

**SCHOOL OF ENVIRONMENTAL TECHNOLOGY,
FEDERAL UNIVERSITY OF TECHNOLOGY
MINNA, NIGER STATE, NIGERIA**

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R. E. Olagunju

B. J. Olawuyi

E. B. Ogunbode

**SETIG
2020
INTERNATIONAL
CONFERENCE**

BOOK OF PROCEEDINGS

MAIN THEME:

Sustainable Housing And Land Management



3RD -5TH MAY, 2021



**SCHOOL OF ENVIRONMENTAL TECHNOLOGY COMPLEX,
FUT, MINNA, NIGER STATE, NIGERIA**

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Dean, School of Environmental Technology
Federal University of Technology Minna, Nigeria

**School of Environmental
Technology International
Conference
(SETIC 2020)**

3RD - 5TH MAY, 2021

**Federal University of Technology Minna, Niger
State, Nigeria**

CONFERENCE PROCEEDINGS

EDITORS IN CHIEF

R. E. Olagunju

B. J. Olawuyi

E. B. Ogunbode

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PREFACE

The School of Environmental Technology International Conference (SETIC 2020) is organised by School of Environmental Technology, Federal University of Technology Minna, Nigeria. In collaboration with Massey University New Zealand, Department of Civil Engineering Faculty of Civil Engineering and Built Environment Universiti Tun Hussein Onn Malaysia, Malaysia Centre For Professional Development and Industrial Project Development School of Professional and Continuing Education (SPACE) UTM-KL, Malaysia, Global Academia, Department of Architecture, Faculty of Engineering and Architecture, Istanbul Gelisim University Istanbul Turkey, Sustainable Environmental and Technology (SET) Research Group, Department of Architecture, Universiti Sains Islam. The main theme for this year conference is "SUSTAINABLE HOUSING AND LAND MANAGEMENT". This promotes and encourage innovative and novelty for policy issues for inclusive and sustainable housing, access to finance for housing and land development, sustainable building materials, building cost management, sustainable and resilient cities, geoinformatics for land management, rapid urbanization, sustainable land use and spatial planning, gender issues in access to land.

The responses from participants for this conference are overwhelming, well attended, and successful. The operation mode was Virtual for all participants who choose the oral presentation mode. While, Physical for all poster medium presenters. Our participants are from various Universities and other sector across the globe, from countries like United State for America (USA), Turkey, Malaysia, China, Saudi Arabia, Kenya, New Zealand just to mention a few. Hence, this conference provides a good platform for professionals, academicians and researchers to widen their knowledge and approach on latest advances in research and innovation. Papers presented in this conference cover a wide spectrum of science, engineering and social sciences.

Finally, a note of thanks must go to SETIC 2020 Local Organizing Committee (LOC) for their remarkable dedication in making this conference a success. We hope the event will prove to be an inspiring experience to all committee members and participants.

ACKNOWLEDGEMENTS

The effort put together in achieving the success of SETIC 2020 is predicated on the feat of the first and second edition of School of Environmental Technology International Conference held in 2016 and 2018, respectively. The support and goodwill from Vice-Chancellor of Federal University of Technology, Dean School of Environmental Technology, Dr Dodo Y. A., Dr Moveh S. and many other highly motivated people are highly appreciated.

It is also my privilege and honour to welcome you all, on behalf of the Local Organizing Committee (LOC) to the 3rd edition of the Biennial School of Environmental International Conference (SETIC 2020). This Conference which was earlier schedule for 7th to 11 April, 2020 is holding now (3rd to 5th May, 2021) due to the challenges of COVID-19 Pandemic and the ASUU-FGN crisis which made our public Universities in Nigeria to be closed for about one year. We thank God for keeping us alive to witness the great SETIC2020 event, in an improved form exploiting the new-normal situation posed by the Pandemic for a hybrid (i.e. both physical and virtual) form of Conference participation.

The conference provides an international forum for researchers and professionals in the built environment and allied professions to address fundamental problems, challenges and prospects Sustainable Housing and Land Management. The conference is a platform where recognized best practices, theories and concepts are shared and discussed amongst academics, practitioners and researchers. This 2020 edition of SETIC has listed in the program a Round Table Talk on Housing Affordability beyond COVID-19 with selected Speakers from across the globe available to do justice on the topic of discussion.

Distinguished Conference participants, permit me to warmly welcome our Keynote and Guest Speakers:

- Prof. Ts. Dr. Mohd Hamdan Bin Ahmad, *Deputy Vice Chancellor (Development) Universiti Teknologi Malaysia (UTM)*;
- Assoc. Prof. Dr. James O.B. Rotimi, *Academic Dean Construction, School of Built Environment, College of Sciences, Massey University of New Zealand*;
- Assoc. Prof. Sr. Dr. Sarajul Fikri Mohammed, *General Manager, Centre for Professional Development and Industrial Project Development School of Professional and Continuing Education (SPACE), UTM-KL*.
- Prof. Ts. Dr. Zanail Abidin Akasah, *Visiting Professor on Sustainable Solar Integrated Design Building Design, International Micro Emission University (IMEU)/HIMIN Ltd. China & Senior Research Fellow, The Architects Resource, Jos, Nigeria*;
- Ar. Dr. Elina Mohd Husini, *Department of Architecture, Faculty of Engineering & Built Environment, Universiti Sains Islam*;
- Asst. Prof. Dr. Yakubu Aminu Dodo, *Department of Architecture, Faculty of Engineering and Architecture Istanbul Gelisim University, Istanbul Turkey*

and the five Speakers for our Round Table Talk on Housing Affordability Beyond COVID-19

- Dr. Muhammad Mustapha Gambo, *Manager, Policy, Research and Partnerships, Shelter Afrique, Nairobi, Kenya*;
- Prof. Dr. Soumia Mounir, *Department of Architecture Ecole Nationale d'Architecture d'Agadir [The National School of Architecture of Agadir], Morocco*

- Dr. Said Alkali Kori, *General Manager, Projects and Portfolio management, Family Homes Fund, Federal Ministry of Finance, Abuja;*
- Ts. Dr. Sasitharan Nagapan, *Department of Civil Engineering, Faculty of Engineering and Built Environment, Universiti Tunku Hussein Onn Malaysia, Malaysia;*
- Dr. Mercy Nguavese Shenge, *AIA Assoc. Historic District Commissioner, City of Rockville, MD, USA.*

for accepting to share from their knowledge, wealth of experience and be available to interact with participants on varied issues on “**Sustaining Housing and Land Management**”.

As reflected on the Conference program, the Conference activities will be Virtual for power point presenters to run in four parallel sessions on the Zoon platform while the participants for Poster presentations (mostly Postgraduate students) are expected to have their Posters displayed in the Environmental Complex Building of the Federal University of Technology, Minna. With a total of One Hundred and One (101) articles captured in the Conference Proceedings covering the seven subthemes of the Conference, I have no doubt that we are all in for an impactful experience at SETIC2020 as we brainstorm, exchange ideas, share knowledge and participate in evolving more approach to sustainable housing and land management drives.

I implore us all to enjoy every moment of the deliberations and ensure we maximize the great opportunity offered by the Conference to network for better research and career development as we also make new friends.

I also on behalf of myself and the LOC express our appreciation to the Dean, School of Environmental Technology and the entire Staff of the School for giving us the opportunity to steer the ship for SETIC2020. To the Reviewers and various Committees that served with us, I say thank you for helping us through despite the pressure of work.

Thanks, and God bless you all.

Olawuyi, B.J. (PhD)
Chairman, LOC
SETIC2020

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DECLARATION

PEER REVIEW AND SCIENTIFIC PUBLISHING POLICY STATEMENT

3rd MAY 2021

TO WHOM IT APRIL CONCERN

I wish to state that all the papers published in SETIC 2018 Conference Proceedings have passed through the peer review process which involved an initial review of abstracts, blind review of full papers by minimum of two referees, forwarding of reviewers' comments to authors, submission of revised papers by authors and subsequent evaluation of submitted papers by the Scientific Committee to determine content quality.

It is the policy of the School of Environmental Technology International Conference (SETIC) that for papers to be accepted for inclusion in the conference proceedings it must have undergone the blind review process and passed the academic integrity test. All papers are only published based on the recommendation of the reviewers and the Scientific Committee of SETIC

Babatunde James OLAWUYI
Chairman SETIC 2020
Federal University of Technology, Minna, Nigeria

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Prof. Ajayi M.T.A	Policy Issues for Inclusive and Sustainable Housing
Prof. Sanusi Y.A	Rapid Urbanization, Sustainable Land Use and Spatial Planning
Prof. Jimoh R.A.	Sustainable Building Material

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PROFILE OF KEYNOTE SPEAKERS AND GUEST SPEAKERS

SETIC 2020 organisers wishes to thank our keynote speakers, and Guest speakers for accepting to create time to share from their rich wealth of knowledge and interact with delegates and participants on varied issues being examined at this year's conference. A brief profile of each keynote speaker is provided here, this would allow for future interaction and networking with them.

		
<p>Prof. Ts. Dr. Mohd Hamdan Bin Ahmad Deputy Vice Chancellor (Development) University Teknologi Malaysia</p>	<p>Prof. Ts. Dr. Zainal Abidin Akasah (Visiting Professor) Dokumen Sains Integrasi & Aplikasi Desain International Islamic University (IIUM) / IIRIM 129 Kuala Lumpur, Malaysia Member of the Institution of Architects</p>	<p>Associate Prof. Dr. James O.S. Rotimi, Academic Dean Construction, School of Built Environment, College of Sciences, Massey University of New Zealand.</p>
		
<p>Assoc. Prof. Sr. Dr. Sarajul Fikri Mohamed General Manager, Centre for Professional Development and Industrial Project Development School of Professional and Continuing Education (SPACE) UTM-42, Malaysia</p>	<p>Asst. Prof. Dr. Yakubu Aminu Dodo GEM, HYDREST MANAGES Istanbul Gelismis University, Istanbul Turkey</p>	<p>Ar. Dr. Elina Mohd Husini Department of Architecture Faculty of Engineering & Built Environment, Universiti Sains Islam Malaysia</p>

ROUND TABLE PANEL SPEAKERS

Round Table Talk

On Housing Affordability Beyond Covid-19

Main Theme

SUSTAINABLE HOUSING AND LAND MANAGEMENT



Dr. Muhammad Mustapha Sambo
Manager, Policy, Research and Partnerships,
Shelter Afrique, Nairobi, Kenya



Prof. Dr. Soumia Mounir
Département of Architecture Ecole Nationale
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Management Family Home Fund Federal
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City of Rockville, MD, USA



Asst. Prof. Dr. Yakubu Aminu Dodo
GEM, M-CREST MANABICHES
Istanbul Gelismis University, Istanbul Turkey
Moderator

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ASSESSMENT OF INDOOR THERMAL PERFORMANCE FOR SUSTAINABLE SENIOR HOUSING FACILITY IN MINNA, NIGERIA

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ABSTRACT

Recent research has linked recovery rate and prevention of ailments to the environment in which it is taking place. The objective of this study was to assess the effect of the condition/performance on the perceived Indoor Air Quality (IAQ) and the indoor air-related symptoms of senior's facilities. In this study, indoor air quality design considerations gotten from literature are used as a reference for comparison with what is found in the facility. The design considerations are expected to work as a reference for promoting environments that are adapted for the needs of older adults. The perceived IAQ and the related symptoms were collected by means of questionnaire survey and observation schedule among the senior adults in the facility. The performance was significantly low in the facility, having little impact on the quality of the indoor environment. Therefore, it is imperative that IAQ design consideration be adapted in the design of residential apartments for the elderly as it helps to prevent, promote and provide a curative remedy for their well-being.

KEYWORDS: Indoor air quality, Landscape, Respiratory health, Seniors, Ventilation.

1.0. INTRODUCTION

The main challenge for the future is the ageing population, particularly the increasing number of very old people (80 years and above). The old-age dependency ratio (those above or equal to 65 years) is projected to increase from 25.4% to 53.5% in the period 2008–2060 (European Commission, 2009). Increasing longevity can determine a rise in medical costs and an increase in demands for health services, since older people are typically more susceptible to chronic diseases. Nigeria, as one of the fastest population growth, is projected to become the third largest (Mudiare, 2013). Figure 1 shows the estimates and projections of population size, from 1950 to 2050, in Nigeria. There are studies that aimed to review the state of the Nigerian health care system and to provide possible recommendations to the worsening state of health care in the country (*J Pharm Bioallied Sci.*, 2011). Due to technological advancements in medicine and water, hygiene and sanitation measures, Nigeria reports a significant increase in survival for persons over age 60. Figure 2 shows the estimates and projections of the number of persons over age 60, by general population and by sex, from 1950 to 2050, in Nigeria (United Nations 2002).

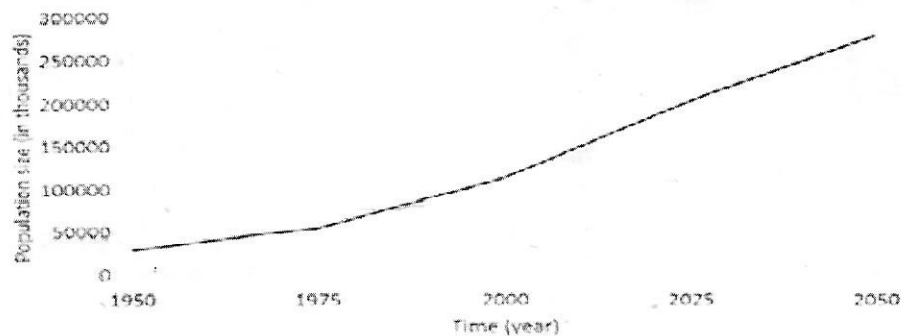


Figure 1. Estimates/projections of population size in Nigeria, 1950-2050(United Nations 2002)

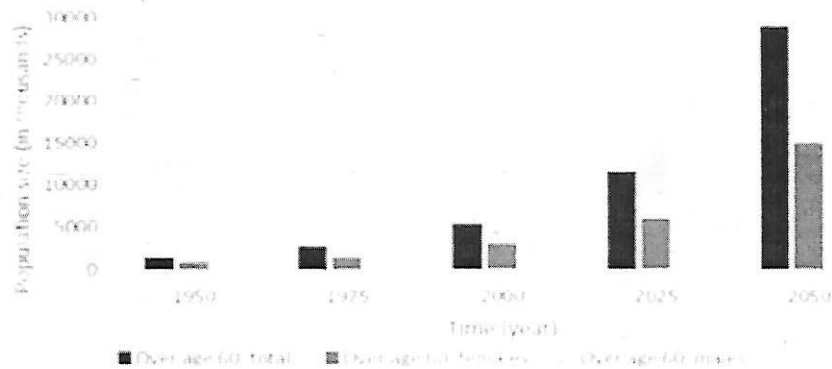


Figure 2. Estimates and projections of the number of persons over age 60 (in thousands), by general population and by sex, in Nigeria, 1950 to 2050. (United Nations 2002).

The well-being and health of the elderly particular in Nigeria, has been a source of concern to many researchers, and human rights organisations. Governments at the federal and state levels seem to have no concrete policies for the elderly in terms of social security, provision of social services, as well as health care. In 2000, Rivers state government in Nigeria embarked on a Free Medical Services (FMS) programme for the elderly population, as well as for children 0-6 years old. The elderly are also at higher risk of the effects of outdoor and indoor air pollution because of increased susceptibility and vulnerability. Outdoor air pollution is responsible for short-term and chronic adverse effects on cardiopulmonary morbidity and mortality in the elderly. [Bentayeb M, 2012]. There have been studies of poor acceptance of health care services as a result of infrastructural and personnel deficiencies; emotional and physical discomforts have been made. This has largely affected the utilization of Nigerian health services by the populace and it shows the need for better patient centred health care initiatives in policymaking and planning for health as well as the health care delivery services and programmes (Ephraim-Emmanuel, 2015). However, in industrialized countries, the elderly spend most of their time indoors [Simoni M, 2012]. 5% of those who are above 65 years and 20% of those who are above 85 years are nursing home residents (www.uscare.com). Due to reduced outdoor activities the elderly people are potentially more exposed to indoor air pollutants than the rest of the population. Therefore, keeping the elderly healthy by preventing illnesses due to poor air quality is a major challenge for many countries requiring a better understanding of the health consequences of the exposure to environmental factors, including air pollution [Bentayeb and Norback, 2015]. So far, respiratory health effects of indoor air pollution have been well documented in the general population; on the other hand, this important item was only seldom analysed in the elderly living in nursing homes and by few researchers' groups. The prevalence of the indoor air-related symptoms has been high also in developed elderly care residence.

The physical layout and design features of older adults' homes influence the way in which they use and perceive them. In addition, physical attributes of older adults' houses (e.g. inadequate ventilation, insufficient illumination) have long been associated with illnesses among the older adults (Viegi G, 2009); therefore, it could be expected that some environments are riskier than others for older adults. The principles of sustainable architecture are expected to work as a reference for promoting environments that are adapted for all, including the needs of older adults.

WHO (2005) identified indoor air quality as the eight most important risk factor and responsible for 2.7% of the global burden of disease. Indoor air quality causes more concern as places are crowded with people are at risk of spreading diseases caused by airborne bacteria. Although several studies demonstrate the significant health impact of health-care facilities

other diseases in Nigeria; most studies failed to investigate association between indoor air quality which is most effective for the prevention of illness and promote a self-healing environment. This study seeks to assess the perceived quality of the indoor living environment in providing a safe and self-healing environment in Old People's Home, Minna. It sets out to examine how the physical features, indoor air quality parameter and building design of the indoor environment of older adults' residence may influence and be related to their reported health.

1.2. Study area.

This study is carried out in Minna, Niger State, situated at latitude 9°37' North and longitude 6°33' East. The northeast part of the city has a rock outcrop that acts as a physical constraint to development. Minna is 200 Kilometres from Abuja, the federal capital and covers 100,000 Hectares of land at the present development (Minna Master Plan, 1979). For the average weather in Minna, the wet season is oppressive and overcast, the dry season is partly cloudy, and it is hot year round. Over the course of the year, the temperature typically varies from 60°F to 94°F and is rarely below 54°F or above 101°F. The hot season lasts for 2.4 months, from February 2 to April 16, with an average daily high temperature above 92°F. The hottest day of the year is March 15, with an average high of 94°F and low of 71°F. The cool season lasts for 3.2 months, from June 23 to September 29, with an average daily high temperature below 85°F. The coldest day of the year is December 30, with an average low of 60°F and high of 89°F. The study was conducted among the elderly residents in the Old People's Home, Minna, comprising basically of rooms on a floor building situated in a residential environment. (Tomasi, C 1998).

2.0. THEORETICAL FRAMEWORK

In fact, in sub-Saharan Africa, barriers to healthcare faced by older people have included elevated medical costs related to transportation to the health centre as well as disease management, minimal number of specialized centres for care, and lack of programs to optimize culturally- and age-sensitive care at federal health centres. Geriatric medical services are not prioritized in the Nigerian health system, which has been observed due to lengthy waiting time for healthcare appointments, low provider-patient ratio, and poor communication among elders and their healthcare providers, which may lead to unwillingness to utilize health services.

According to Abbas and Ghazali, 2012, natural views from windows, presences of green open spaces, colour, sounds, natural lighting and ventilation also gave more insight into the human crave for natural settings which reveals how nature offers an environment for healing from the effect of acquired stress.

2.1. Variables/ Design Considerations for Indoor Air Quality (IAQ) in the facility.

The environment is very important to enhance the healing process; therefore, it is imperative to identify how relevant IAQ considerations is to the senior's environment. The various ways in which these considerations can be experienced in the facility are as follows: natural ventilation/lightning in interior spaces, shading devices and a therapeutic environment. (Ghiaus et al., 2005).

2.1.1. Natural ventilation and lightning in interiors spaces: Strategies of natural ventilation can be Single-sided ventilation, Cross ventilation and Stack ventilation.

I. Single-sided ventilation is induced by wind variation (Ghiaus et al., 2005). Air exchange in the room occurs in a way that air enters and exits the room from openings on one side. The air inflowing is the different masses of air flowing near the opening of the window at different speed. Maximum room depth is 2.5 m times the height, approximate window height is 1.5 m, and window area is 1/20 of the floor area.

II. Cross ventilation is air crossing the room, entering from one opening and leaving from another opening. The second opening can be positioned in various ways and can either be windows or doors (Allard et al., 2005). Cross ventilation is driven by differences in pressure. Thus, a pressure difference is created between both surfaces which causes the air flow when opposite openings are created since the air is forced to flow from high to low pressure (Ghiaus et al., 2005).

III. Stack ventilation is a chimney-like process that creates a natural convection current that does not require fans. It involves the circulation of air through the entire internal environment of the building. The correct design of stack ventilation depends on the Neutral Pressure Level (NPL). This is the level responsible for balancing the airflow rates that enter and exit the building and tends to place itself closer to the largest openings. It depends on size and location of openings and indoor and outdoor temperatures. The higher the upper opening, the higher the NPL and therefore the higher the fresh air reaches the upper part of the building (Ghiaus et al., 2005).

Air vents and clerestory windows are not very common in Nigeria, although they are very effective for stack ventilation as hot air rises to the top, hence they provide a medium through which foul air is channelled out of the building, and could be integrated for effective natural ventilation of indoor spaces.

Natural lightning: Natural lightning is very relevant as it aids the smooth running of day to day activities. It is of utmost importance to the care givers as well as the patients. Based on the literature reviewed, natural lighting helps to ease the performance of visual tasks, controlling the body's circadian system which has a direct impact on senior's mood and behaviour. It also facilitates the direct absorption for critical chemical reactions within the body and in addition production of vitamin D in the body from early morning sun. Serotonin and melatonin among others are stimulated and suppressed in patients due to exposure to natural light. *

2.1.2. Landscape

Landscape is an area of land with natural sceneries or elements (McGarigal, 2017). It has the ability to reduce stress and boost human beings comfort and physical condition as people drift towards natural elements (Molthrop, 2011). Landscape configurations exist as healing gardens, therapeutic gardens, viewing gardens, edible gardens, roof garden, vertical gardens and indoor plant. Monasteries developed intricate gardens during the middle ages in Europe to convey images of calming distraction to the ill (Ulrich, 2002).

According to (Huelat, 2008) gardens offer several benefits to healthcare facilities, curtails stress and depression to healthcare users, valuable and more desirable quality, boosts up patient contentment, improves staff work productivity. Indoor plants effectively purify and filter the environment, as they absorb atmospheric gases and release oxygen therefore; they purify the air from the existing pollutants (Huelat, 2008). Their function encompasses releasing moisture, to prevent dryness.

2.1.3. Shading devices: Shading devices could be added internally or externally in different orientations to control the excess solar radiation entering the window. Direct sunlight and glare is curtailed by the use of shading devices as the intensity is adjusted besides resulting in proper distribution of daylighting entering the room. (CIEE, 1997). Light coloured louvers or blinds are to be used with the purpose of reflecting out the sunlight. External shading devices are either anchored to the skin of the building externally or an extension of the external skin to block undesirable solar heat. They are to a greater extent more efficient than interior shading devices in obstructing unwanted solar heat. Exterior shading devices includes: Fragmented horizontal overhang, Horizontal overhang with screening, Vertical or Fragmented vertical fins.

2.2. Respiratory Symptoms

Ageing leads to the deterioration of immune defences and lung function, and predisposition to respiratory infections (Viegi G, 2009). This requires a better understanding of the health consequences of the exposure to environmental factors, including air pollution. Adverse respiratory health effects due to air pollution are well established (Migliaretti G, 2007). Various studies have demonstrated a relationship between indoor and outdoor air pollution and respiratory morbidity and mortality in this age group at the general population level after stratification for age (Filleu L, 2004). A recent systematic review on adverse respiratory effects of indoor and outdoor air pollution in the elderly indicated that exposure these pollution leads to asthma and chronic obstructive pulmonary disease (COPD) and higher COPD mortality than in the rest of the population. Indoor temperature, relative humidity and carbon dioxide (CO₂) can also contribute to respiratory health issues (Fraga and Ramos, 2008). These few cited literatures clearly indicate that in order to create a safe and healthy environment for patient recovery, IAQ is an important issue.

2.2.1. Symptoms, Causes and Consequences of Poor IAQ

The American National Standard Institute's opines that some of the symptoms of poor IAQ in a health care facility includes, limited fresh air, temperature & humidity outside comfort zone, eye/nose/throat irritation, dry facial skin, respiratory infections, asthma, fatigue, headaches, increased allergic reactions, sick building syndrome – SBS. Also, potential causes of poor air quality include, reduced ventilation, building materials and furnishings, deferred maintenance, pesticides, housekeeping Supplies, and chemicals in Personal Care Products.

Consequences of Poor IAQ include; Health Problems, Reduced productivity, Higher Costs to Fix, Problems than to Prevent, Poor Public Relations, Liability Issues. The specific objective of the GERIE study (Geriatric study on health effects of air quality in nursing homes in Europe) (www.geriestudy.eu) was to contribute to filling the gaps in knowledge that exist in the field health effects of indoor air quality in the elderly. This was achieved by exploring the relationships of common indoor air pollutants and comfort parameters to respiratory symptoms and diseases among the elderly permanently living in nursing homes, who are potentially at high risk of exposure to air indoor air pollution from usual nursing home activities, such as cleaning and disinfection.

3.0. RESEARCH METHODOLOGY

3.1 Description of Case Study

The field study was conducted in Minna, the capital of Niger state. It was carried out with structured observation schedule, questionnaire administered to the residents and measurements of indoor thermal comfort and the nature of residential thermal environment of the old people's home located at Bosso district, in Minna, Niger State. The facility is a government-owned apartment built in 1986, adapted for good accessibility for people aged 70 years and over. The facility comprises 12 bedrooms, nursing station and other offices, the physical disabled apartment comprises of 25 bedrooms. It was selected as a case study because it could typify present situation of older persons living areas in Minna in terms of physical environment.

3.2. Data collection and methods

All the data used in this study are primary data; the data were processed with descriptive statistics for visualizing data-chart to have a better handle on the data (Befring 1994). Purposive sampling method was adopted to select the respondents to evaluate the condition of the facility environment on patients' outcome. According to Zikmund (2003), purposive sampling is "a non-probability sampling technique in which a researcher selects the sample based on his/her judgment about some appropriate characteristics required of the sample members". The rationale for the selection was based on the premise that the selected respondents had stayed in

the resident for quite a while, interacted with the spaces being evaluated and might otherwise have been affected by it.

Care givers such as officers, cooks and other stakeholders had their opinions sampled through personal conversations. Vital information's were gotten from this interaction which further assisted in the course of the research specifically for the checklist.

The observation schedule was designed by the researcher based on studying IAQ checklist manuals and observation schedule related to the sustainable design measures (Centre for Disease Control and Prevention 2005) according to the IAQ variables from literature. The first section of the observation schedule focuses to the property information, while the second section gathered information on the living information. The variables were analysed and scored based on the fieldwork results. Analysing these data involved relating each question on the schedule with the principles of IAQ.

Participants replied to a standardised questionnaire on sociodemographic factors, and health and potential risk factors with few open-ended questions, designed by the researcher in accordance the European Community Health Survey questions for respiratory health and related risk factors (Castejon-Cervero MA, 2011). Overall, 15 questionnaires were administered to participants (aged 65–80 years). The structured questionnaires were used to deduce the rating of user's satisfaction on the variable. The demographic characteristics of the participants of the survey are shown in Table 1.

Table 1: The Demographic characteristics of study population

Characteristics	N=15
Gender	
Female	11
Age	3
65-69	3
70-74	7
75-79	3
80-84	2
85+	0
Marital status	
Married	11
Widowed	4
Divorced	0
Others	0
Time of residence	
Less than 1 year	0
Between 1 and 5 years	5
More than 5 years	10

Source: Fieldwork (2019)

4.0. RESULTS AND DISCUSSION

In this section, first the scores of the different parts of older adult's apartment in old people's home (based on the checklist analysis) are reported, and second, the results of the survey are described. The survey analysis evaluates the resident's indoor air quality based on their perceived health symptoms and the building design as in the literature.

4.1. Design Considerations/Variables for Indoor Air Quality in the Residential facility.

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The various ways in which these considerations can be experienced in the facility are natural lighting interiors spaces, natural ventilation in interior spaces, shading devices and a therapeutic environment.

4.1.1 Natural lighting in interiors spaces

In the facility visited, various types of natural lighting media were available. Windows and courtyard were the most common media. Figure 4.2 gives an illustration of the most common media used for admitting light to the interior spaces.

4.2.2 Natural ventilation in interiors spaces of hospitals

The relevance of natural ventilation in the senior's apartment spaces is seen in provision of indoor thermal comfort and a decrease energy consumption of air condition devices in the buildings. The window and courtyard admits air into the building. Figure 4.2 highlights the media of natural ventilation in a chart form.

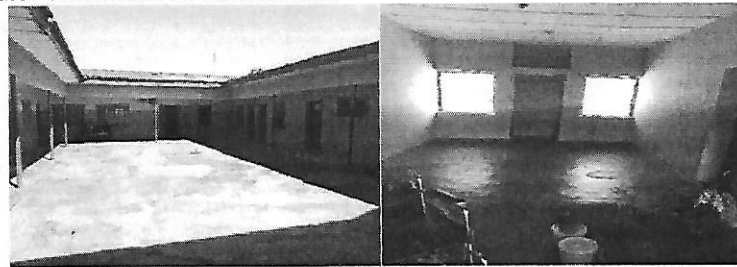


Plate I & II: Courtyard (*right*) and window (*left*) as medium for lightning and ventilation.

The windows are cross ventilated with sizes, 1800 x 1500 mm in the bedrooms and 1800 x 2400mm in the Lounge. Air vents and clerestory windows are not used as they are not very common in Nigeria as seen from previous studies.

4.2.3. Shading devices: The type of shading devices in the facility were vertical fins anchored to the skin of the building obstructing direct sunlight and glare.

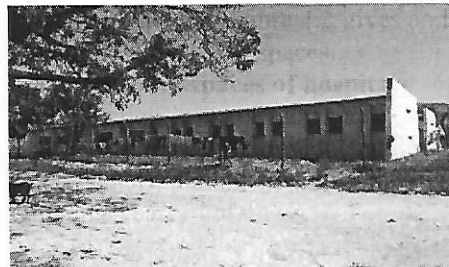


Plate III: Vertical fins serving as shading device

4.2.4 Landscape and biodiversity.

Biodiversity is the combination of varieties of species whether plant or animal on land and water to form an assorted environment which helps in balancing atmospheric gases, water quality, provision of variety of fruits, provision of spices and herbs to aid the healing process.

i. Outdoor landscaping.

Observation shows that biodiversity and landscape configuration were not put into proper consideration in the planning of the facility as seen in plate IV&V, only trees as the biodiversity component of the environment was found. Therefore, it is very relevant to integrate biodiversity and landscape configuration in the facility for the purification and filtration of the environs, releasing moistures and preventing dryness, to curtail stress and depression to the elders, decrease pain, boost up patient contentment and in addition to improve staff work productivity.

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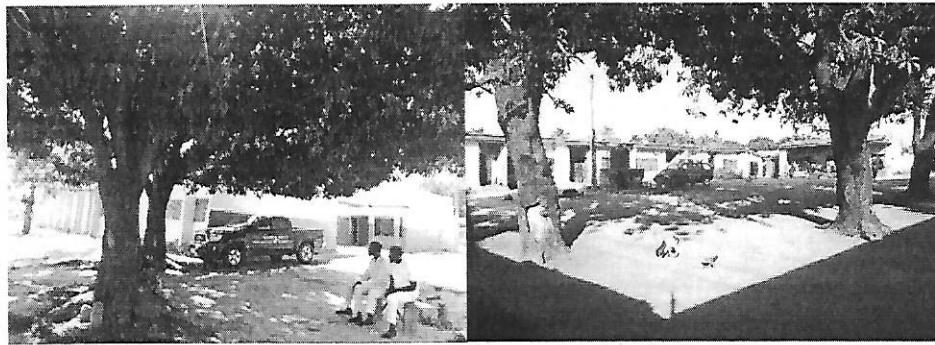


Plate IV & V: Trees provided as the only landscape element on the outdoor of the building
Source: Fieldwork (2019)

ii. Indoor landscaping: Indoor landscape plays a very important role in communicating the relevance of indoor air quality, they are achieved when natural elements such as plants, water, reliefs and geological formations are incorporated in the indoor spaces of a residential premises. Indoor landscape stimulates good emotions and instigates a pleasant psychological state of mind. Stress reduction and progress in clinical outcomes emphasises its relevance in the residence for the elderly. In the facility visited, there are no measures for indoor landscape.

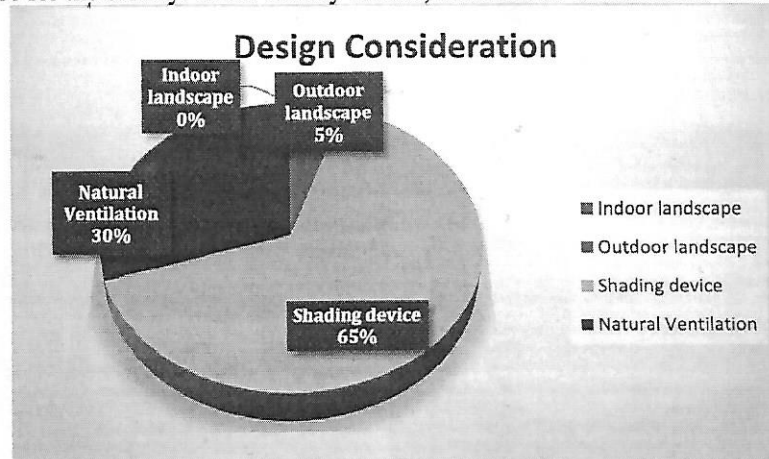


Figure 4.2.4: Design Consideration for Indoor air quality
Source: Fieldwork (2014)

4.2. Respiratory Symptoms

Household Characteristics and Occupant Activities were associated with Respiratory Health among the senior adult in the study. According to the Poisson regression analysis, to have higher prevalence of cough, running nose, allergies, wheeze, shortness of breath and chest pain. House characteristics that made a significant contribution to these respiratory symptoms included biomass fuel, cooking, source of lighting, floor and wall coverings.

Respiratory health among Seniors: Senior participants reported at least one respiratory symptom and the most common respiratory symptom was cough (40%), followed by runny nose (20%), chest pain (10%), skin allergies (10%) and other symptoms (15%), there were no report of wheeze (Table 3).

Table 2: Housing Design

CHARACTERISTICS	TYPE
Number of rooms	36
Number of Residents	21
Smoking/Alcohol	-
Floor material	Concrete
Wall material	Block
Roof material	POP
Kitchen location	Outside
Source of Electricity	Electricity

Source: Fieldwork (2019)

Table 3: Respiratory symptoms

CLASSIFICATION	RESPONDENTS (%)
Respiratory symptoms	
Cough	40
Runny nose	20
Chest pain	10
Skin irritation	10
Other Symptoms	
No Symptoms	5

Source: Fieldwork (2019)

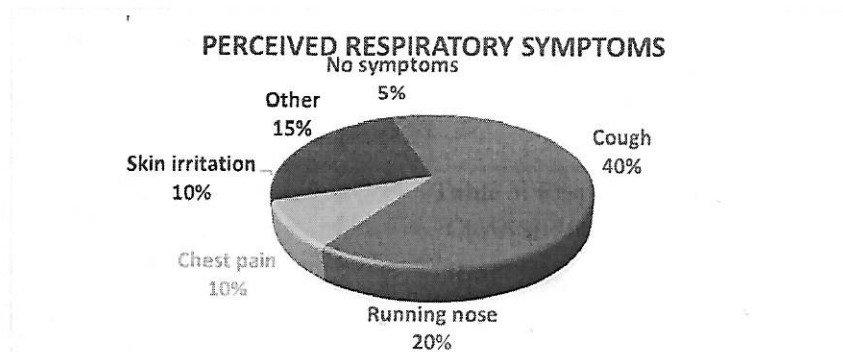


Figure 4.2: Perceived respiratory symptoms

Source: Fieldwork (2019)

5.0. CONCLUSION/ RECOMMENDATION

The study demonstrates association between certain building characteristics (i.e. the building orientation, wall and floor materials, housing type and number of rooms) as potential risk factors for certain diseases. It suggests that the state and condition of the geriatric facility as regards indoor air quality is generally not satisfactory. This is due to a significantly low level of attention paid toward organic IAQ design consideration, basically, lighting therapeutic views, biodiversity and landscape element. It is therefore important that government through the management of facilities for geriatric care, provide space with adequate integration of natural elements in and around the environment, to meet the aspirations of the users because the nature of environment a patient is exposed is expected to have an effect on the prevention of illness and aid recovery process. Intervention studies have proved that poor indoor air quality for the elderly can be improved significantly by using different strategies; including,

- Improved ventilation such as installing chimneys and smoke hoods
- Enlarged windows (Awning windows) should be used as a window type, 1800mm x 1800mm should be adopted as a minimum standard for window design.

- Landscape configurations should be in existence. Such as healing gardens, therapeutic gardens, viewing gardens, edible gardens, roof garden, vertical gardens and indoor plant as in reviewed literatures.
- Horizontal and vertical fins should be well design as part of the building form to serve as shading devices.

REFERENCE.

- Abbas, M. Y., & Ghazali, R. (2012). Healing Environment: Paediatric Wards, Status and Design Trend, *Procedia - Social and Behavioural Sciences*, 49, 28–38.
- Befring, E. (1994). *Laering og skole: Vilkar for eit verdig liv [Learning and school: Conditions for a dignified life]*. Oslo, Norway: Det Norske Samlaget
- Bentayeb M, Simoni M, Baiz N. (2012) Geriatric study in Europe on health effects of air quality in nursing homes group. Adverse respiratory effects of outdoor air pollution in the elderly. *Int JTuberc Lung Dis.*;16(9):1149–1161.
- Bentayeb M, Norback D, Bednarek M, et al. (2015) GERIE study. Indoor air quality, ventilation and respiratory health in elderly residents living in nursing homes in Europe. *Eur Respir J.*;45(5):1228–1238.
- Castejon-Cervero, M. A., Jimenez-Parras, R., Fernandez-Arias, I., et al. (2011). Evaluation of compliance with the EGS guidelines in Spain, using Achievable Benchmarks of Care (ABC(R)) methodology: the IMCA Study. *European Journal of Ophthalmology*, 21(2), 149–155.
- Centers for Disease Control and Prevention. Update on CDC's response to Hurricane Katrina [Internet]. Atlanta (GA): Centers for Disease Control and Prevention; 2005 Sep 19. Available from: URL: <http://www.cdc.gov/od/katrina/09-19-05.htm>.
- CIEE, (1997). *Tips for Daylighting with Windows*. 1st ed. [ebook] Available at: http://windows.lbl.gov/pub/design_guide/section5.pdf. Retrieved 20TH September, 2018.
- Ephraim-Emmanuel BC, Dotimi DA, Apiakise EW, Arogo A, Diekedie A, Abali EW. (2015) Traditional remedies used in the treatment of dental ailments: a case study of Otakeme community in Bayelsa state. *Point J Med Med Res.*;1(2):036-041.
- European Commission. 2009 ageing report: economic and budgetary projections for the EU-27 member states (2008–2060). Luxembourg: Office for Official Publications of the European Communities; 2009.
- Filleu L, Le Tertre A, Baldi I, et al. (2004) Difference in the relation between daily mortality and air pollution among elderly and all-ages populations in South Western France. *Environ Res.*
- Fraga S, Ramos E, Martins A, et al. (2008) Indoor air quality and respiratory symptoms in Porto schools. *Rev Port Pneumol*; 14: 487–507.
- Ghiaus, C., Iordache, V., Allard F. and Blondeau, P. (2005). Outdoor-indoor pollutant transfer. International Conference “Passive and Low Energy Cooling for the Built Environment”, May 2005, Santorini, Greece. 2, 3-4
- Huelat, B. J. (2008). The Wisdom of Biophilia-Nature in Healing Environments. *Journal of Green Building*, 3 (3), 23-35.
- Joseph B. Kinanee (2015) An Evaluation of the Government Free Medical Programme For The Elderly In Nigeria: Implications For Geriatric Care
- J Pharm Bioallied Sci.* (2011) Oct-Dec; 3(4): 470–478. doi: [10.4103/0975-7406.90100](https://doi.org/10.4103/0975-7406.90100)
- McGarigal, K. (2017.). What is landscape? [Online] Available at: http://www.umass.edu/landeco/teaching/landscape_ecology/schedule/chapter3_landscape.pdf.
- Migliaretti G, Dalmaso P, Gregori D. (2007) Air pollution effects on the respiratory health of the resident adult population in Turin, Italy. *Int J Environ Health Res*; 17: 369–379.

- Minna Master Plan (1979): The Capital City of Niger State. Town Planning Division, Ministry of Housing and Environment, Niger State. – Final Report. Prepared by Max Lock Group, Nig. Ltd. <https://wedc-knowledge.lboro.ac.uk/details.html?id = 8324>.
- Molthrop, E. (2011). Biophilic Design; A Review of Principle and Practice. [Online] Available at: http://dujs.dartmouth.edu/wp-content/uploads/2011/06/11s_final-37-39.pdf.
- Mudiare PE. Abuse of the aged in Nigeria: elders also cry. *American International Journal of Contemporary Research*. 2013 Sep; 3(9):79-87.
- Simoni M, Jaakkola MS, Carrozzi L. (2003) Indoor air pollution and respiratory health in the elderly. *Eur Respir J*; 21 (40):15s–20s.
- Stabat, P., Caciolo, M. and Marchio, D. (2012) Progress on single-sided ventilation techniques for buildings, *Advances in Building Energy Research*, 6 (2), 212-241.
- Tomasi, C.; Vitake, V.; De Santis, L.V. (1998). "Relative optical mass functions for air, water vapour, ozone and nitrogen dioxide in atmospheric models presenting different latitudinal and seasonal conditions". *Meteorology and Atmospheric Physics*. 65 (1): 11–30.
- Ulrich, R. S., Zimring, C., Zhu, X., DuBose, J., Seo, H., Choi, Y., Quan, X., & Joseph, (2008). A review of the research literature on evidence-based healthcare design (part I). *Health Environments Research and Design*, 1, 61–125.
- United Nations, Department of Economic and Social Affairs, Population Division. World population ageing 1950-2050 [Internet]. New York: United Nations; 2002 [cited 2016 Aug 31]. <http://www.un.org/esa/population/publications/worldageing19502050>
- Viegi G, Maio S, Simoni M, et al. (2009) The epidemiological link between ageing and respiratory diseases. In: Bellia, Incalzi R. *Respiratory Diseases in Elderly*. ERS Monogr; 43: 1–17.
- WHO Global InfoBase Team. The SuRF report 2. Surveillance of chronic disease risk factors: country-level data and comparable estimates. Geneva, World Health Organization, 2005.
- Zikmund, W.G. (2003), "Business Research Method", 7th edn., Cengage Learning, India.