Urbanization, Housing Quality and Health: Towards a Redirection for Housing Provision in Nigeria

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ABSTRACT

Nigeria's housing provision is perceived in terms of quantity with less attention to its quality and impact on people's health. The quality of indoor air in housing and its associated risks to human health was assessed in this paper to improve housing provision in Nigeria. Quantitative data collected from Bauchi, Nigeria includes household survey, housing characteristics, indoor carbon dioxide (CO_2) and particulate matter (PM2.5 and PM10). PM2.5 and PM10 recorded in the building were (63 $\mu m/m3$) and (228 $\mu m/m3$) and observed to be greater than safe values of 25 $\mu m/m3$ (PM2.5) and 50 $\mu m/m3$ (PM10) recommended by the World Health Organization (WHO). Some building features associated with some ailments were found to be risk factors. The study recommended a redirection for more quality housing provision. It concludes that housing characteristics should be targeted for public health interventions as a means of improving the quality of urban housing in Nigeria.

1. Introduction

Housing has become an important issue in meeting the challenges presented by global urbanization. In developing nations, particularly in Africa, the need for housing have repeatedly emerged and become so critical. This is most pronounced with Africa's population projected to reach over 700 million by 2030. African nations have over 4.5 percent yearly urbanization rate, which has resulted in a population explosion, resource constraint and shortage of houses. Consequently, in numerous

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African nations, access to safe, decent and affordable housing remains a challenge (UNEP, 2007). Currently, 72% of the urban population in Africa reside in slums with risks of diseases and insecurity. To meet the challenges of housing demand arising from the rapid urbanization, housing delivery should not be limited to quantity at the expense of quality in the provision of a healthy, safe, inexpensive and satisfactory shelter.

Population growth in most metropolitan urban communities in Nigeria has assumed a geometrical progression with such an impact on housing provision which its demand has become disproportionate in level. This extent of the housing shortage has become extensive with the deficit considered quantitatively and qualitatively. In 2019, the urban population rose to 51.2 percent, meanwhile over the last 50 years, it grew substantially from 17.8 to 51.2 percent and rose to a maximum of 3.19 percent in 1981 and then decreased to 1.61 percent in 2019. According to Aliyu and Amadu (2017), in the year 2011, the Nigeria housing deficit was estimated to be within the range of 12 and 16 million. This comes with the challenge of providing adequate housing for close to 200 million people. Consequently, most people live in substandard housing with the problem exacerbated by continuous urbanization making housing provision more demanding especially for the low-income groups.

Among the United Nations (1992) key strategies are to advance sustainability in the aspect of the development of human settlement through the provision of adequate housing for everyone. The implication of this agenda is the entitlement of everyone to reside in a quality house which assures a healthy, safe, secured, happy and comfortable life. According to Cattaneo et al. (2009), there is a correlation between housing quality and the health, satisfaction and happiness of the occupants. Thus, among the prominent criteria in quality housing provision should be occupant's health and well-being. In this context, Ranson (1991) asserted that healthy housing should not be viewed as staying away from sicknesses but rather to incorporate sufficient spaces to meet the occupants need for daily comfort. In light of these, attention should be given to ensure that housing delivery encompasses quality and health provision for the occupants.

2. Literature Review and Conceptual Framework

Several researchers (Guenther and Vittori, 2008; Li et al.,2007; and Arundel et al.,1986) have posited that adequate ventilation should be central in designing buildings to lessen the possibility of transmitting infectious diseases. Similarly, other researchers (Ulrich et al., 2008) have also underscored that buildings should be designed to lessen occupants' exposure to risks of diseases. Such risks, according to the Institute of Medicine (2011) include sick building syndrome and other risks which could arise from the occupants becoming exposed to pollutants found indoors. Despite the growing body of knowledge linking architecture and human health, residential housing is still associated with significant health hazards. The DHHS (2009) and Jacobs (2011) defined healthy housing as built and maintained apartments and their immediate environment enhancing the health of its occupants. Hornberg and Pauli (2011) extended the definition as houses that provide sufficient physical, natural and states of mind that strengthens wellbeing, solace and security. While some authors (Udofia et al., 2014) argues that among the factors leading to poor health conditions of building occupants are poor environmental and housing conditions which could trigger the transmission of infectious diseases, others (Alnsour, 2011; Rauh et al., 2002), posit that the materials from which the building is built may also influence the occupant's wellbeing. Rauh et al. (2008) further expressed that other ways through which occupant's health is influenced by housing are when exposed to poor conditions and other deficiency in the provision of basic facilities to make housing liveable. Fullilove and Fullilove (2000) validated this view by asserting that housing delivery deficiency could worsen housing conditions which in turn could trigger a range of diseases, disorders and dysfunction. As such, housing quality as described by Muhammad et al. (2015) should not be limited to physical building conditions and basic facilities for liveability, but also include indoor air quality. Thus, housing also requires quality and not just quantity. This view is upheld by Aderamo and Ayobolu (2010) who suggested that adequacy of housing must be both qualitative and quantitative to accomplish its ultimate goals. Coker et al. (2008) and Jiboye (2010) additionally corroborated that housing quality is a vital component which influences occupant's health and well-being. This view agrees with

those of Kembel et al. (2012) who described buildings as complex ecosystems containing microorganisms in trillions that connect along with living creatures and their environment. According to Aribigbola (2011) and Amao (2012), housing quality should, therefore, enhance good living, possess minimum health standard and should be affordable for all.

Several studies (Emmenlin, 2007; Kovesi, et al., 2007; Ishihama et al., 2009; Bjornsson et al., 1995) have reported that poor indoor air quality poses an infection risk through the concentration of airborne bacteria which are associated with adverse respiratory symptoms. According to the World Health Organization (WHO), the quality of the indoor air is projected to become the eighth major factor that will account for the two percent in the spread of diseases worldwide (WHO, 2005). Graudenz et al. (2005) further reported that indoor variables such as temperature, humidity, ventilation and accumulated biological pollutants can deteriorate the quality of the indoor environments. As such, Aderamo & Ayobolu (2010) observed that other determinants of housing quality included internal facilities, walling materials, and the source of lighting in the absence of electricity.

Studies in Nigeria have also been undertaken on the factors affecting housing. For instance, in Ibadan, Amao (2012) established that several houses were in a poor condition, lacked adequate ventilation, lighting and pleasant external environment. These findings relate to a study in Ibadan by Coker et al. (2008) which showed that the houses were grossly deficient for habitation. Similarly, in Osun State, Lanrewaju (2012) also established the existence of poor-quality housing that was below the required standard. Despite numerous studies focusing on the varied impacts of health linked to poor housing quality, there is still a scarcity in the literature on the impact of urbanisation on healthy housing delivery in the developing countries with a particular reference to Nigeria, a gap filled in the current study. Arising from the foregoing, this study sought to assess the indoor air quality as a health risk in the existing urban housing in Nigeria using Yelwa ward of the Bauchi city as a case study. The specific objectives were (i) to determine the house(s) more susceptible to ill-health based on their indoor CO_2 and PM_{10}/$PM_{2.5}$ and (ii) to find any association among the health symptoms linked to the building parameter/air quality. This paper, therefore, fills the current gap in knowledge in the provision of healthy housing development in Nigeria.

A conceptual framework (Figure 1) was developed to investigate the factors identified in the literature review. It summarises and describes the relationship, connection and association between factors that combine to influence the implications of urbanization on housing and health in Nigeria. The major factors identified are classified to include housing drivers, housing deficit, housing delivery, current housing delivery deficiency and housing dweller's demand (the expectations of the occupant).
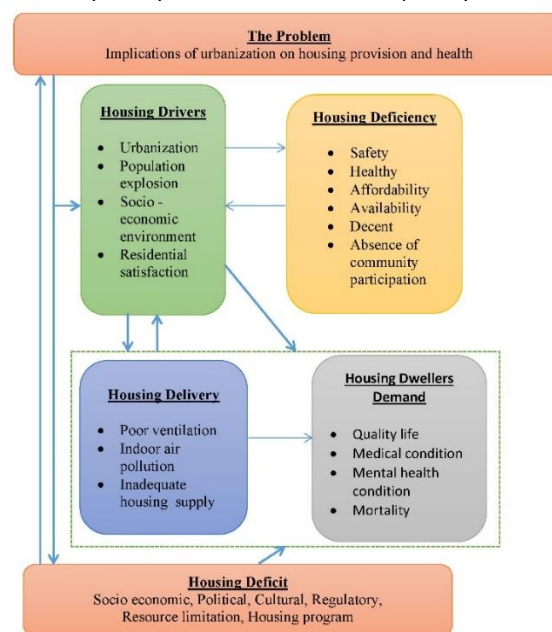

Figure 1. Conceptual framework to assess implications of urbanization on housing and health (Developed by Author)

3. Methods
3.1 Location of Study
Nigeria, a country in West Africa is divided into 36 states and a Federal Capital Territory (FCT). Bauchi is a city in the North-East geopolitical zone of Nigeria and according to the 2006 population census by the National Bureau of Statistics (2010) has a population of 493,810. Officially, Bauchi city is divided into eight wards, each comprising of 43,654 households, spread across various housing densities (i.e. low, medium and high) in residential areas (Bello et al., 2007; Gani et.al., 2012).

3.2 Study Population
The study area is divided into eight wards having over 421, 187 residents, which formed the sample frame. Yelwa ward having the highest number of population (50,533) and highest number of households (6563) living in naturally ventilated low-rise housing types was purposively selected as a case study. This formed the target population. Since there are 6563 households in the study area, a sample size of 150 households was obtained from the calculations (Czaja and Blair, 2005; Creative Research Systems, 2003) below:

$$SS = \frac{Z^2 * (p) * (1 - p)}{C^2}$$

Where:
Z= Z value (e.g. 1.96 for 95% confidence level)
P= percentage picking a choice, expressed as decimal (.5 used for sample size needed)
C= confidence interval, expressed as decimal

The sample size was calculated as follows:
$$SS = \frac{1.96^2 * (0.5) * (1 - 0.5)}{0.1^2}$$

SS= 96.04

From the above calculations, the number of households needed is ninety-six. However, the figure obtained requires further some adjustments for finite populations. Thus, using the formula adopted from Czaja and Blair (2005) the finite populations was calculated as:

$$New\ SS = \frac{SS}{1 + \frac{SS - 1}{POP}}$$

Where:
POP= population
$$New\ SS = \frac{96.04}{1 + \frac{96.04 - 1}{6563}}$$

$$New\ SS = 94.67$$

Thus, from the figure obtained above, a sample size ranging from 95 and above was required. To make provision for non-response, 150 households were selected and invited to participate in the survey using stratified random sampling. The survey involved a household questionnaire comprising of 30 questions and a building audit checklist. A member of each household was required to answer the occupant survey questions. Only 116 consented to participate in phase one of the study through the use of questionnaires. The participants who were 18 years and above were asked if anyone living in their houses had experienced a particular health issue and/or experienced any symptoms itemised in the survey questionnaire at any point in the past five years. The main outcome of interest was self-reported illness. This was defined as at least one of the diseases and its symptom (cough, sore throat, or runny nose). Ethics approval was obtained from the University of Leeds, the United Kingdom and every participant signed a form indicating their consent and voluntary agreement to participate anonymously and with their confidentiality protected.

3.3 Source of Data
Data collection was undertaken in three phases. The first phase involved the administration of a questionnaire on occupant's background and health complaints through direct contact with the building occupants by the research assistants. Phase two involved building audit and phase three involved indoor air quality monitoring. Air quality parameters were measured using Airnode sensors (Airvisual, USA) whose CO_2 values were calibrated against a Rotronic CL11 (Rotronic, BSRIA, Bracknell, UK). Occupant's exposure to indoor CO_2 emission, $PM_{2.5}$ and PM_{10} particulate matter were recorded above 1m from the ground in the bedroom and the living room for a minimum of 12 hrs with Airnode sensors in the dry season (i.e. October–November 2017).

3.4 Statistical Methods
In the current study, the incidence of the occupant's health complaints constituted the dependent variable as the major outcome. Recoding was done to indicate 0 as no symptoms and 1 as having symptoms.

Respiratory symptoms were classified into two, namely; upper and lower symptoms. The independent variable constitutes occupant's demographic characteristics, building operation and indoor environment conditions (i.e. temperature, relative humidity and presence of CO_2). Data analysis employed IBM SPSS Statistics 23 for simple descriptive statistics to generate the results. To identify the risk factors of buildings on the occupants, logistic regression models were employed along with bivariate logistic analysis. Other non-parametric tests such as Odds ratios, Chi-squares and Fisher exact tests were carried out to assess the relationships between the dependent and independent variables. The significant variables for the bivariate investigation having the value of 'p' under 0.05 were added in the logistic regression. Ranking of indicators of ventilation (CO_2) was carried out according to the WHO guideline value using the following values as the benchmark; less than 600 ppm (acceptable); between 600–1300 ppm (complains); and 1300 ppm (very bad).

4. Results and Discussions

Findings show that 67% of the respondents were male, while 33% were female. The typical family in the survey consists of a family of four members and earned below N20, 000 ($50) monthly (i.e. about $1.25 per day). Particulate matter was quantitatively assessed on the participating households. The mean particulate matter found was 63 $\mu m/m^3$ and 228 $\mu m/m3$ respectively, ranging from 10 $\mu m/m^3$ - 231 $\mu m/m^3$ (PM2.5) and 20 $\mu m/m^3$ - 1667 $\mu m/m^3$ (PM10). Findings demonstrate that the majority (79.5%) of the household's exposure to the PM2.5 value recorded surpassed the value considered to be safe for human health (i.e. 25 $\mu m/m3$ for PM2.5 and 50 $\mu m/m3$ for PM10) prescribed by WHO. This suggests that the exposure of the greater number of the respondents (79.5%) was more than twice greater in $PM_{2.5}$ and multiple times more in PM_{10} than the recommended value. These findings are in line with the results from previous studies conducted in India where Ansari et al. (2010) and Saksena et al. (1992) also reported the high mean particulate matter.

With evidence from the reviewed literature on the outcome of excessive concentrations of PM2.5 (i.e. breathing difficulties, irritation of the lungs, risks malfunctioning lung etc.) in the indoor environment, this could account for its impact on the occupant's health conditions. Similarly, the occupants having contact with a greater value of PM_{10} in the indoor environment proved that they are at risk of respiratory illness (Dockery and Pope, 1994). Households with these respiratory illnesses are responsible for a greater percentage of human loss of life resulting from indoor air pollution. The high concentrations of the PMs in the indoor environment could be a result of (i) some of the houses are surrounded by untarred roads and unpaved walkways which allows the entry of large quantity of dust particles into the buildings (ii) absence of landscaping elements such as green areas and trees around the buildings to absorb the dust particles and filter the air (iii) improper building orientation to determine the appropriate placement of fenestrations (i.e. windows) and occupant's behavioural pattern in the operation of the buildings.

Other diseases associated with the respiratory system include tuberculosis (TB), asthma, pneumonia and influenza. In this study, the incidence of influenza was found to be significantly related to PM2.5 (Wald = 5.087 p = 0.024). On the other hand, PM_{10} has Wald statistics with significant p-values for two ailments; chickenpox (Wald = 4.029, p = .045) and influenza (Wald = 4.002, p = .045). Meanwhile, the greater percentage (41.4%) of the respondents answered in the affirmative that their indoor environment affected their health while 30.2% disagreed. However, 19.8% claimed that they did not know if the indoor environment affected their health while the remaining 8.6% gave no response. Findings obtained from Table 1 indicated that the symptom that was generally acknowledged by most of the respondents is weakness/fatigue. This was indicated by the largest percentage (78.4%) of the respondents and was closely followed by dizziness (69.8%) and headaches and stiff neck (68.1%). The least popular symptom acknowledged was "coughing up blood or sputum (mucus from deep inside the lungs)" which was identified by 14.1% of the respondents.

Table 1. Symptoms of illness experienced by the respondents in the indoor environment.

SN	Variables	Yes		No	
		f	%	f	%
1	Headaches and a stiff neck	79	68.1	37	31.9
2	Dizziness	81	69.8	35	30.2
3	A tingling/pins/needles feeling	33	28.4	83	71.6
4	Difficulty or fast breathing	42	36.2	74	63.8
5	Increased heart rate	37	31.9	79	68.1
6	Loss of consciousness (i.e. fainting)	27	23.3	89	76.7
7	Weakness/fatigue	91	78.4	25	21.6
8	Sore throat	63	54.3	53	45.7
9	Muscle pains	62	53.4	54	46.6
10	Severe watery/or loose diarrhea	42	36.2	74	63.8
11	Nausea (i.e. the feeling that you are going to vomit	39	33.6	77	66.4
12	Vomiting everything	22	19.0	94	81.0
13	A bad (severe) cough that lasts 3 weeks or longer	37	31.9	79	68.1
14	Pain in the chest	53	45.7	63	54.3
15	Coughing up blood or sputum (mucus from deep inside the lungs)	17	14.7	99	85.3
16	Sore or itchy eyes	62	53.4	54	46.6
17	Skin complaints/rashes/eczema	59	50.9	57	49.1

To determine the susceptibility of the houses to ill-health based on their indoor CO_2 and PM_{10}/$PM_{2.5}$, the overall mean concentration of CO_2 obtained was 584 ppm. This was less than 600 ppm, which indicates on the range (for acceptable value) that the ventilation was adequate. Although some of the houses exhibited adequate ventilation, the reason for this could be as a result of multiple interacting factors such as the way the occupants operated their buildings, many houses were built within fence walls and around a courtyard (Figure 2), hence, households were able to leave their windows opened for long hours both night and day.

Figure 2. Houses built within fence walls and around courtyard allowing windows to be opened.

However, findings show that several houses due to their poor design approach (Figure 3) had their CO_2 up 2201ppm (i.e. more than 1300 ppm (very bad). Although the p-values of the Wald statistics show that CO_2 is not a significant risk factor in the incidence of any of the diseases in the prevailing residents' indoor environment (RIE), the indices as none of the Wald statistics for CO_2 is less than 0.05. The average indoor temperature obtained in the houses was 28.9 °C and the mean relative humidity was 40.7%. These values exceeded by slight the difference compared to the values suggested by ASHRAE, which is between 21 – 26 degree Celsius (temperature) and 30 - 70

percent (relative humidity) ANSI/ASHRAE, 2014). The slightly higher than the recommended value of the indoor temperature could be a result of inadequate window openings and in the appropriate window placement on the buildings for sufficient ventilation. This indicated that most of the occupants are not thermally comfortable coupled with the challenge that the majority of the occupants earned below $50/month and as such unable to afford to pay for the energy required to make their houses comfortable.

Figure 3. Windows of houses opening into a narrow lobby with insufficient setbacks between buildings, causing insufficient airflow for adequate ventilation.

Logistic regression analyses of the incidence of diseases were carried out on the RIE indices across the houses under study (Table 2). A cursory look at the p-values of the Wald statistics for the houses concerning each of the diseases shows that it is only in the incidence of meningitis that houses become a significant risk factor, as the p-value is less than 0.05. In all other cases, the p-values surpassed the 0.05 and hence houses are not significant risk factors for the diseases. For Meningitis, however, the odds-ratio (Exp. B) is slightly greater than one.

Table 2. Susceptibility to ill-health based on indoor CO_2 and $PM_{10}/PM_{2.5}$.

Disease	Variable	B	SE	Wald	Df	Sig	Exp(B)	-2 Log likelihood	Cox & Snell R Square	Nagelkerke R Square
				Variables in the Equation					**Model Summary**	
Tuberculosis	House	-.076	.112	.452	1	.501	.927			
	PM2.5_24Hrmean	.004	.014	.097	1	.755	1.004			
	PM10_24HrMean	.001	.003	.110	1	.740	1.001	34.510	0.018	0.043
	CO2_24HrMean	-.001	.003	.139	1	.709	.999			
	Constant	-1.891	2.132	.786	1	.375	.151			
Pneumonia	House	-.091	.066	1.918	1	.166	.913			
	PM2.5_24Hrmean	-.007	.011	.363	1	.547	.993			
	PM10_24HrMean	.001	.002	.291	1	.589	1.001	78.528	0.054	0.079
	CO2_24HrMean	.002	.001	1.498	1	.221	1.002			
	Constant	-1.250	1.072	1.359	1	.244	.286			
Asthma	House	.021	.095	.050	1	.823	1.021			
	PM2.5_24Hrmean	-.005	.018	.082	1	.775	.995			
	PM10_24HrMean	.000	.004	.011	1	.916	1.000	44.512	0.014	0.030
	CO2_24HrMean	.001	.002	.568	1	.451	1.001			
	Constant	-2.825	1.549	3.325	1	.068	.059			
Meningitis	House	.149	.075	3.927	1	.048	1.161			
	PM2.5_24Hrmean	.006	.010	.379	1	.538	1.006			
	PM10_24HrMean	-.002	.003	.670	1	.413	.998	69.308	0.069	0.105
	CO2_24HrMean	.000	.002	.008	1	.928	1.000			
	Constant	-2.412	1.324	3.318	1	.069	.090			
Measles	House	.016	.068	.057	1	.812	1.016			
	PM2.5_24Hrmean	.012	.011	1.167	1	.280	1.012			
	PM10_24HrMean	-.004	.003	1.819	1	.177	.996	76.735	0.046	0.066
	CO2_24HrMean	.001	.001	.969	1	.325	1.001			
	Constant	-1.990	1.132	3.092	1	.079	.137			
Chickenpox	House	.104	.065	2.545	1	.111	1.110			
	PM2.5_24Hrmean	-.012	.010	1.366	1	.242	.988			
	PM10_24HrMean	.004	.002	3.373	1	.066	1.004	82.412	0.129	0.179
	CO2_24HrMean	.001	.001	.600	1	.439	1.001			
	Constant	-2.467	1.160	4.522	1	.033	.085			
Influenza	House	.121	.064	3.557	1	.059	1.129			
	PM2.5_24Hrmean	-.027	.011	6.597	1	.010	.973			
	PM10_24HrMean	.005	.003	3.414	1	.065	1.005	92.728	0.149	0.206
	CO2_24HrMean	-.002	.002	2.057	1	.152	.998			
	Constant	.028	.155	.034	1	.854	1.029			
Malaria	House	-.020	.017	1.421	1	.233	.980			
	PM2.5_24Hrmean	.004	.005	.530	1	.467	1.004			
	PM10_24HrMean	.000	.003	.009	1	.923	1.000	25.797	0.013	0.055
	CO2_24HrMean	4.349	2.474	3.089	1	.079	77.41			
	Constant	.028	.155	.034	1	.854	1.029			

To determine the correlation between the total number of symptoms and illnesses observed by households and building parameter, a Spearman's rank-order correlation was performed (Table 3). There were weak positive correlations between the total number of symptoms and four building parameters (main building orientation, type of housing unit, the orientation of window opening, and size of household). The only significant relationship was observed between the total number of symptoms and the type of housing unit ($r = .215$,

$p = .021$). All the other relationships were not statistically significant. There were weak negative relations between the total number of symptoms and four of the remaining building parameters (the type of window, window size, type of cooking fuel and main source of lighting). The only significant relationship was observed between the total number of symptoms and the main source of lighting ($r = .300$, $p = .001$). All the other relationships were not statistically significant (Table 3).

Table 3. Correlation between number of symptoms and building parameter/air quality.

Correlations			
			Total number of symptoms experienced
Spearman Rho	The main building orientation	Correlation Coefficient	.097
		Sig. (2-tailed)	.303
		N	115
	Type of housing unit	Correlation Coefficient	.215
		Sig. (2-tailed)	.021
		N	115
	Window size	Correlation Coefficient	-.065
		Sig. (2-tailed)	.508
		N	107
	Household size	Correlation Coefficient	.105
		Sig. (2-tailed)	.263
		N	115
	Type of window in the bedroom	Correlation Coefficient	-.128
		Sig. (2-tailed)	.173
		N	114
	Size of the bedroom window	Correlation Coefficient	-.081
		Sig. (2-tailed)	.393
		N	114
	Window orientation in the bedroom	Correlation Coefficient	-.171
		Sig. (2-tailed)	.066
		N	116

The building characteristics were cross-tabulated with the incidence of the reported diseases to explore the association between them; Chi-square values and Fishers' exact test were computed at 0.05 level of significance. The results show that the main building orientation is significantly associated with the incidence of measles ($p < 0.02$), meningitis ($p < 0.03$) and TB ($p < 0.04$). The materials used for floor covering were also found to significantly associate with Meningitis ($p < 0.01$), measles ($p < 0.02$) and influenza ($p < 0.002$). Their odds ratio is less than 1 implying that as the floor material improves from earth, wood, cement and to rug, the odds of incidence of the three ailments are reduced. This result agrees with the explanations on the findings of Alnsour (2011) that the health of building occupants is directly linked to the quality of the building materials used for the building. Meanwhile, logistic regression analyses of the diseases along with indoor air quality show no relationship with CO_2. However, PM10 shows a significant relationship with chickenpox (Wald = 4.029, p = .045) and influenza (Wald = 4.002, p = .045); while PM2.5 (Wald = 6.263, p = 0.012) is a significantly related to Influenza. The above findings point to the general trend observed towards the approach to indoor environments that exists in current housing provision in the study area. The findings revealed the required intervention and measures for the consideration of housing indoor environments.

5. Conclusion and Recommendations

This paper presented the implications of urbanization on housing provision and its consequences on the building occupant's health. It established that as urbanisation increases, there is a corresponding increase in huge housing deficits for teeming Nigerian populace. Exacerbating the already huge challenge of housing deficits is the less attention given to housing quality as a significant area of the non-clinical contributor to the quality of health of building occupants. This study found some association between certain building characteristics and some diseases experienced by the building occupants as potential risk factors in the residential housing provision. The outcome of this study calls for a redirection in quality housing provision in Nigeria. This should be occupant-centred with reduction strategies of indoor particulate matter which combine to deteriorate the indoor environments that trigger susceptibility to infectious diseases. Future intervention in public health policies for quality housing provision is needed to contribute towards efforts to address the conundrum of a safe and healthy-promoting building for growing urban poor populace in Nigeria. To curtail the implications of urbanization on housing provision in Nigeria, this paper recommends the need for synergy between the built environment professionals and the national government to formulate policies and develop guidelines that promote healthy housing. This

could limit an array of avoidable diseases arising from deficiencies in housing quality. Besides, there is a need for constant revision of the nation current housing policies to reflect the importance and improvement required for healthy housing. This would serve as the basis for providing a healthy and socially acceptable housing for the teeming populace in Nigeria. In practice, building design professionals need to incorporate comprehensive aspects of healthy housing into their design such as (i) appropriate building orientation to capture natural daylighting and adequate natural air for appropriate airflow and air flush within the buildings (ii) appropriate positioning of fenestrations on the elevations of the buildings (iii) introduction of shading elements around the windows and entrances to reduce overheating of the interior, and (iv) integration of soft and hard landscaping elements within and around the houses to absorb or lessen the dust particles entering into the building. Architects and housing developers also need occupant's inputs in their design to create healthy housing and environments. This brings to fore the necessity of integrating neighbourhood design method in practice through the inclusion of paved sidewalks, green and places for leisure to enhance occupant's health. This would need to be backed up with appropriate data obtained from the building occupants.

6. Limitations
This paper presents a study which is preliminary and cross-sectional in its design. The sample size used in the study is considered to be small, thereby posed some methodological limitations which could have affected the results. This agreed with observations made by Bruce et al. (2002) which reported in their findings that as a result of some limitations arising from methodological issues, some studies carried out on housing environments and health from the third world countries finds no significant relationship between them. Further, the equipment used to capture indoor environmental parameters of the investigated buildings could not capture the particulate matter continuously for 24 hours as anticipated due to constraints of electricity supply to power the equipment.

Conflict of interests
The Author declares no conflict of interest.

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