INTERNATIONAL JOUNAL OF: BUILT ENVIRONMENT AND EARTH SCIENCE

TIMBOU-AFRICA ACADEMIC PUBLICATIONS
INTERNATIONAL JOURNAL, NOVEMBER, 2022 EDITIONS
VOL. 11 NO. 4 ISSN: 1881-2167

INVESTIGATING THE IMPLICATION OF POOR VENTILATION ON HEALTH CONDITION OF INFORMAL-SETTLEMENT RESIDENTS: A CASE STUDY OF LUGBE, ABUJA.

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ABSTRACT

The formal settlement areas of cities in Nigeria are always infiltrated by informal settlers because of provision of services to the inhabitants of the formal settlement areas. All over the world, including Nigeria, all the major cities are over populated, faced with inadequate housing, buildings in disrepair, traffic jams, bad roads, pressure on infrastructure, etc. To further compound matters, pollution worsens the living conditions of slum residents. Waste dump sites, open incinerators, power generators, vehicle emissions and fossil fuel burning serve as air pollutants that greatly effect slum residents. This means that these residents

Introduction

Over the past twenty years, indoor air quality has received much attention being a development of indoor air pollution. Many complaints of health impacts in relation to indoor air pollution arise and the causes of these complaints are often not identified, despite thorough measurements of indoor air in modernized as well as urbanized residential buildings. To some extent, these complaints have been blamed on energy-efficiency measures, but more on the built environment.

So, the resulting poor living conditions highlight the interconnectivity of the structure of the buildings in a settlements, population crescendos and the environment. That is, there is a direct relationship between the structure of the buildings, the immediate environment and the quality of life of the residents in such areas (De Sherbinin et al., 2007). For instance, an overcrowded space places an extra drain on already limited resources, and will have future consequences. Like Harte (2007) asserts, such consequences will create a degradation of natural ecosystems, the inability to maintain renewable resources and ecosystem services. The degradation could affect the provision of clean water and air, the conservation and regeneration of fertile soil, and the control of floods to mention a few (Harte, 2007). This degradation of the environment is more pronounced in informal settlements.

This study was focused on measures of adequacy of the building structural quality, emphasizing access to natural ventilation for

good indoor air quality. Currently, more than half of the urban population across all of Africa lives in urban informal settlement, and by the year 2050, there is a projected increase from 400 million to 1.2 billion urban dwellers (UN Habitat, 2016). In urban megacities such as Lagos, congestion is already a problem. Huchzermeyer and Karam (2006) note that the formation and continuity of informal settlement vary greatly in size and location. The reason why people prefer informal area, and the way informal settlements are formed need to be understood during upgrading intervention in a particular area. Poor residents who live in informal areas are faced with substandard living conditions, which will only worsen as more migrants settle into these areas

Ventilation is a key concern based on the evolving construction pattern of these residences. Most residences have one or two small windows in the front and back of the house, but may lack windows on the side (Abel, 2014). This means that some of the bedrooms may not have windows at two sides; thus, attributing to the poor ventilation of air inside the house. Figure 1 and figure 2 provides a good view of the lack of windows on the side of a dwelling, and a small window toward the back of the room. Most of the windows are often obstructed by screens or iron bars. The screens may be in place to prevent insects, while the bars may be in place to prevent burglaries.

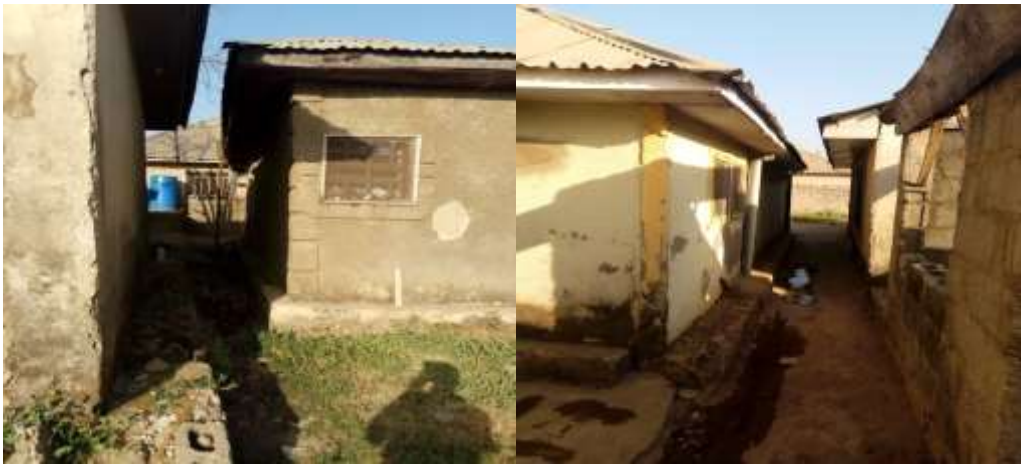

Figure 2: Showing poor environment and nearness of the buildings

The United Nations Human Settlements Programme (UN-Habitat, 2010) has stated that about 80 million Nigerians, representing 79 per cent of the population, are living in slum caused by informal settlements in most states of Nigeria. In Abuja, the capital city of Nigeria and like other urban environment in Nigeria, the growth of informal settlements has largely been as a result of inadequate and non-affordable housing for all classes of the citizenry. Similarly, other things like the challenge of securing land tenure for the teeming populace, the high cost of building materials, inaccessible mortgage mechanisms for the poor as well as the high rents of urban accommodation has been responsible for many of the city's suburban slums.

In the case of Lugbe community in Abuja, overcrowding has led to poor living conditions, which has negatively impacted the environment. Using the five-point framework postulated by the UN Habitat (2015), which include: 1) no or limited access to improved water; 2) no or limited access to improved sanitation facilities; 3) insufficient living space; 4) inadequate structural

quality or durability; and 5) security of living tenure, Lugbe is considered an informal settlement with poor living condition.

These settlements consist of poorly built shanties and houses without proper sewage management, constant electricity, waste disposal and running water. Bad road, inefficient waste collection and management have contributed immensely to poor air quality of the environment through bad odour generated from dump ground around and dust from the bad road. For the fact that majority of these houses are illegally constructed and are not in accordance with the state master plan, they lack proper planning and do not follows any building regulation. As a result, most units lack adequate ventilation, limited natural lighting, sanitary, water supply and privacy, which are the basic social amenities of life due to lack of breathing spaces between buildings. So, the inhabitant in this area are daily exposed to environmental hazard and poisonous polluted air that evidently have degenerated their healthy living.

This situation is not bearable and can only be improved if changes are made as soon as possible. This change cannot be visible without research based evidence of the living condition of the people in slum areas such as Lugbe that highlight the areas where urban renewal and proper integration of the slum dweller can take place. This study explored the physical characteristics of the houses in the study area in terms of its adequacy in opening and building setbacks for proper ventilation to ascertain the factors contributing to indoor air pollution and health hazard symptoms common to the residents in the study area. The physical boundary of this study is limited to natural ventilation study of the residences in informal settlement areas in Nigeria. Being unrealistic to study all the informal settlement areas in Nigeria, and study has shown that the characteristics of this kind of settlement is similar, the study was delimited to Lugbe satellite metropolis in Abuja.

The Study Area

Abuja is the capital city of Nigeria. It is located in the centre of Nigeria, within the Federal Capital Territory (FCT). Abuja is a planned city, and was built mainly in the 1980s. It officially became Nigeria's capital on 12 December 1991, replacing Lagos. At the 2006 census, the city of Abuja had a population of 776,298. Abuja, (www.wikipedia.com). According to the CIA World Fact book (2012), the population of Abuja as of 2009 was 1.857 million and continues to increase annually.

Lugbe is one of the popular suburban settlements in Abuja. It is in the Abuja Municipal Area Council (AMAC). It is largely residential and densely populated. Lugbe is about 17 minutes' drive from the Central Business District of Abuja and 13 minutes' drive to the Abuja Airport. It is along the airport road. Lugbe is divided into five districts namely Lugbe south, Lugbe north, Lugbe central, Lugbe west, Lugbe east. Though Lugbe is not in the Federal Capital City (FCC), its proximity to the city centre and also to the Abuja airport has brought it into lime light and attracted significant development to the area. The need for better planned housing in the city, led to this district being absorbed into a newly created phase 5 of the Federal Capital City (FCC) Abuja.

Several learning, social and business activities take place in and around Lugbe. These activities have risen in line with the growing population of the neighbourhood. The recent opening of the Novare Gateway Mall has made the area a destination for shopping and leisure. Other places of interest include Voice of Nigeria Transmission Station (VON), Nigerian Biotechnology Agency (NABDA) and National Space Research and Development Agency (NARSDA).

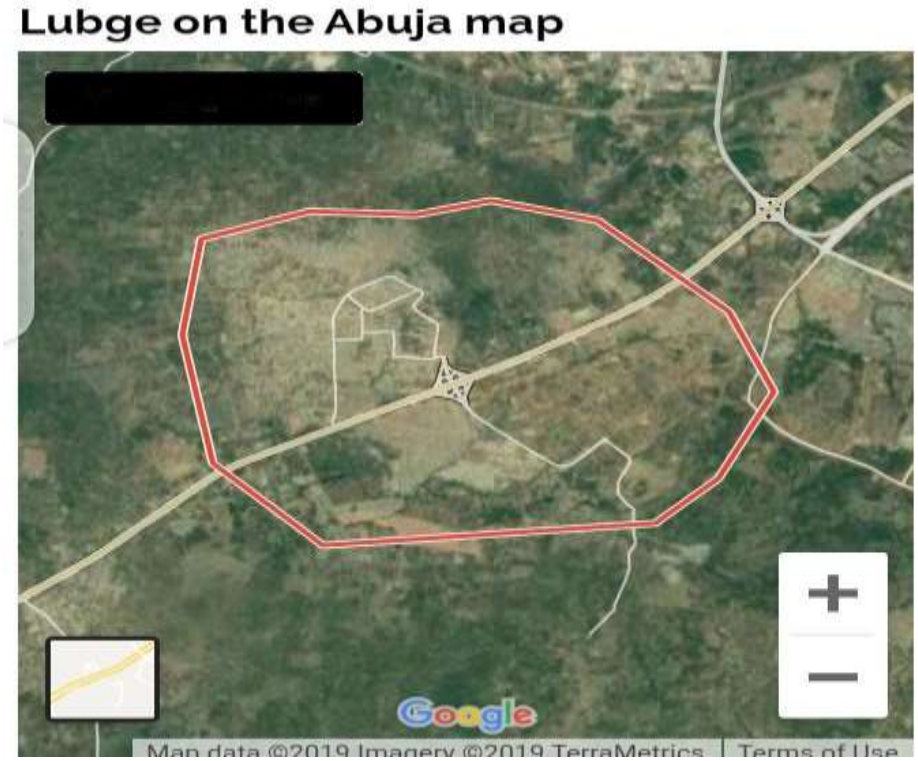

Figure 2: Map of Lugbe. https://www.google.ca/maps/place/Lugbe+Boundary (2019)

The Lugbe Area just like most other area councils in Abuja consists of the planned areas and the unplanned areas. The nature and structure of housing pattern in the planned areas differ from those of the unplanned area (Jackson, 2010). This also goes down to reveal the standards of living of people living in both places (Jackson, 2010). Poor housing condition which resulted from the influx of people leading to overcrowding and pressure on the existing infrastructure and amenities has resulted to detrimental consequences such as outbreak of diseases, lack of comfort and deterioration of infrastructures among others (Lucas, 2011).

Lucas (2011) also stated that the cities have continued to experience the influx of people because of the concentrations of economic and social activities and infrastructures in the cities as well as the pressure and expectation of gainful employment by people from rural areas. The rate of urbanization and the resultant effects such as housing shortage, overcrowding congestion, high occupancy rate and the over stretching of existing facilities in such areas has forced both high and low income earners to settle at the periphery of cities where they can get access to land for building construction. The deplorable condition of the housing environment in the inner core of the cities has also motivated people to move out to the suburbs. This they do hoping to acquire some form of decent housing of their own. High cost of accommodation has also propelled some people to move to the suburb and build their own houses even though the houses neither meet up to standard nor adhere to building regulation and housing policies (Yusuf, 2012).

Methodology

The primary data was sourced through the use of a questionnaire administered to the residents in the selected study area. Furthermore, the study utilised relevant text and publications on the subject matter; which form the background of the study. A substantial information was

obtained from the well-focused housing, human psychology, human behavioural pattern and environment related journals, seminar papers, and research monographs from reputable publish houses and library in order to obtain sufficient materials for literature review.

All the residents' in the informal settlement at the satellite sites around Abuja metropolis constituted the general sampling frame for the study. The residents of Lugbe community was selected for this study where a random sample was systematically selected for the study.

Since the focus of the study is on household, the sample size (n) was calculated in terms of the number of households that must be selected referencing the equation for such calculation by Turner (2003) and Kothari (2012). Using research sample based on stratified sampling design, a total of 140 households were therefore randomly selected and surveyed in the study area. One in every ten (10) houses on the street was chosen as cases to be studied. The questionnaires were administered on the heads of the households, and where the head is not available, the wife serves as the respondents. A total of 100 questionnaires were returned and used for analysis. The sampled can be said to be adequate since it sums up as 71% of the questionnaires administered.

The instrument was used to elicit data on vital research factors highlighted in the objectives. The questionnaire consists of 30 variables in question format, coined succinctly in short and simple form, thereby avoiding ambiguities. The data collected from the respondents were subjected to both descriptive and inferential statistics. The descriptive statistics was used to show the frequency and percentile distribution of the results from the study. In utilising inferential statistics, a simple regression analysis was used to demonstrate whether or not there are significant relationship between indoor space condition, change in season and preference of environmental change, and the factors that contributes to the air quality of the indoor environment.

Findings and Discussion

This study was proposed to investigate the implication of poor ventilation on the health condition of the residents in the informal settlement of Lugbe satellite town in Abuja. Poor ventilation is one of the leading consequent of informal settlement and is known for its haphazard and unruly construction pattern. The objectives set to achieve the purpose of this aim cut across understanding why the respondents choose to live in an informal settlement and the effect of their choice of living environment on their health.

Findings

From Table 1, it can be seen that majority of the respondents (80.4%) are in the working categories of age bracket 30years to 60years, in which 56% are female. The health hazard symptoms prevalent in the study area due to the condition of the indoor environment is dizziness (47.3%), closely followed by eye irritation (21.4%). Furthermore, the table also show that this symptoms are felt mostly in every designed spaces of the indoor environment (41%), and worse rather at night (57.1%) than day (32.1%). Similarly, the table shows that the symptom is revealed during summer (25%), more persisting during winter (28.6%) and worse in monsoon season (35.7%).

To measure the choice of housing location of the respondents to their daily business activities, they were asked about the factors responsible for their choice of residence location. When asked, about 35% stated that the area is closer to their place of work, 18% stated that they own the house they are living in. also, 17.9% stated that the place is far from their place of work but

cheaper to live while less than 10% said the environment feel homely to them. In table 2, we went further to inquire about the spacing between buildings in the settlement under study. This is required to objectively assess the level of design consideration for proper airflow through building interiors. The respondent were asked to define the space between buildings using elements of measure familiar to them such as human size, motorcycle, and car. It can be seen in table 2 that 45.5% stated that buildings are built close to each other without any define space. However, in some other cases, about 27.7% posits that the space between their buildings to the next building is up to 600mm (motorcycle); while only 9% stated that the building space in their area is up to 1200mm (Tricycle).

Table 1: Demographic condition of the respondents in the study area

S/N	Variables	Frequency	Percent
1	**Age**		
	18-30	22	19.6
	31-40	52	46.4
	41-50	22	19.6
	51-60	4	3.6
2	**Sex**		
	Male	29	25.9
	Female	62	55.4
3	**Health Hazard symptoms**		
	No symptoms	17	15.2
	Dizziness	53	47.3
	Eye irritation	24	21.4
	Respiratory	6	5.4
4	**Room of symptoms occurrence**		
	Kitchen	17	15.2
	Every Area	46	41.1
	Bed Rooms	25	22.3
	Overcrowded Room	12	10.7
5	**Time of occurrence**		
	Day	36	32.1
	Night	64	57.1
6	**Season of occurrence**		
	Summer	28	25.0
	monsoon	40	35.7
	Winter	32	28.6
7	**Afterleavingtheroom**		
	Yes	38	33.9
	No	62	55.4
8	**Why you prefer to stay in the residence**		
	I built it	21	18.8
	it is closer to my place of work	39	34.8
	it is far from my place of work but cheaper	20	17.9

	the environment is more homely for me	10	8.9

The respondents were further asked about where they would like an effective change in their environment. As a result, emphases of the respondents were laid on good road (26.8%), health care centre (26.8%) and street light (17.9%) according to table 2. The study went further to find the relationship between the design quality (in terms of spacing for proper ventilation of buildings) and the respondent's preference of change in their environment. The result in table 3 shows that the factor loading only explain 28.7% (R-square = 0.287) of the relationship. However, the results show a significant relationship within and between the variables at 95% confidential level.

Table 2: effect of design quality on changes in environment required by the respondents

s/n	Variables	Frequency	Percentage
1	**How close neighbour house to window**		
	No space in between	51	45.5
	wide enough for only human to pass (600mm wide)	30	27.7
	wide enough for keke napep to pass (1200mm wide)	10	8.9
2	**Situation that you like to change**		
	Good road	30	26.8
	Health care centre	30	26.8
	Street Light	20	17.9
	Security	10	8.9
	Transportation	10	8.9

Table 3: relationship between design quality and changes in environment required by the respondents

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.					
		B	Std. Error	Beta			R Square Change	F Change	df1	df2	Sig. F Change
1	(Constant)	5.427	.442		12.290	.000	.287	39.446	1	98	.000
	Situation that you like to change	-1.020	.162	-.536	-6.281	.000					

Similarly, this study was designed to understand the factors responsible for poor indoor air quality. Mean ranking was used to rank the factors according to their influence on the indoor air quality. As shown in table 4, dust in the indoor environment ranked first (mean score = 2.0), availability of fury pets indoor ranked second (mean score = 1.8), while New home, new

construction and lamp based fuel ranked third respectively (mean score = 1.7). Also, use of local stove/oven and odour from the environment ranked fourth and fifth respectively.

Table 4: Environmental factor affecting the air quality of an indoor environment

	Yes		No		Mean value	Mean ranking
	Freq.	%	Freq.	%		
New home	34	30.4	66	58.9	1.7	3rd
New construction	31	27.7	69	61.9	1.7	3rd
smoker	69	61.6	31	27.7	1.3	6th
Change of weather	71	63.4	29	25.9	1.3	6th
New carpeting	74	66.1	26	23.2	1.3	6th
Old carpeting	79	70.5	21	18.8	1.2	7th
Addition of fume emitting gadget	76	67.9	23	20.5	1.2	7th
New hobby using chemical based substance	83	74.1	17	15.2	1.2	7th
Use of pest/plant control chemicals	76	67.9	24	21.4	1.2	7th
Use of insect repellent	89	79.5	11	9.8	1.1	8th
Odour from environmental dumps	63	56.3	37	33	1.4	5th
Use of body spray	89	79.5	11	9.8	1.1	8th
Attached garage	89	79.5	11	9.8	1.1	8th
Use of local stove/oven	40	35.7	60	53.6	1.6	4th
Dust in home	99	88.4	1	0.9	2.0	1st
Availability of fury pets indoor	20	17.9	80	71.4	1.8	2nd
Lamp base fuel	29	25.9	71	63.4	1.7	3rd

Furthermore, the study looked at the relationship between the factors affecting the air quality of the indoor environment and respondents' perception of their indoor space conditions. The model summary shows that the factors loaded represent only 19.6% relationship (R-square = 0.196), and that there is no significant relationship between the perception of room condition and the factors affecting the air quality of the indoor environment in the study area (r = 0.526). However, when each variables in the factors affecting the air quality of an indoor environment was assessed, the condition of indoor environment show strong relationship with only lamp that uses fuel (r = 0.049).

Similarly, the study looked at the relationship between the factors affecting the air quality of the indoor environment and change of seasons in the study area. The model summary in table 6 shows that the factors loaded represent 48.5% relationship (R-square = 0.485), and that there is a significant relationship between change in season and the factors affecting the air quality of the indoor environment in the study area. However, when each variables in the factors affecting the air quality of an indoor environment was assessed, the change in season show significant correlation with cleaning product used in the interior (r = 0.033) and attachment of garage (r = 0.013). This shows that the effect is in the collective of all factors that impede the air quality of the indoor environment.

Table 5: Relationship between room condition and factors contributing to poor indoor air quality

Model		Unstandard Coefficients		Standard Coefficients	t	Sig.	Model Summary				
		B	Std. Error	Beta			R Square Change	F Change	df1	df2	Sig. F Change
1	(Constant)	-.444	6.282		-.071	.944	.196	.952	20	78	.526
	New home	.967	.727	.512	1.329	.188					
	Newconstruction	-.896	.716	-.463	-1.251	.215					
	newsmoker	.684	1.083	.350	.631	.530					
	changedweather	-.286	.918	-.144	-.312	.756					
	newcarpeting	.269	.674	.130	.399	.691					
	oldcarpeting	.458	.789	.205	.580	.563					
	Additiongas	-.651	.954	-.307	-.683	.497					
	newhobby	.232	.885	.095	.262	.794					
	Use pesticide	-.576	.566	-.275	-1.019	.311					
	Use insecticide	2.990	1.907	1.048	1.568	.121					
	Environ odour	-.143	.199	-.077	-.721	.473					
	Garage	-1.665	1.363	-.559	-1.221	.226					
	Local stove	-.216	.834	-.118	-.259	.796					
	furypetsindoor	1.397	1.256	.613	1.112	.270					
	lampbases	-1.231	.614	-.625	-2.004	.049					

Table 6: Relationship between change in season and factors contributing to poor indoor air quality

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Model summary				
		B	Std. Error	Beta			R Square Change	F Change	df1	df2	Sig. F Change
1	(Constant)	.231	4.325		.054	.957	.485	3.673	20	78	.000
	New home	.607	.501	.374	1.213	.229					
	Newconstruction	-.451	.493	-.271	-.914	.363					
	newsmoker	-.137	.746	-.082	-.184	.854					
	Changedweather	.213	.632	.125	.338	.736					
	newcarpeting	-.207	.464	-.116	-.446	.657					
	oldcarpeting	.120	.543	.063	.222	.825					
	Additiongas	-.199	.657	-.109	-.302	.763					
	newhobby	-.037	.609	-.018	-.061	.951					
	Use pesticide	.144	.389	.080	.369	.713					
	Use insecticide	1.512	1.313	.616	1.152	.253					

	Environ. odour	-.232	.137	-.145	-1.693	.094					
	cleaningproducts	.948	.437	1.213	2.166	.033					
	Garage	-2.382	.938	-.931	-2.539	.013					
	Local stove	-.577	.574	-.367	-1.006	.317					
	furypetsindoor	-.571	.865	-.292	-.661	.511					
	lampbases	-.069	.423	-.041	-.164	.870					

Also, the study looked at the relationship between the factors affecting the air quality of the indoor environment and respondents' preference of environmental change in the study area. The model summary in table 7 shows that the factors loaded represent 77.9% relationship (R-square = 0.779), and that there is a significant relationship between change in season and the factors affecting the air quality of the indoor environment in the study area. This shows that change in climatic season affects the air quality of an indoor environment. However, when the relationship of each variables in the factors affecting the air quality of an indoor environment was assessed, the change in season show significant correlation with cleaning product used in the interior (r = 0.000), fury pet in the indoor environment (r = 0.000) and lamp base fuel fume (r = 0.010). This shows that the effect is in the collective of all factors that impede the air quality of the indoor environment.

Table 7: Relationship between respondents' preference of environmental change and factors contributing to poor indoor air quality

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Model summary				
		B	Std. Error	Beta			R Square Change	F Change	df1	df2	Sig. F Change
1	(Constant)	-15.006	4.726		-3.175	.002	.779	13.738	20	78	.000
	New home	.396	.547	.146	.724	.471					
	Newconstruction	-.391	.539	-.141	-.726	.470					
	newsmoker	-.508	.815	-.181	-.623	.535					
	changeweather	.501	.690	.175	.726	.470					
	newcarpeting	-.603	.507	-.204	-1.191	.237					
	oldcarpeting	.523	.594	.163	.881	.381					
	Additiongas	.449	.718	.148	.626	.533					
	newhobby	-.458	.666	-.131	-.687	.494					
	Use pesticide	-.114	.425	-.038	-.268	.789					
	Use insecticide	.932	1.435	.228	.650	.518					
	Environ. odour	-.004	.150	-.001	-.026	.980					

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ISSN: 1881-2167

	cleaningproducts	2.182	.478	1.675	4.566	.000					
	Garage	.270	1.025	.063	.264	.793					
	Local stove	1.206	.627	.460	1.923	.058					
	furypetsindoor	5.559	.945	1.702	5.882	.000					
	lampbase	-1.218	.462	-.431	-2.635	.010					

Discussion

The findings of this case study support the findings of qualitative studies, highlighting the many factors that are attributed to Lugbe's informal conditions (Akinwale, 2013; Olajide 2010a; Agbola, 1997). Lugbe fails to meet the formal conditions put forth by the UN Habitat (2015). First, Lugbe has limited building space around, and the closeness of these building reduces the level at which natural ventilation is harnessed. Meanwhile, there are factors that causes pollution of air in the indoor environment that requires a better airflow for healthy living. Since the airflow is lacking in the interior, the accumulation of the bad air quality in the interior breed hazardous and contaminations that impede the healthy living of the inhabitants. Among these factors that pollutes the air quality of the indoor environment, as shown in this study, are dust that its level is determined by the quality of the environment, availability of fury pets indoor which is a result raising of high level dust, uncleanliness of a new home, a construction environment and fumes of a fuel base lamp. This study, therefore showed that the identified factors that affect the indoor air quality of the studied environment are the improper planning and design quality of the informal settlement; and this is prominent during dry season. The consequence is the impeding of the quality of airflow into the indoor environment, and the generated air pollution in the interior resulting in threat on the health of the inhabitants. This is evident as the study showed that there is a significant relationship between the design quality of the environment, the change between wet and dry season, preference of environmental change and the factors that affect the air quality of the indoor environment.

Secondly, there is insufficient living space both in the community and within the residences. The informal housing structures are built within close proximity to one another, leaving very little privacy from neighbours. Furthermore, within the bungalow housing, though design guidelines suggest one to two people should reside in a room, but in Lugbe, more than two people share a room. This leads to cramped quarters and degradation of housing quality and quality of life for residents. Lastly, the security of living tenure is questionable. Since the residents have built informal housing on public or private properties, the rightful land owners can evict the informal residents at any point in time.

CONCLUSION

Abuja in one of the world's megacities. Estimated at having over 5 million inhabitants, with an annual influx of 600,000 incoming migrants on an annual basis, the city is poised for a huge expansion by the year 2050. Most migrants arrive from rural areas with the hopes of finding riches and an improved way of living compared to their agricultural roots. However, they are often met with the realities of urban living. These realities include high rates of unemployment and rampant poverty. The inability to live in more prosperous areas of the city leaves migrants with no choice but to settle in informal areas, which are the basic reasons for the occupants of Lugbe community. These areas offer substandard living conditions, lead to numerous medical conditions, and entrap many residents in a culture of poverty that is hard to escape. The photographs and other information presented from this case study demonstrate the daily blight faced by residents of the Lugbe informal area. Residents live in substandard housing

conditions, which include overcrowding, shared toilets and kitchens, and refuse dispersed all over the common areas.

Overall, poor air quality is said to be responsible for a decrease in work performance, general feeling of poor health, reduced ability to concentrate, or illness (WHO, 2002). Consequently, of the living condition of the people in slum areas such as Lugbe that highlight the areas where urban renewal and proper integration of the slum dweller should be taken as priority in Nigeria. Therefore, this study suggests the need for an environmental analysis examining the urban physical quality, the use of environmental resources, waste management, pollution, landscaping and design features (Simon, Adegoke and Adewale, 2013). Examining the application to an individual urban area entails a city wide analysis, neighbourhood statistics, existing plan and policies, specified goals and aims, as well as future requirements. Opoko, Ibem, and Adeyemi (2015) suggest that in order to put urban regeneration plans into practice, a close partnership between the residents of informal settlements and the government needs to occur in order to address the infrastructure supply deficit in these areas. By enacting community-based partnerships, initiatives for upgrades will have the input of neighbourhood residents. Additionally, this study postulates that the investment in more single-family apartments and self-contained flats will satisfy the desires of residents who aspire to move from housing accommodations that are situated like rooming houses (Opoko, Ibem, and Adeyemi, 2015). Enhancing the living spaces can potentially improve the lives of the residents in these living spaces.

REFERENCES

Abel, A.A. (2014). Urban slum characteristics in the Niger Delta Region of Nigeria: Imperatives for improvement. *IOSR Journal of Humanities and Social Science* 19(10), 9-18. Retrieved from http://www.iosrjournals.org/iosr-jhss/papers/Vol19-issue10/Version-9/B0191090918.pdf

Adebayo, A.K., & Iweka, A.C. (2016). Households' ethnic background and crowding in public housing multifamily apartments in Lagos. *ATBU Journal of Environmental Technology* 9(2), 86-99.

Adewunmi, F. (2011). Nigeria's middle-class: How we live, and what we want from life. *How We Made it in Africa.* Retrieved from https://www.howwemadeitinafrica.com/nigerias-middle-class-how-we-live-and-what-we-want-from-life/12563/

Aggarwal, A. (2017). *Informal and formal settlements*. Retrieved from https://planningtank.com/dissertation/informal-formal-settlements-indian-context

Agbola, T. (1997). Lagos: A socio-economic profile of selected neighbourhoods. In *The architecture of fear: Urban design and construction response to urban violence in Lagos, Nigeria.* Institut francais de recherché en Afrique. Doi: 10.4000/books.ifra.498

Agha, E. (2016). In Badagry, deadly 'One Million Boys' gang reigns. *Daily Trust.* Retrieved from https://www.dailytrust.com.ng/news/feature/in-badagry-deadly-one-million-boys-gang-reigns/130327.html

Ajetumobi, R. (2015). *Pre-dynastic Lagosian: Habitat and theories of migration.* Retrieved from http://www.edoworld.net/PRE_DYNASTIC_LAGOSIANS.html

Akalne, O., & Adejare, G.S. (2017). Conceptualising megatcities and megaslums in Lagos, Nigeria. *Africa's Public Service Delivery and Performance Review* 5(1), 1-9. https://doi.org/10.4102/apsdpr.v5i1.155

Akinwale, O.P. et al. (2013). Living conditions and public health status in three urban slums of Lagos Nigeria. *South East Asia Journal of Public Health* 3(1), 36-41.

Aluko, O. E. (2010). The impact of urbanization on housing development: The Lagos experience, Nigeria. *Ethiopian Journal of Environmental Studies and Management*, 3(3), 64-76.

Amnesty International. (2018). *Nigeria: Deadly mass forced evictions make life misery for waterfront communities.* Retrieved from https://www.amnesty.org/en/latest/news/2017/11/nigeria-deadly-mass-forced-evictions-make-life-misery-for-waterfront-communities/

Asomba, I. (2013). Horrible link road: Ajegunle, on verge of isolation. *Vanguard.* Retrieved from https://www.vanguardngr.com/2013/05/horrible-link-road-ajegunle-on-verge-of-isolation/

Atuma, U. (2018) Ajegunle: Inside Nigeria's Jungle City. *The Sun.* Retrieved from http://sunnewsonline.com/ajegunle-inside-nigerias-jungle-city/

Ayovo, F., & Ugbede, K. (2015). Unemployment and crime rate in Nigeria: A nexus and Implications for national development. *World Academic Journal of Demography and Population Studies* 3(2), 41-47. Retrieved from www.worldacademicresearchjournals.org

Bartlett, S., Dodman, D., Hardoy, J., Satterhwaite, D., Tacoli, C. (2009). *Social aspects of climate change in urban areas in low and middle income nations.* Retrieved from http://siteresources.worldbank.org/INTURBANDEVELOPMENT/Resources/336387-1342044185050/8756911-1342044630817/V2Chap27.pdf

Baston, D.E. (2015). A first look: Disaster management challenges in Lagos, Nigeria. *HDIAC Journal* 2(3). Retrieved from https://www.hdiac.org/node/2394

Bobadoye, S.A., & Fakere, A.A. (2013). Slum prevalence in Nigeria: What role for architects? *World Environment* 3(2), 45-51.

Bosworth, B. (2016, June 14). South Africa has been key to putting informal settlements on the Habitat III agenda. *Citiscope News.* Retrieved from http://citiscope.org/habitatIII/news/2016/06/south-africa-has-been-key-putting-informal-settlements-habitat-iii-agenda

Center for Education Innovations. (2018). *Paradigm Initiative Nigeria.* Retrieved from https://educationinnovations.org/program/ajegunle-life

City Population. (2015). *Local government areas*. Retrieved from https://www.citypopulation.de/php/nigeria-metrolagos.php

de Shebinin, A., Carr, A., Cassels, S. D., & Jiang, L. (2007). Population and environment. *Annual Review of Environmental Resources, 32,* 345-373.

Ede, A., Adeyemi, K., & Joshua, O. (2015). Effects of climate change on built environment in Lagos, Nigeria. *International Journal of Engineering Technology and Computer Research* 3(2), 14-22.

Emordi, E.C., & Osiki, O.M. (2008). Lagos: the 'villagized' city. *Information, Society and Justice 21*, 95-109. doi: 10.3734/isj.2008.2107

Gandy, M. (2006). Planning, anti-planning and the infrastructure crisis facing metropolitan Lagos. *Urban Studies, 43*(2), 371-396.

Guzi, M., Kabina, K., & Tijdens, K.G. (2016). *Living wages in Nigeria—Lagos State.* Amsterdam: WageIndicator Foundation

Harte, J. (2007). Human population as a dynamic factor in environmental degradation. *Population and Environment 28,* 223-236. doi: 10.1007/s11111-007-0048-3

Hunter, L.M. (2000). *The environmental implications of population dynamics.* Santa Monica CA: Rand.

Huchzermeyer, M. & Karam, A. (2006). Informal settlements: A perpetual challenge? Cape town, South Africa: UCT Press

Ighobor, K. (2016). Lagos now wears a new look. *African Renewal.* Retrieved from https://www.un.org/africarenewal/sites/www.un.org.africarenewal/files/Africa_Renewal_EN_April_2016.pdf

Ilesanmi, A. O. (2012). Housing, neighborhood quality and quality of life in public housing in Lagos, Nigeria. *International Journal of Housing Science, 36*(4), 231-240.

Kazeem, Y. (2016). *Lagos is Africa's 7th largest economy and is about to get bigger with first oil finds.* Retrieved from https://qz.com/676819/lagos-is-africas-7th-largest-economy-and-is-about-to-get-bigger-with-its-first-oil-finds/

Komolafe, A.A., Adegboyega, S.A., Anifowose, Y.B., Akinluyi, F.O, Awoniran, D.R., (2014). Air pollution and climate change in Lagos, Nigeria: Needs for proactive approaches to risk management and adaptation. *American Journal of Environmental Sciences 10*(4), 412-423. doi:10.3844/ajessp.2014.412.423

Lagos Link. (2017). *Map of Lagos metropolitan area.* Retrieved from https://lagoslink.com/lagos-map-of-lagos-state/

Linard, C., Gilbert, M. Snow, R., Noor, A., & Tatem, A. (2012). Population distribution, settlement patterns and across Africa in 2010. *PLoS One, 7*(2), e31743. Retrieved from https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3283664/

MacKinnon, D.P. (2011). Integrating mediators and moderators in research design. *Research for Social Work Practice 21*(6), 675-681. doi: 10.1177/1049731511414148

Majale, M. (2002). *Towards pro-poor regulatory guidelines for urban upgrading: A review of papers presented at the international workshop on regulatory guidelines for urban upgrading at Bourton-on-Dunsmore.* Retrieved from https://assets.publishing.service.gov.uk/media/57a08d3c40f0b64974001734/R7850_Majale_RGUU1_Review.pdf

McMichael, A. (2000). The urban environment and health in a world of increasing globalization: Issues for developing countries. *Bulletin of the World Health Organization, 78*(9), 1117-1126.

Moody, J.B. (2011). Population is only part of the environmental impact equation. *The Conversation.* Retrieved from https://theconversation.com/population-is-only-part-of-the-environmental-impact-equation-4009

Morka, F.C. (2007). *A place to live: A case study of the Ijora-Badia community in Lagos, Nigeria.* Retrieved from http://www.unhabitat.org/grhs/2007

Mosenbergen, D. (2017). Nigeria's water bill could criminalize drinking water for millions. *Huffington Post.* Retrieved from https://www.huffingtonpost.com/entry/lagos-water-crisis-bill-nigeria_us_58c8b63ce4b01c029d7758b7

Oduwaye, L. (2009). Challenges of sustainable physical planning and development in Metropolitan Lagos. *Journal of Sustainable Development 2*(1), 159-172.

Ogunseli, T. (2015). Factsheet: Who owns the land in Nigeria? *Africa Check.* Retrieved from https://africacheck.org/factsheets/factsheet-who-owns-the-land-in-nigeria/

Olajide, O. (2010). *Urban poverty and environmental conditions in informal settlements of Ajegunle, Lagos Nigeria.* Available from http://www.academia.edu/17702597/Urban_Poverty_and_Environmental_Conditions_in_Informal_Settlements_of_Ajegunle_Lagos_Nigeria

Olajide, O. (2010a). Confronting the Lagos informal land use: Issues and challenges. *Real Corp* Retrieved from http://www.corp.at/archive/CORP2010_152.pdf

Olulade, P. (2016). Assessing the Lagos megacity selected slum settlements' housing and environmental conditions. *Journal of Multidisciplinary Engineering Science and Technology* 3(8), 5408-5416.

Olukoju, A. (2004). Nigerian cities in historical perspectives. In Toyin Falola and Steven J. Salm (Eds.), *Nigerian cities* (pp. 11-47). Trenton: Africa World Press.

Opoko, A.P., Ibem, E.O., & Adeyemi, E.A. (2015). Housing aspiration in an informal settlement: A case study. *Urbani izziv* 26(2), 117-132. doi: 10.5379/urbani-izziv-en-2015-26-02-003

Oteri, A.U., & Ayeni, R.A. (2016). The Lagos megacity. *Water, Megacities, and Global Change.*Retrieved from http://eaumega.org/wp-content/uploads/2016/05/EN-Lagos-Monograph.pdf

Piguet, E., Pecoud, A., & Guchteneire,P. (2011). *Migration and climate change.* New York: Cambridge University Press.

Population and Development Working Group. (2005). *Population dynamics and economic development: Elements of a research agenda.* Retrieved from https://www.hewlett.org/wp-content/uploads/2016/08/CGD_pop_ dynamics_and_econ_dev_elements_research_agenda.pdf

Rand Policy Brief. (2000). *Population and environment: A complex relationship.* Santa Monica, CA: Rand Distribution Services.

ResearchGate (2018). Map of Nigeria showing Lagos, the case study site. Retrieved from https://www.researchgate.net/figure/Map-of-Nigeria-showing-Lagos-the-case-study-site_fig1_272668687

Salami, R., von Meding, J., & Giggins, H. (2017). Urban settlements' vulnerability to flood risks in African cities: A conceptual framework. *JAMBA: Journal of Disaster Risk Studies* 9 (1). doi: 10.4102/jamna.v9i1.370

Sieff, K. (2017). The world is drowning in mounds of garbage. *The Washington Post.* Retrieved from https://www.washingtonpost.com/world/africa/the-world-is-drowning-in-ever-growing-mounds-of-garbage/2017/11/21/cf22e4bd-17a4-473c-89f8-873d48f968cd_story.html?noredirect=on&utm_term=.ff31ea4c0dc0

Simon, F.R., Adegoke, A.K. & Adewale, B.A. (2013). Slum settlements regeneration in Lagos Mega-city: An overview of a waterfront Makoko community. *International Journal of Education and Research* 1(3), 1-17.

Tshabalala, S. (2015). This Nigerian architect wants to turn Africa's water slums into floating cities. *Quartz.* Retrieved from https://qz.com/501383/this-nigerian-architect-wants-to-turn-africas-water-slums-into-floating-cities/

Ugochukwu, I.B., & Chioma, I.B. Local building materials: Affordable strategy for housing the urban poor in Nigeria. *Procedia Engineering 118*,42-49.
doi: 10.1016/j.proeng.2015.08.402

UN Habitat. (2015). *The City Prosperity Initiative.* Retrieved from https://unhabitat.org/wp-content/uploads/2016/02-old/CPI_2015%20Global%20City%20Report.compressed.pdf

UN Habitat. (2016). *Habitat III issue papers: Informal settlements.* Retrieved from https://unhabitat.org/wp-content/uploads/2015/04/Habitat-III-Issue-Paper-22_Informal-Settlements.pdf

UNICEF. (2012). *Reducing health disparities in Lagos State: An investment case.* Retrieved from https://www.unicef.org/health/files/Lagos_investment_case.pdf

UNW-DPAC. (n.d.). *Water and cities: Facts and figures.* Retrieved from http://www.un.org/waterforlifedecade/swm_cities_zaragoza_2010/pdf/facts_and_figures_long_final_eng.pdf

Water Aid. (2018). *Towards effective integration of nutrition and water, sanitation and hygiene.* Retrieved from https://washmatters.wateraid.org/

World Atlas. (2017). *15 Biggest cities in Africa.* Retrieved from http://www.worldatlas.com/articles/15-biggest-cities-in-africa.html

World Bank. (2013). *Population living in slums.* Retrieved from http://data.worldbank.org/indicator/EN.POP. SLUM.UR.ZS