. 514–523.

Council on Foreign Relations (2020). Boko Haram in Nigeria. Global Conflict Tracker,

Retrieved 5th May 2021 from https://www.cfr.org/interactive/global-conflict-tracker/conflict/boko-haram-nigeria

D'alessandro, D., Gola, M., Appolloni, L., Dettori, M., Fara, G.M., Rebecchi, A., Settimo, G. and Capolongo, S. (2020) COVID-19 and living space challenge. Well-being and public health recommendations for healthy, safe, and sustainable housing. Acta Biomed. 91, pp. 61–75.

Dietz, L., Horve, P. F., Coil, D. A., Fretz, M., Eisen, J. A. and Van Den Wymelenberg, K. (2020). 2019 Novel Coronavirus (COVID-19) Pandemic: Built Environment Considerations To Reduce Transmission. mSystems, 5(2), e00245-20.

Dettori, M., Altea, L., Fracasso, D., Trogu, F., Azara, A., Piana, A., Arghittu, A., Saderi, L., Sotgiu, G. and Castiglia, P. (2020). Housing Demand in Urban Areas and Sanitary Requirements of Dwellings in Italy. Journal of environmental and public health, 2020, pp. 323-326 7642658.

Effoduh, J. O. (2020). Why Nigeria's EndSARS movement is more than a call to end police brutality. World Economic Forum. Retrieved 30th March 2021 from https://www.weforum.org/agenda/2020/12/Nigeria-endears-police-brutality-protest/

Hatcher, J. (2020). Modular Buildings in the Time of Covid-19. Retrieved 15th September 2020 from: https://smartbuildingsmagazine.com/features/modular-buildings-in-the-time-of-covid-19

Harrouk, C. (2020). Architecture Post COVID-19: The Profession, the Firms, and the Individuals. Retrieved 13th September from https://www.archdaily.com/939534/architecture-post-covid-19-the-profession-the-firms-and-theindividuals

Hensher, M., Kish, K., Farley, J., Quilley, S. and Zywert, K. (2020). Open knowledge commons versus privatized gain in a fractured information ecology: Lessons from COVID-19 for the future of sustainability. Global Sustainability, 3, E26.

Hoffman, L. (2014). Epidemics, The Wiley Blackwell Encyclopedia of Health, Illness, Behavior and Society, eds. pp. 23-30

Kwok, K. O., Lai, F., Wei, W. I., Wong, S. Y. S. and Tang, J. W. T. (2020). Herd immunity - estimating the level required to halt the COVID-19 epidemics in affected countries. The Journal of infection, 80(6), e32–e33.

Liu, Y., Gayle, A. A., Wilder-Smith, A. and Rocklöv, J. (2020). The reproductive number of COVID-19 is higher compared to SARS coronavirus. Journal of travel medicine. 27, pp.

Liu, J., Liao, X., Qian, S., Yuan, J., Wang, F., Liu, Y., Wang, Z., Wang, F. S., Liu, L. and Zhang, Z. (2020). Community Transmission of Severe Acute Respiratory Syndrome Coronavirus 2, Shenzhen, China, 2020. Emerging infectious diseases, 26(6), pp.1320–1323.

Li, Q., Guan, X., Wu, P., Wang, X., Zhou, L., Tong, Y., Ren, R., Leung, K. S. M., Lau, E. H. Y., Wong, J. Y., Xing, X., Xiang, N., Wu, Y., Li, C., Chen, Q., Li, D., Liu, T., Zhao, J., Liu, M., Tu, W., … Feng, Z. (2020). Early Transmission Dynamics in Wuhan, China, of Novel Coronavirus-Infected Pneumonia. The New England journal of medicine, 382(13), 1199–1207.

Lippe-McGrow, J. The Future of Design after COVID-19. (2020). Retrieved 13th September 2020 from https://www.departures.com/lifestyle/architecture/architects-predict-future-of-design

Lubell, S. Commentary: Past Pandemics Changed the Design of Cities. Six Ways COVID-19 Could Do the Same. Retrieved 15th September 2020 from https://www.latimes.com/entertainment-arts/story/2020-04-22/coronaviruspandemics-architecture-urban-design

Marshall, W. (2020) Can COVID-19 (Coronavirus) Spread through Food, Water, Surfaces and Pets. Retrieved 16th September 2020 from https://www.mayoclinic.org/diseases-conditions/coronavirus/expert-answers/cancoronavirus-spread-food-water/faq-20485479

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

Olaiya, T.T., (2020) 'NHR condemns rising killings, rights violation during lockdown extension', The Guardian, 12 May, retrieved 20th April 2021, from https://guardian.ng/news/nhrc-condemns-rising-killings-rights-violation-during-lockdown-extension/

Oliveira, M., Mason-Buck, G., Ballard, D., Branicki, W., & Amorim, A. (2020). Biowarfare, bioterrorism and biocrime: A historical overview on microbial harmful applications. Forensic science international, 314, 110366.

Ogunmodede, C. O. (2020). How the EndSARS Movement Upended Politics as Usual in Nigeria. World Politics Review. Retreievd 12th September, 2020 from https://www.worldpoliticsreview.com/articles/29170/how-the-endears-movement-upended-Nigerian-politics

Ookeditse, L (2020). Reimagining Botswana's national security in light of Covid-19. African Security Review, Vol. 29, No. 3, 267–279

Okonta D. E. (2023). Investigating the impact of building materials on energy efficiency and indoor cooling in Nigerian homes. *Heliyon*, 9(9), e20316.

Patwari, R. (2020). A Qualitative Study of The Sustainability of Prefabricated Buildings. 10.13140/RG.2.2.34203.39200.

L. T., Nguyen, T. V., Luong, Q. C., Nguyen, T. V., Nguyen, H. T., Le, H. Q., Nguyen, T. T., Cao, T. M. and Pham, Q. D. (2020). Importation and Human-to-Human Transmission of a Novel Coronavirus in Vietnam. *The New England journal of* medicine, 382(9), 872–874.

Radosavljevic V. (2019) Environmental Health and Bioterrorism. Encyclopedia of Environmental Health. 2019, pp. 450–457.

Richardson, S., Hirsch, J. S., Narasimhan, M., Crawford, J. M., McGinn, T., Davidson, K. W., the Northwell COVID-19 Research Consortium, Barnaby, D. P., Becker, L. B., Chelico, J. D., Cohen, S. L., Cookingham, J., Coppa, K., Diefenbach, M. A., Dominello, A. J., Duer-Hefele, J., Falzon, L., Gitlin, J., Hajizadeh, N., Harvin, T. G. and Zanos, T. P. (2020). Presenting Characteristics, Comorbidities, and Outcomes Among 5700 Patients Hospitalized With COVID-19 in the New York City Area. JAMA, 323(20), pp. 2052–2059.

Smith, A.P (2002) The health of nations: infectious disease, environmental change, and their effects on national security and development. Cambridge, MA: MIT Press.

Smith, R. and Quale, J. O (2017). *Site Architecture: Constructing the Future*, Taylor & Francis: Abingdon, UK.

Stambol. Touchless Technology in the Wake of COVID-19. Retrieved 19th September from https://www.stambol.com/2020/05/11/touchless-technology-in-the-wake-of-covid-19/

Thunström, L., Ashworth, M., Finnoff, D. and Newbold, S. C. (2021). Hesitancy Toward a COVID-19 Vaccine. EcoHealth, 18(1), pp. 44–60.

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), pp. 1-20.

Totten, R. (2015) Epidemics, national security, and US immigration policy. Defense & Security Analysis, 31(3), pp. 199-212.

Van Doremalen, N., Bushmaker, T., Morris, D. H., Holbrook, M. G., Gamble, A., Williamson, B. N., Tamin, A., Harcourt, J. L., Thornburg, N. J., Gerber, S. I., Lloyd-Smith, J. O., de Wit, E. and Munster, V. J. (2020). Aerosol and Surface Stability of SARS-CoV-2 as Compared with SARS-CoV-1. The New England journal of medicine, 382(16), pp. 1564–1567.

Wainwright, O. (2020) Smart Lifts, Lonely Workers, No Towers or Tourists: Architecture after Coronavirus. Retrieved 13th September 2020 from https://www.theguardian.com/artanddesign/2020/apr/13/smart-lifts-lonely-workers-notowers-architecture-after-covid-19-coronavirus

Wintle, T. (2020). COVID-19 and the City: The Future of Pandemic-Proofed Buildings. Retrieved 13th September 2020 from https://newseu.cgtn.com/news/2020-07-12/COVID-19-and-the-city-The-future-of-pandemic-proofedbuildings- RCqRHMSn72/index.html

WHO (2018). Managing Epidemics. Key facts about major deadly diseases.

WHO Coronavirus disease (COVID-2019) situation reports. 2020. Retrieved 5th July 2021 from https://www.who.int/emergencies/diseases/novel-coronavirus-2019/situation-reports

WHO (2020). Disease Outbreak.

Wong, L. P., Alias, H., Wong, P. F., Lee, H. Y., and Abubakar, S. (2020). The use of the health belief model to assess predictors of intent to receive the COVID-19 vaccine and willingness to pay. *Human vaccines & immunotherapeutics*, 16(9), pp. 2204-2214.

Zambrano-Monserrate, M.A. Ruano, M.A. and Sanchez-Alcalde, L. (2020). Indirect effects of COVID-19 on the environment. *Science Total Environment*, 2020, p. 728.