Published 28 February 2025 by the University of KwaZulu-Natal
https://journals.ukzn.ac.za/index.php/JICBE

Journal of Inclusive cities and Built environment. Vol. 5 Issue 8

How to cite: C.O Ajala, et al., 2025. Relationship between informal settlements and residents' health in North-central Nigeria. *Journal of Inclusive cities and Built environment.* Vol. 5 Issue 8, Pg 11-32

RELATIONSHIP BETWEEN INFORMAL SETTLEMENTS AND RESIDENTS' HEALTH IN NORTH-CENTRAL NIGERIA

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Published 28 February 2025

ABSTRACT

Informal settlements in developing countries like Nigeria are marked by substandard housing and inadequate access to essential services. Rapid urbanization has led to their expansion, resulting in poor living conditions that significantly impact residents' health. These settlements lack crucial infrastructure such as clean water, sanitation, and waste management systems, contributing to the spread of infectious diseases and increasing the risk of waterborne illnesses. This study explores the link between informal settlements and residents' health in North-central Nigeria, focusing on selected settlements in Abuja, Benue, Plateau, and Kogi states. Data were gathered through surveys and medical record reviews from primary healthcare centers. The findings reveal a high prevalence of diseases such as malaria, typhoid, and fever, which are closely linked to poor housing conditions and inadequate healthcare access. The study underscores the urgent need for interventions to improve living conditions and healthcare services to reduce health risks in these areas.

KEY WORDS Informal Settlements, Residents' Health, Housing Conditions

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1. INTRODUCTION

Urban informal settlements worldwide are diverse and complex, often characterized by poor-quality housing, inadequate basic facilities, overcrowding, and unfavourable environmental conditions (Wahab, 2017; Aboulnaga *et al*., 2021). These settlements are ambiguously described in the literature due to variations across disciplines, countries, and eras. However, there is broad consensus on their common features. UN-Habitat (2016) defines informal settlements as unlawfully occupied residential areas or unplanned settlements where housing does not conform to building and planning codes. Oguche *et al*. (2019) describe them as areas developed without adhering to formal rules, often on land without legal claims by the occupants. Informal settlements significantly shape the spatial layout of urban areas in developing countries like Nigeria. Limited formal employment opportunities lead to livelihood strategies that spill into public spaces, blurring boundaries between private and public areas. The location of these settlements affects their consolidation and growth within the urban network. Despite their complexity and prominence in global discourse, effective government responses remain rare. Understanding the formation, evolution, and impact of informal settlements is crucial for urban planners and other professionals involved in urban development.

The proliferation of informal settlements in North Central Nigeria reflects global trends but is worsened by local socio-economic and political factors. Rapid population growth and inadequate urban planning have led to the expansion of these settlements. Challenges are further compounded by land tenure systems, ethnic conflicts, and political instability (Falegan *et al*., 2023). Health implications are significant, with poor sanitation, inadequate waste management, and lack of clean water contributing to diseases such as cholera, typhoid fever, and diarrhoea (Olusunle *et al*., 2017; Nanle *et al*., 2023). Health disparities are exacerbated by overcrowded living conditions and poor healthcare access, particularly affecting women and children. High rates of maternal and infant mortality and malnutrition have been documented, highlighting poor health outcomes (Adegun and Aina, 2021; Oluwadare *et al*., 2024). However, the informal settlements in north-central, Nigeria have taken on the form of a hydra-headed planning creature that impedes urban expansion, stable and healthy living. To create sustainable environments and improve livability, it is essential to draw government attention to issues within these settlements, especially those affecting residents' health. This study examines selected informal settlements in FCT, Kogi, Benue, and Plateau states, providing insights into the relationship between these settlements and residents' health, including how inhabitants seek medical attention. By evaluating various health variables in these areas, the study aims to formulate strategies to enhance living standards and health outcomes.

2. LITERATURE REVIEW

The increasing impact of unregulated urbanization and rapid population growth is a significant issue for informal settlements. Factors such as insurgency, civil disputes, land ownership and housing costs, land tenure security, migration, and employment contribute to their creation and development (Satterthwaite *et al*., 2018; Oyedele *et al*., 2019). Millions of urban residents who support the urban economy live in these settlements, which are a crucial part of urban expansion (Adegun and Aina, 2021). These communities face numerous livability challenges, including poor housing conditions, inadequate sanitation, indiscriminate waste disposal, and lack of basic infrastructure.

Studies on residents' health in urban informal settlements demonstrate a direct relationship between health and the human environment (Oladunni *et al*., 2018; Satterthwaite *et al*., 2018; UN-Habitat, 2020; Zerbo *et al*., 2020; Alabi *et al*., 2021; Olubodun and Aluko, 2022; Ismail *et al*., 2024). These studies primarily focus on density and income levels rather than providing comparative analyses of informal settlements over time, illness types, and hospital records across cities. They highlight the lack of effective urban development management and growth strategies. Further research is needed to address the limited health risk data and guide urban policy, especially as many African cities, including those in Nigeria, have a high proportion of informal settlements. A comprehensive study by Olusunle *et al*. (2017) and Adegun and Aina (2021) on waterborne illnesses in North Central Nigeria's informal communities identified high rates of diseases like cholera, typhoid fever, and diarrhoea. The lack of access to clean water and sanitary services significantly contributes to these health issues. The study emphasizes the urgent need to improve infrastructure for safe drinking water and sanitation, and to develop hygiene education programs. Researchers also highlight the importance of government support and community involvement in addressing the root causes of poor sanitation and water quality.

A survey by the Nigerian Ministry of Water Resources (2022) found that only 30% of households in informal areas of North Central Nigeria have access to piped water, compared to 70% in formal urban areas. This disparity increases the risk of waterborne diseases like cholera, typhoid fever, and diarrhoea (Olusunle *et al*., 2017). Health disparities are further exacerbated by limited access to healthcare services and poor health-seeking behaviours. The Nigerian Ministry of Health (2021) reported that only 40% of residents in informal settlements have access to primary healthcare within a 5-kilometer radius, compared to 80% in formal areas. Socio-economic barriers such as poverty and unemployment contribute to poor health outcomes. This situation highlights the urgent need for comprehensive research and evidence-based interventions to address health issues in North Central Nigeria's informal settlements.

3. THE STUDY AREA

The study focused on informal settlements in North Central Nigeria, specifically in FCT, Kogi, Benue, and Plateau States. It concentrated on the Gwagwalada area council, Lokoja, Makurdi, and Jos North Local Government Area due to their rapid urbanization and significant influx of people, leading to a proliferation of informal settlements such as slums and shantytowns. These areas are urban hubs driven by numerous activities, necessitating the study of their urban core and settlement dynamics (Oguche *et al*., 2019; Gwanshak *et al*., 2021; Ibrahim, 2022; Ukoje and Ibor, 2022; Wahab, 2017). The areas within the selected cities in Nigeria's North-central region, which exhibit notable characteristics of informal settlements, are detailed in Table 3.1.

Table 3.1: The selected informal settlements in North-central region

State	City	Selected informal Settlements
FCT	Gwagwalada	Zuba, Tungan-maje, Old-kutunku and New-kutunku
Kogi	Lokoja	Old-market area, Adankolo, Lokongoma, Felele and Oworo
Benue	Markurdi	Banada, Gaadi, Fiidi, Logo and adeke
Plateau	Jos North	Jenta-Adamu, Rukuba road, Kabong and Utan

Source: Authors' fieldwork, 2023

4. RESEARCH METHODOLOGY

The study combined primary and secondary data sources, including physical observations, questionnaires, and various published and unpublished works. Primary data focused on socio-economic characteristics, housing quality, occupancy ratios, settlement types, and factors influencing the location of informal settlements and disease occurrences. Secondary data on residents' health records were obtained from public Primary Health Care centers in the study area, focusing on data from the past five years. This included patient complaints, diagnoses by healthcare professionals, and treatment cases related to housing-related diseases, classified with a medical consultant's help. A total of 18 disease types were examined. The study examined 18 informal settlements with approximately 79,032 households. It covered five settlements each in Kogi and Benue, and four each in Plateau and the FCT. Following Mweshi and Sakyi's (2020) principle of using larger sampling ratios for smaller populations, a 1% sampling ratio was applied to areas with over 1,000 households, and 5% for less than 1,000 households. Consequently, a 5% sampling ratio was used for three settlements in Kogi, and 1% for the remaining areas, including Benue, Plateau, and the FCT. To address non-responses or missing data, an extra 2% (17 samples) was added, resulting in a total of 880 samples. The breakdown of returned and analyzed questionnaires was as follows: Kogi (318), Benue (174), Plateau (181), and FCT (199), amounting to 872 responses. Health records were retrieved from 12 out of the 15 identified Primary Health Care (PHC) centers in the study area. These details are illustrated in Table 4.1. Data from the questionnaires and PHC records were analyzed using descriptive (frequency and percentage) and inferential statistics (chi-square, factor analysis, correlation, and regression).

Table 4.1: Sample Size employed for the study

State	L.G. A	Selected-informal settlements areas	Estimated households	Samples taken	No. of returned sampled	No. of PHC available	No. of PHC accessed & retrieved data	PHC assessed in the area
Kogi	Lokoja	Old-market/ secretariat area	21,280	213	318	5	2	Accessed
		Adankolo	1,576	16+2=18**				NA
		Lokongoma	333*	17+2=19**				Accessed
		Felele	641*	32				
		Oworo layout	788*	39				
		TOTAL	**24,618**	**321**				
Benue	Makurdi	Banada	7,478	75	174	2	2	NA
		Gaadi	3,036	30				NA
		Fildi	2,525	25				Accessed
		Logo I	1,801	18+3=21**				NA
		Adeke	2,085	21+2=24**				Accessed
		TOTAL	**16,925**	**175**				
Plateau	Jos North	Jenta-Adamu	5764	58	181	4	4	Accessed
		Rukuba road	4366	44				Accessed
		Kabong	4484	45				Accessed
		Utan	2972	30+4=34**				Accessed
		TOTAL	**17,586**	**181**				
FCT	Gwagwalada	Zuba	2,893	29+2=31**	199	4	4	Accessed
		Tungan maje	2,833	28+2=30**				Accessed
		Old-Kutunku	3,792	38				Accessed
		New-Kutunku	10,385	104				Accessed
		TOTAL	**19,903**	**203**				
			79,032	880	872	15	12	

Sources: Author's field work 2023

*Note: * indicates 1% (>1,000) sample while others are 5% (<1,000).*

*** indicates additional 2% of the total samples (862) for non-responses or missing data (2% of 862= 17.24);*

= Available but not assessed; NA = Not Available

5. RESULT DISCUSSION

Table 5.1: Socio-Economic Characteristics of the respondents

Characteristics		Aggregate		State of Residence							
				Kogi		Benue		Plateau		FCT	
		N	%	N	%	N	%	N	%	N	%
Gender	Female	403	46.2	154	48.4	84	48.3	80	44.2	85	42.7
	Male	469	53.8	164	51.6	90	51.7	101	55.8	114	57.3
Age	18-29 years	188	21.6	60	18.9	31	17.8	54	29.8	43	21.6
	30-49 years	438	50.2	148	46.5	98	56.3	95	52.5	97	48.7
	Above 50years	246	28.2	110	34.6	45	25.9	32	17.7	59	29.6
Occupational Status	Trader	435	49.9	147	46.2	92	52.9	101	55.8	95	47.7
	Civil Servant	121	13.9	45	14.2	22	12.6	24	13.3	30	15.1
	Student	95	10.9	38	11.9	18	10.3	27	14.9	12	6.0
	Retired	91	10.4	29	9.1	0	0.0	0	0.0	62	31.2
	Others	130	14.9	59	18.6	42	24.1	29	16.0	0.0	0.0
Educational Status	No Formal Education	226	25.9	73	23.0	45	25.9	65	35.9	43	21.6
	Primary	283	32.5	110	34.6	62	35.6	36	19.9	75	37.7
	Secondary	230	26.4	81	25.5	50	28.7	54	29.8	45	22.6
	Tertiary	94	10.8	35	11.0	17	9.8	20	11.0	22	11.1
	Others	39	4.5	19	6.0	0	0.0	6	3.3	14	7.0
Marital Status	Single	169	19.4	91	28.6	21	12.1	27	14.9	30	15.1
	Married	438	50.2	154	48.4	91	52.3	102	56.4	91	45.7
	Divorced/Separated	153	17.5	29	9.1	40	23.0	30	16.6	54	27.1
	Widowed	112	12.8	44	13.8	22	12.6	22	12.2	24	12.1
Duration of Stay in the area (years)	1-4	133	15.3	39	12.3	30	17.2	32	17.7	32	16.1
	5-9	264	30.3	96	30.2	54	31.0	63	34.8	51	25.6
	10-14	310	35.6	115	36.2	72	41.4	50	27.6	73	36.7
	≥ 15	165	18.9	68	21.4	18	10.3	36	19.9	43	21.6
Monthly Income	≤ ₦10,000	206	23.6	44	13.8	48	27.6	45	24.9	69	34.7
	₦10,001-20,000	270	31.0	80	25.2	81	46.6	72	39.8	37	18.6
	₦20,001-30,000	182	20.9	72	22.6	29	16.7	28	15.5	53	26.6
	₦30,001- 40,000	135	15.5	91	28.6	9.0	5.2	18	9.9	17	8.5
	≥ ₦40,000	79	9.1	31	9.7	7.0	4.0	18	9.9	23	11.6

Source: Author's field survey, 2022

In Table 5.1, 53.8% of respondents are male and 46.2% are female, with the FCT having the highest male proportion (57.3%) and Kogi State the lowest (51.6%). This study represents both male and female perspectives. It was observed that women in informal settlements are more engaged in daily survival activities, making men more present during the day. Most respondents (50.2%) are aged 30-49, with Benue State having the highest proportion (56.3%) and Kogi State the lowest (46.5%). This indicates the presence of both young adults and elderly in the informal settlements across the selected states. Their occupation indicates that 49.9% are traders, with the highest concentration in Plateau State (55.8%), followed by Benue (52.9%), FCT (47.7%), and Kogi (46.2%) States. Other occupations include civil servants (13.9%), students (10.9%), retirees (10.4%), and a variety of self-

employed roles such as blacksmithing, fishing, and farming. This indicates that most residents have some form of employment, regardless of the economic conditions. Regarding education, 32.5% of respondents have a first leaving certificate, most notably in FCT (37.7%), Benue (35.6%), Kogi (34.6%), and Plateau (19.9%). This suggests that the majority of respondents are capable of understanding the survey questions. The result in Table 5.1 also indicates that 50.2% of respondents are married, with the highest percentage in Plateau State (56.4%). Most respondents (35.6%) have lived in the area for 10-14 years, and the majority earn between ₦10,001-20,000 per month, below the minimum wage of ₦30,000 as of 2022. The minimum wage was increased to ₦70,000 in 2024 but has not been implemented in some states, particularly noticeable in Benue State.

Table 5.2: Types of informal settlements across the selected States

Types	Kogi		Benue		Plateau		FCT			
	N	%	N	%	N	%	N	%	X2	P
1	16	5.0	8	4.6	13	7.2	17	8.5		
2	252	79.2	114	65.5	92	50.8	88	44.2		
3	0	0.0	3	1.7	5	2.8	17	8.5		
4	19	6.0	2	1.1	20	11.0	15	7.5	189.723	0.000
5	16	5.0	40	23.0	18	9.9	44	22.1		
6	11	3.5	0	0.0	0	0.0	8	4.0		
7	4	1.3	7	4.0	33	18.2	10	5.0		

Source: Author's field survey, 2022

Note:

1 = Settlements on public land; 2 = Settlements on private land; 3 = Settlements for refugees; 4 = Upgraded squatter settlement; 5= Illegal change of structure;6= Settlements on power line and 7= others

The result in Table 5.2 shows that the most common type of informal settlements in North-central Nigeria are built on private land, particularly in Kogi State (79.2%). Illegal structural changes are more common in Benue (23%) and FCT (22.1%), while settlements on public land and near power lines are notable in FCT (8.5% and 4.0%). Other settlements, like those on rocks and river banks, are significant in Plateau State. Structures built along riversides are prone to flooding during periods of heavy rainfall, which can compromise their structural integrity and reduce their longevity. Chi-square test indicates a significant statistical difference in the types of informal settlements across the states, with a P-value of 0.000.

Table 5.3: Housing Types, age and ownership across the selected states

Variables		Kogi		Benue		Plateau		FCT	
		N	%	N	%	N	%	N	%
Types of House	Bungalow	192	60.4	70	40.2	85	47.0	89	44.7
	Flat (detached)	36	11.3	15	8.6	31	17.1	34	17.1
	Semi-detached	17	5.3	38	21.8	21	11.6	17	8.5
	Compound	61	19.2	51	29.3	26	14.4	55	27.6
	Others	12	3.8	0	0.0	18	9.9	4	2.0
Age of Building	1-5yrs	50	15.8	48	27.6	35	19.3	38	19.1
	6-10yrs	88	27.8	55	31.6	75	41.4	57	28.6
	11-15yrs	132	41.6	45	25.9	43	23.8	72	36.2
	16yrs and above	47	14.8	26	14.9	28	15.5	32	16.1
House ownership	Tenant	205	64.5	88	50.6	99	54.7	122	61.3
	Owner-occupier	113	35.5	86	49.4	82	45.3	77	38.7

Source: Author's field survey, 2022.

The analysis in Table 5.3 shows that bungalows are the most common housing type in North-central Nigeria, particularly in Kogi

State (60.4%). Detached flats are more prevalent in Plateau and FCT, while semi-detached and compound houses are common in Benue State. Storey buildings are notable in Plateau due to the rocky terrain. Most buildings in Kogi and FCT are 11-15 years old, while in Plateau and Benue, they are 6-10 years old. Recent buildings (1-5 years) are more common in Benue, and buildings aged 16 years and older are more prominent in FCT and Plateau. Aged buildings often indicate substandard housing linked to health issues. Most houses in informal settlements are tenant-occupied, especially in Kogi (64.5%), while owner-occupied homes are higher in Benue (49.4%). This trend is likely due to low-income earners, mainly traders, who struggle to upgrade their housing.

Table 5.4: Housing Characteristics across the selected states

Characteristics		Kogi		Benue		Plateau		FCT	
		N	%	N	%	N	%	N	%
Number of Rooms	1-5	86	27.0	49	28.2	43	23.8	46	23.1
	6-10	149	46.9	80	46.0	79	43.6	116	58.3
	11-15	53	16.7	42	24.1	50	27.6	29	14.6
	16 and above	30	9.4	3	1.7	9	5.0	8	4.0
Wall material	Mud unplastered	28	8.8	36	20.7	22	12.2	20	10.1
	Mud plastered	53	16.7	56	32.2	41	22.7	56	28.1
	Block wall unplastered	59	18.6	37	21.3	46	25.4	40	20.1
	Block wall plastered	94	29.6	45	25.9	72	39.8	83	41.7
	Others	84	26.4	0	0.0	0	0.0	0	0.0
Roof material	Thatched	12	3.8	36	20.7	11	6.1	13	6.5
	Asbestos	45	14.2	12	6.9	8	4.4	13	6.5
	PVC	18	5.7	20	11.5	0	0.0	22	11.1
	Concrete	49	15.4	3	1.7	17	9.4	40	20.1
	Zinc	186	58.5	103	59.2	143	79.0	111	55.8
	Others	8	2.5	0	0.0	2	1.1	0	0.0
Floor material	Earth	30	9.4	28	16.1	21	11.6	28	14.1
	Cement	181	56.9	103	59.2	111	61.3	106	53.3
	Terrazo	48	15.1	16	9.2	18	9.9	22	11.1
	Tile	59	18.6	27	15.5	31	17.1	43	21.6
Window type	Glass	44	13.8	20	11.5	35	19.3	47	23.6
	Wood	158	49.7	84	48.3	56	30.9	57	28.6
	Metal and glass	98	30.8	47	27.0	71	39.2	71	35.7
	Mat/Nylon	18	5.7	23	13.2	19	10.5	24	12.1
Ceiling type	Asbestos	112	35.2	82	47.1	97	53.6	89	44.7
	Wood	64	20.1	41	23.6	45	24.9	33	16.6
	Cardboard	102	32.1	19	10.9	18	9.9	24	12.1
	PVC	19	6.0	17	9.8	19	10.5	40	20.1
	Others	21	6.6	15	8.6	2	1.1	13	6.5
Toilet type	Water closet	135	42.5	51	29.3	65	35.9	82	41.2
	Pit latrine	35	11.0	38	21.8	32	17.7	38	19.1
	Open space	148	46.5	85	48.9	84	46.4	79	39.7
Bathroom material	Block plastered	60	18.9	8	4.6	26	14.4	80	40.2
	Block unplastered	96	30.2	30	17.2	61	33.7	42	21.1
	Zinc	122	38.4	27	15.5	47	26.0	60	30.2
	Wood	40	12.6	21	12.1	19	10.5	17	8.5
	Mud plastered	0	0.0	22	12.6	11	6.1	0	0.0
	Mud unplastered	0	0.0	66	37.9	17	9.4	0	0.0

Source: Author's field survey, 2022.

The results in Table 5.4 reveal that most houses in North-central Nigeria have 6-10 rooms, especially in Kogi (46.9%) and Benue (46.0%). Houses with 11-15 rooms are more common in Plateau (27.6%), while those with 16 or more rooms are higher in Kogi (9.4%). Benue has the highest proportion of houses with 1-5 rooms (28.2%). Most building walls in Kogi (29.6%), Plateau (39.8%), and FCT (41.7%) are made of block and plaster, while in Benue, they are mostly made of mud and plaster (32.2%). Unique materials like wood, palm leaves, and iron sheets are notable in Kogi. Regarding roofing, zinc is the dominant material in Plateau (79.0%), Benue (59.2%), Kogi (58.5%), and FCT (55.8%). Thatched roofing is more common in Benue (20.7%), while asbestos roofing is higher in Kogi (14.2%). Buildings with PVC roofing are more common in Benue State (11.5%) compared to FCT (11.1%) and Kogi State (5.7%). Plateau State does not use PVC roofing, likely due to its colder climate. Concrete roofing is more prominent in FCT (20.1%). Other roofing materials, including plank/wood, bamboo, nylon, and stone-coated roofs, are significant only in Kogi (2.5%) and Plateau (1.1%) states. These materials can attract pests, cause moisture build-up, degradation, and structural weakness, and are prone to weather damage, aesthetic flaws, fire hazards, natural disasters, and reduced durability. Prolonged exposure to dust or dirt from these materials may lead to respiratory and eye health issues, according to medical consultants. Table 5.4 indicates that cement is the primary floor material for most buildings in North-central Nigeria, especially in Plateau State (61.3%). Cemented floors, if properly maintained, are strong and long-lasting despite potential cracks that can be repaired. Earth floors, composed of clay, sand, and occasionally manure, are more common in Benue State (16.1%), and are linked to respiratory issues and other health concerns. The table also shows that wooden windows are predominant in Kogi (49.7%) and Benue (48.3%) States, while metal and glass windows are more common in Plateau (39.2%) and FCT (35.7%). Wooden windows, if not well maintained, can be prone to breaking, decaying, and insect attacks, and their functionality can be affected by weather conditions.

The same Table 5.4 show that majority of the ceiling's material are made of asbestos particularly in Plateau State. Wood ceilings are also more common in Plateau, while cardboard ceilings are notable in Kogi. PVC ceilings are more prevalent in FCT. Nylon, bamboo, iron, and open ceilings (no ceiling) are more common in Benue state. Moreover, PVC and asbestos can increase heat, attract insects, and pose health risks. The Table 5.4 also reveals that open defecation is widely practiced in Benue (48.9%), Kogi (46.5%), and Plateau (46.4%) states. In contrast, most residents in FCT use water closets for defecation. Open defecation is common in developing nations with high poverty levels, such as Nigeria, due to a lack of access to sanitary facilities, and it remains prevalent in North-central Nigeria (Chikwe *et al*., 2020). Various studies have highlighted that open defecation poses significant health and environmental risks (Abiodun, 2021; Olu *et al., 2022; Inah et al., 2022).*

It can lead to water pollution when human waste contaminates rivers or waterways, transmitting diseases like cholera, typhoid, and diarrhoea. It also pollutes the air, releasing harmful bacteria and toxins. The accumulation of waste can overwhelm the environment, causing further issues. In addition to water-borne diseases, open defecation is linked to vector-borne illnesses, as flies and other insects are attracted to waste, potentially contaminating food and causing various health problems (Yusuf and Shehu, 2017; Abebe and Tucho, 2020; Obilor et al., 2022).

Table 5.5: Building Conditions across the selected states in North-central, Nigeria

Condition	Kogi	Remark	Benue	Remark	Plateau	Remark	FCT	Remark
WCI	0.68	Fair	0.68	Fair	0.76	Good	0.66	Fair
RCI	0.74	Fair	0.69	Fair	0.70	Fair	0.62	Fair
FCI	0.46	Poor	0.44	Poor	0.42	Poor	0.45	Poor
WIDCI	0.72	Fair	0.77	Good	0.75	Good	0.72	Fair
CCI	0.64	Fair	0.62	Fair	0.71	Fair	0.71	Fair
BCI	0.648	Fair	0.640	Fair	0.668	Fair	0.632	Fair
AGBCI	0.647							Fair

Source: Author's field survey, 2022

Note: WCI -Wall condition index; RCI - Roof condition index; FCI - Floor condition indexWIDCI - Window condition index; CCI- Ceiling condition index; BCI- Building condition index (per state); AGBCI – Aggregate of BCI at North-central

Table 5.5 indicates that building walls in Kogi (0.68), Benue (0.68), and FCT (0.66) are in fair condition, while those in Plateau (0.76) are in good condition, likely due to the state's colder climate, which encourages better maintenance. However, walls in fair condition are prone to cracking, which can lead to structural issues and health risks, including increased vulnerability to pests and diseases like Lassa fever (Ben-Enukora *et al., 2021; Izah et al., 2022). The Table 5.5 also shows that the condition of roofs in the selected states and FCT ranges from fair to poor, with indices from 0.2 to 0.74. Kogi has the highest index (0.74) and FCT the lowest (0.62). Poor roof conditions can cause long-term health issues, including respiratory infections (Alexandre et al., 2020). The same result in Table 5.5 shows that floors in the selected states and FCT are in poor condition, with indices of 0.46 (Kogi), 0.44 (Benue), 0.42 (Plateau), and 0.45 (FCT). Poor floor conditions, often damp and mouldy, are linked to respiratory illnesses like asthma and bronchitis (Fakunle et al., 2023). Delayed repairs can also damage building structures. Also, Table 5.5 shows that windows are in good condition in Benue (0.77) and Plateau (0.75) but only in fair condition in Kogi and FCT (0.72). Good windows in Benue and Plateau require little to no repairs, whereas Kogi and FCT need significant repairs due to broken or missing parts.*

However, poor window conditions can lower air quality and allow harmful pollutants, leading to health issues such as headaches and respiratory problems (Akande et al., 2023a and 2023b). The ceiling conditions in the North-central region are generally fair, with significant defects like leaks and rot. The indices range from 0.62 to 0.71, with Plateau and FCT having the highest (0.71) and Benue the lowest (0.62). Leaky or decaying ceilings can lead to moisture accumulation and health issues such as heart problems and lung cancer (Ifyalem and Jakada, 2023; Emetere et al., 2024). The summarized Building Condition Index (BCI) shows most buildings are in "fair condition," with indices of 0.648 (Kogi), 0.640 (Benue), 0.668 (Plateau), and 0.632 (FCT). The aggregate Building Condition Index (AGBCI) for North-central Nigeria is 0.647, indicating mostly fair conditions with deficiencies needing repairs. The health implications could range from acute to chronic illnesses.

Table 5.6: Occupancy ratio across the selected states

Variables		Kogi		Benue		Plateau		FCT			
		N	%	N	%	N	%	N	%	X2	P
Total Number of Persons in Room	1-5	118	37.1	78	44.8	77	42.5	38	19.1	97.167	0.000
	6-10	156	49.1	84	48.3	90	49.7	111	55.8		
	11-15	20	6.3	12	6.9	14	7.7	47	23.6		
	>16	24	7.5	0	0.0	0	0.0	3	1.5		
Total number of Persons in Building	1-5	26	8.2	11	6.3	15	8.3	23	11.6	16.918	0.050
	6-10	65	20.4	41	23.6	28	15.5	36	18.1		
	11-15	103	32.4	36	20.7	48	26.5	50	25.1		
	>16	124	39.0	86	49.4	90	49.7	90	45.2		

Source: Author's field survey, 2022.

Table 5.6 shows that the highest number of persons per room in North-central states is between 6-10, especially in FCT (55.8%). The highest number of persons per building is 16 and above, notably in Plateau (49.7%) and Benue (49.4%). This indicates high occupancy rates and overcrowding, reflecting poor housing conditions. Overcrowding negatively impacts housing quality and increases demand on amenities. Chi-square results show significant differences with P-values of 0.000 and 0.050.

Table 5.7: Waste disposal methods and Sources of Water across the selected states

Variables		Kogi		Benue		Plateau		FCT			
		N	%	N	%	N	%	N	%	X2	P
Waste disposal method	Collected	43	13.5	0	0.0	12	6.6	43	21.6	140.724	0.000
	Buried	7	2.2	25	14.4	3	1.7	5	2.5		
	Burnt	35	11.0	34	19.5	28	15.5	27	13.6		
	Unkept	8	2.5	14	8.0	5	2.8	3	1.5		
	Open space	157	49.4	78	44.8	66	36.5	88	44.2		
	Others	68	21.4	23	13.2	67	37.0	33	16.6		
Source of Water	Piped water	76	23.9	4	2.3	10	5.5	39	19.6	100.481	0.000
	Communal piped water	28	8.8	33	19.0	32	17.7	50	25.1		
	River	23	7.2	31	17.8	12	6.6	14	7.0		
	Well	116	36.5	70	40.2	71	39.2	64	32.2		
	Others	75	23.6	36	20.7	56	30.9	32	16.1		

Source: Author's field survey, 2022

Table 5.7 reveals that open waste disposal is common across North-central Nigeria, with Kogi State having the highest prevalence. FCT has the highest number of respondents using collected waste disposal services, either public or private, at a minimum charge of ₦1,500 per month. Benue State shows higher percentages of residents who bury or burn their trash, while Plateau State uses various other methods, including dumping in rivers, drainage canals, and roadside areas. Open waste disposal creates breeding grounds for mosquitoes and rodents, releasing odors and spreading diseases. The Chi-square analysis shows a significant difference in waste disposal methods, with a P-value of 0.000.

Regarding water sources, most respondents use well water, especially in Benue State (40.2%). Piped water is more common in Kogi state (23.9%), while communal pipe water is more pronounced in FCT (25.1%). River water usage is higher in Benue state than others. Other sources include seasonal rainwater, boreholes, and water vendors. Plateau State has a higher usage of alternative water sources due to its rocky terrain. The housing characteristics reflect the informal settlement nature of the area, with houses over six years old having cracked walls, loose roofs, and high occupancy rates (6-10 people per room). Poor construction materials and lax planning regulations result in low-quality housing, linked to issues like poor waste disposal, low productivity, and unfavourable social conditions. According to Akinwande and Hui (2024), the informal sector has been the primary supplier of housing since Nigerian independence, with only 20% to 40% of urban development legally sanctioned. The lack of formal sector involvement contributes to poor urban environments, with 75% of urban residents living in substandard conditions (Jiboye, 2020). Overcrowding is widespread, with more than five people per room, negatively impacting health. Studies by Eze (2023), and Imhanfidon *et al. (2023) confirm that overcrowded and unsanitary conditions in Abuja's informal settlements harm residents' health.*

Table 5.8: Factors influencing the location of Informal Settlements in the North-central

Factors	Loading Power	Eigen values	% of Variance	Cumulative %
Neighbourhood livability		5.128	30.162	30.162
Cost of living	0.906			
Concentration of indigenous group	0.883			
Peaceful environment	0.852			
Closeness to work	0.777			
Community association	-0.429			
Environmental		2.389	14.056	44.218
Climatic condition	0.843			
Land acquisition	0.819			
Business activities	0.803			
Water supply	0.733			
3 Spatial		2.083	12.252	56.470
More space for other uses	0.913			
Privacy	0.764			
Chieftaincy title	0.519			
4 Health and Natural		1.692	9.952	66.422
Topography of land	0.862			
Health facilities	0.713			
5 Social		1.466	8.621	75.043
Marriage	0.895			
Basic infrastructural facilities	-0.761			
6 Cultural		1.023	6.018	81.061
Cultural festival	0.914			

Source: Author's field work, 2022

Table 5.8 summarizes the factors influencing the location of informal settlements in North-central Nigeria. The data from the selected states underwent principal component analysis to identify the main triggers. Factors showing multicollinearity (r>0.8) were removed, and the residuals were rotated using the varimax method for better interpretation. There are 17 variables, with the six categorized principal components having eigenvalues ≥1, accounting for 81.1% of the total variance. The six principal components factor categorized based on their loading power are: **(1) Neighbourhood Livability**: Includes cost of living (0.906), concentration of indigenous group (0.883), peaceful environment (0.852), and closeness to work (0.777); **(2) Environmental Factor**: Includes climatic condition (0.843), land acquisition (0.819), business activities (0.803), and water supply; **(3) Spatial Factor**: Includes more space for other uses (0.913), privacy (0.764), and chieftaincy title (0.519); **(4) Health and Natural Factor**: Includes topography of the land (0.862) and health facilities (0.713); **(5) Social Factor**: Includes marriage (0.895) and basic infrastructural facilities (0.761); **(6) Cultural Factor**: Includes cultural festival (0.914). All factors except "community association" (0.429) significantly influence the location of informal settlements. The highest loading factors under each principal component include cost of living (0.906), climatic condition (0.843), more space for other uses (0.913), topography of the land (0.862), marriage (0.895), and cultural festival (0.914).

Table 5.9: Description of factors influencing the occurrence of diseases/illnesses in north-central, Nigeria

Factors	Loading Power	Eigen values	% of Variance	Cumulative %
Hygiene, living and building conditions		9.314	44.35	44.35
Overcrowding	0.863			
Malnourishment	0.816			
Unhygienic environment	0.834			
Unclean toilet	0.788			
Unclean kitchen	0.785			
Inappropriate land use	0.786			
Natural ageing of building	0.650			
Lack of building maintenance	0.686			
Pollution		2.397	11.42	55.77
Air pollution	0.774			
Noise pollution	0.899			
Affordability		1.893	9.01	64.78
Self-medication	0.617			
Lack of finance	0.802			
Hazardous land	0.748			
4. Health-related issue (I)		1.670	7.95	72.74
Poor access to health care	0.829			
Hereditary disease	0.835			
5.Health-related issue (II)		1.340	6.38	79.12
Cost of health center	0.823			
Poor source of water	-0.582			
Fear of medical attention	0.675			
6. Environmental condition		1.140	5.43	84.54
Weather condition	0.920			
Poor ventilation	0.653			

Source: Author's field work, 2022

Table 5.9 outlines the perceived factors influencing illness/disease incidence in North-central Nigeria. Using principal component analysis, factors showing multicollinearity (r>0.8) were removed. The remaining factors were rotated using the varimax method to simplify interpretation, resulting in six principal components accounting for 84.5% of the total variance: (1) Hygiene, Living, and Building Conditions with the highest loading factor of 0.863 (Overcrowding); (2) Pollution: "Noise pollution (0.899)"; (3) Affordability: "Lack of finance (0.802)"; (4) Health-related Issue (I): "Hereditary disease (0.835)"; (5) Health-related Issue (II): "Cost of health center (0.823)"; (6) Environmental Condition: The highest loading factor is "Weather condition (0.920)". However, informal settlements in North-central Nigeria are linked to rapid population growth outpacing economic growth, leading to overcrowding and strained infrastructure. Low-income earners primarily inhabit these areas due to affordable housing, resulting in poor living conditions and limited access to social and medical services. This trend aligns with Ogunleye *et al. (2018), highlighting that Nigeria's urban population growth outpaces its economic growth, affecting health and social services.*

Table 5.10: Demographic characteristic of residents that visit Primary Health Care

State	Areas	Primary Health Care				Gender		
		Female		Male			Overall Total per State	
		N	%	N	%	Gender	N	%
Benue	Adeke	930	65.1	498	34.9	Female	1 844	59.5
	Fiidi	917	54.7	758	45.3	Male	1 256	40.5
Kogi	Lokongoma	383	65.7	200	34.3	Female	470	66.6
	Old-market	87	70.7	36	29.3	Male	236	33.4
FCT	Old-kutunkun	709	62.6	424	37.4	Female	4 658	67.2
	Township clinic	1659	67.7	792	32.3			
	Tungan maje	747	70.0	320	30.0	Male	2 276	32.8
	Zuba	1543	67.6	740	32.4			
Plateau	Jenta-adamu	1088	66.1	559	33.9	Female	2 250	65.8
	Kabong- Rukuba	503	65.8	261	34.2			
	New-kabong	188	64.4	104	35.6	Male	1 167	34.2
	Utan	471	66.0	243	34.0			

Source: OPD Register of Primary Health Care Centres in Benue, Kogi, FCT and Plateau State; and Author's compilation, 2022

Table 5.10 presents the gender users of primary health care (PHC) in North-central Nigeria. The data reveals that in Benue State (59.5% female and 40.5% male) residents visited PHC; Kogi State (66.6% female and 33.4% male); FCT (67.2% female and 32.8% male) and Plateau State (65.8% female and 34.2% male) residents visited PHC. This implies that female residents are the prominent users of PHC, especially in FCT (67.2%), possibly due to easy accessibility and functionality. Benue State has the highest of male users of primary health care (40.5%), which might be related to activities such as smoking and drinking local alcohol.

Table 5.11: Summary of medical record on occurrence of Illnesses across the Selected States

Illnesses	Benue (n=3100)		FCT(n=6934)		Kogi(n=706)		Plateau(n=3417)	
	N	%	N	%	N	%	N	%
Malaria	2868	92.5	5896	85.0	627	88.8	2867	83.9
Typhoid	3093	99.7	5669	81.8	662	93.8	2682	78.5
Ulcer	16	0.5	69	1.0	5	0.7	33	1.0
Gastroenteritis	6	0.2	67	1.0	8	1.1	25	0.7
Hypertension	2	0.1	109	1.6	6	0.8	35	1.0
Diabetes	6	0.2	76	1.1	0	0.0	16	0.5
Tuberculosis	1	0.0	3	0.0	0	0.0	0	0.0
PUD	3	0.1	104	1.5	0	0.0	21	0.6
Asthma	0	0.0	14	0.2	0	0.0	3	0.1
Boil	0	0.0	3	0.0	1	0.1	6	0.2
Wound	3	0.1	0	0.0	3	0.4	3	0.1
Rheumatism	1	0.0	0	0.0	0	0.0	0	0.0
Ear Pain	0	0.0	1	0.01	0	0.0	0	0.0
Hepatitis	0	0.0	25	0.4	0	0.0	14	0.4
URT	0	0.0	34	0.5	1	0.1	21	0.6
Fungal Infections	1	0.03	25	0.4	0	0.0	9	0.3
Dermatitis	0	0.0	4	0.1	0	0.0	0	0.0
LRTI	0	0.0	16	0.2	1	0.1	7	0.2

Source: OPD Register of Primary Health Care Centres in Benue, FCT, Kogi, and Plateau State; Author's compilation, 2022

Table 5.11 summarizes health records from selected states in North-central Nigeria for individuals aged 18 to 80 from 2013 to 2022. Major diagnoses in primary health care centers include malaria and typhoid: (i) Benue State: 92.5% malaria, 99.8% typhoid; (ii) FCT: 85% malaria, 81.8% typhoid; (iii) Kogi State: 88.8% malaria, 93.8% typhoid and (iv) Plateau State: 83.9% malaria, 78.5% typhoid. Benue State has the highest incidence of malaria and typhoid, likely due to poor environmental conditions and reliance on untreated river water. High rates of these diseases across North-central states indicate poor sanitation and lack of basic amenities like potable water and proper waste management. Other observed illnesses include ulcer, gastroenteritis, hypertension, diabetes, tuberculosis, PUD, asthma, rheumatism, ear pain, hepatitis, URT, fungal infections, dermatitis, and LRTI. FCT has the highest records for many illnesses, followed by Plateau State, likely due to better accessibility and functionality of primary care facilities.

Inadequate sanitation and lack of potable water increase the risk of infectious diseases in African countries, attracting parasites and disease vectors (Alexandre *et al*., 2020; Zerbo, 2022; Okoro *et al*., 2023; Ogenyi, 2023). Residents' complaints at primary care centers align with diagnoses of malaria, typhoid, and other illnesses linked to poor housing and environmental conditions. However, malaria, caused by parasites transmitted through mosquito bites, had 247 million cases and 619,000 deaths globally in 2021, with 95% of cases and 96% of deaths in the WHO African Region (WHO, 2022a; Cleveland Clinic, 2022). Nigeria's unplanned urbanization leads to a high malaria burden among the urban poor with limited access to quality health services. Effective malaria prevention requires urban management, including adequate housing, piped water, better drainage, and a cleaner environment (WHO, 2022b). Typhoid, a bacterial infection spread through contaminated food and water, thrives in overcrowded cities with inadequate sanitation (Medical News Today, 2022; Birkhold *et al*., 2020). Symptoms include high fever, fatigue, headache, nausea, abdominal pain, and diarrhea. Severe cases can lead to complications like intestinal perforation, hemorrhage, and other serious conditions (Marchello *et al*., 2020).

Studies indicate that inadequate sanitation and lack of potable water increase health risks (Alexandre *et al*., 2020; Zerbo, 2022; Okoro *et al*., 2023; Ogenyi, 2023). The World Health Organization (2023) reports that improved living conditions and antibiotics have reduced typhoid fever in industrialized countries. However, it remains a significant public health issue in Africa, with 11-20 million cases and 12,000-161,000 deaths annually in 2015, and 9 million cases with 110,000 deaths in 2019. Typhoid is more prevalent in areas lacking safe water and sanitation, particularly affecting poor communities and vulnerable groups, including children. Even after symptoms subside, individuals can still spread the bacteria, highlighting the need for timely diagnosis and treatment to prevent complications (Marchello *et al*., 2020).

Hepatitis, tuberculosis, URT, and LRTI are highly contagious diseases transmitted through body fluids, water, and food. Acute diseases progress quickly, while chronic ones can be managed with care. Environmental and housing conditions significantly impact disease development globally (Mi-Hong *et al*., 2021; Edem *et al*., 2021; Hessein *et al*., 2022). Poorly maintained, overcrowded housing increases the risk of diabetes and respiratory diseases. Factors like air pollution, temperature, humidity, water sources, and waste disposal are linked to PUD, gastroenteritis, and respiratory issues. WHO (2018) reported that PUD deaths in Nigeria accounted for 0.26% of total deaths, ranking 54th worldwide. Risk factors include consuming contaminated water and food, using unclean utensils, and contact with infected saliva (National Institute of Diabetes, Digestive and Kidney Diseases, 2014; WHO and UNICEF, 2019). Inadequate ventilation increases the risk of airborne diseases like tuberculosis and indoor pollutants, exacerbating health disparities in disadvantaged neighbourhoods (Sopeyin *et al*., 2020). Conditions in informal settlements severely impact health, emphasizing the need for standard shelter, safe drinking water, sanitation, and hygiene (Hessein *et al*., 2022).

Table 5.12: Correlation Analysis on the incidence of diseases and factors influencing the occurrence.

Correlations			
		Perception of Incidence of Diseases	Perception of factors influencing occurrence of diseases
Perception of Incidence of Diseases	Pearson Correlation	1	0.531**
	Sig. (2-tailed)		0.000
	N	872	867
Perception of factors influencing occurrence of diseases	Pearson Correlation	0.531**	1
	Sig. (2-tailed)	0.000	
	N	867	867

***. Correlation is significant at the 0.01 level (2-tailed).*

Source: Author's field survey, 2022

Table 5.12 reveals a strong correlation (0.531 at 0.01 level) between the perceived incidence of diseases and factors influencing their occurrence. As these factors increase, so does the incidence of diseases. Factors include overcrowding, poor water sources, poor ventilation, and sub-standard housing, leading to diseases such as malaria, typhoid, cough, and abdominal pain. This indicates that each type of illness is closely linked to the factors causing disease in informal settlements in North-central Nigeria. If these issues are not addressed, diseases may gradually increase, leading to long-term health problems for residents.

5.1. Occupancy ratio and resident's health

Table 5.13a: Regression Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	0.675a	0.455	0.449	0.28169

a. Predictors: (Constant), Occupancy ratio

Source: Author's field work, 2022

Table 5.13b: Statistical Significance Test of Regression Model

Model		Sum of square	df	Mean square	F	Sig.
1	Regression	6.163	1	6.163	77.662	0.000b
	Residual	7.380	93	0.079		
	Total	**13.542**	**94**			

Dependent Variable: Residents' health; b. Predictors: (Constant), Occupancy ratio

Source: Author's field work, 2022

Table 5.13c: Regression Coefficients (Coefficients[a])

Model		Unstandardized Coefficients		Standardized Coefficients	T	Sig.
		B	Std. Error	Beta		
1	(Constant)	6.845	0.371		18.439	0.000
	Occupancy ratio	-2.043	0.232	-0.675	-8.813	0.000

Dependent Variable: Residents' health

Source: Author's field work, 2022

A linear regression analysis was conducted to determine the relationship between occupancy ratio and residents' health in North-central Nigeria. The dependent variable is residents' health, while the independent variable is the occupancy ratio. Illness variables were summarized into one using SPSS, and the dependent variable was regressed on the occupancy ratio.

Results (Tables 5.13a-5.13c) show that the relationship is significant (F-value of 77.662 and P-value of 0.000), with a correlation coefficient (R) of 0.675 and a coefficient of multiple determination (R^2) of 0.455. This indicates that 45.5% of illnesses can be attributed to the occupancy ratio in informal settlements. Nearly 50% of the variability in residents' health is related to the occupancy ratio, while the remaining variability may be due to other factors. To determine the weight of the components of Occupancy ratio, reference is made to the regression coefficients as shown in Table 5.13c. Using the standardized beta coefficients, the constant "a" would disappear and the regression equation is of the form:

$Y = a + bx$

a = constant

Y= dependent variable (Residents' health);

x = independent variable (Occupancy ratio).

The formula turns out to be: Y (i.e. Residents' health) = -0.675x.

This implies that for each change or increase of one unit in independent variable (x) (Occupancy ratio), the mean value of dependent variable (y) (Residents' health) is estimated to change/increase by 0.675 unit.

5.2. The Relationship Between Informal Settlements Locations and Residents' Health in the North-central, Nigeria

Table 5.14a: Regression Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	0.979a	0.959	0.954	.08118

Predictors: (Constant), closeness to work, cost of living, boost business activities, adequate basic infrastructural facilities, peaceful environment, good climatic condition, easy land acquisition, good topography of land, good health facilities and Privacy.

Source: Author's computation, 2022

Table 5.14b: Test of Statistical Significance

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	12.989	10	1.299	197.112	.000b
	Residual	0.554	84	0.007		
	Total	**13.542**	**94**			

Dependent Variable: Residents' health

Predictors: (Constant), closeness to work, cost of living, boost business activities, adequate basic infrastructural facilities, peaceful environment, good climatic condition, easy land acquisition, good topography of land, good health facilities and Privacy.

Source: Author's computation, 2022

Table 5.14c: Regression Coefficients

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	**(Constant)**	1.945	.292		6.657	.000
	Closeness to work	-.193	.055	-.296	-3.508	.001
	Cost of living	.208	.065	.844	3.220	.002
	Privacy	-.017	.059	-.021	-2.83	.778
	Topography of land	.070	.041	.084	1.720	.089
	Land acquisition	.016	.032	.104	.509	.612
	Health facilities	.367	.059	.809	6.223	.000
	Climatic condition	-.208	.046	-.627	-4.487	.000
	Peaceful Environment	.012	.038	.018	.312	.756
	Basic infrastructural facilities	-.277	.046	-1.747	-6.081	.000
	Business activities	.223	.031	1.682	7.210	000

Dependent Variable: Residents' health

Source: Author's computation, 2022

Multiple Regression Analysis was used to explore the relationship between informal settlement locations and residents' health in the study area. Ten variables were used as independent factors: closeness to work, cost of living, business activities, basic infrastructural facilities, peaceful environment, climatic condition, land acquisition, topography, health facilities, and privacy. The dependent variable, residents' health, was derived from a composite variable summarizing various illness. Data for both dependent

and independent variables, initially in nominal or ranking forms, were converted to ratio scales by computing means for each spatial unit, making them suitable for parametric tests. The results of the Multiple Regression Analysis, showing the relationship between informal settlement locations and residents' health, are presented in Tables 5.14a, 5.14b, and 5.14c.

The F-value of 197.112 and P-value of 0.000 in Table 5.14b show a significant relationship between informal settlements' locations and residents' health. With a correlation coefficient (R) of 0.979 and an R^2 of 0.959 (Table 5.14a), approximately 95% of the variation in residents' health is explained by the location of informal settlements, with the remaining 5% due to other factors. The regression coefficients (Table 5.14c) for each factor influencing informal settlements' locations are: 0.296, 0.844, 0.021, 0.084, 0.104, 0.089, 0.627, 0.018, 1.747, and 1.682. Factors with the most impact include health facilities, climatic condition, basic infrastructural facilities, and business activities, followed by closeness to work and cost of living. Topography of the land has less effect on residents' health. Significant P-values (0.000, 0.001, 0.002) for these factors indicate a strong relationship with residents' health in terms of quality, structures, conditions, settings, surroundings, and illnesses. The coefficient result also implies that for a one unit change in closeness to work place, residents' health will change with a unit of 0.296. Also, one unit change in cost of living, privacy, topography of land, land acquisition, health facilities, climatic condition, peaceful environment, Infrastructural facilities and business activities, residents' health will change with a unit of 0.844, 0.021, 0.084, 0.104, 0.089, 0.627, 0.018, 1.747 and 1.682 respectively in the study area.

5.3. Monthly income and health seeking behaviour in north-central, Nigeria

Table 5.15: Monthly Income and Health Seeking Behaviour in Entire Study Area

Monthly Income (N)												
Variables	≤10,000		10,001-20,000		20,001-30,000		30,001-40,000		>40,000			
	N	%	N	%	N	%	N	%	N	%	X2	P
a) Drugs Prescribed by:												
Hospital	98	(47.6)	106	(39.3)	115	(63.2)	104	(77.0)	50	(63.3)	64.85	0.000
Chemist	105	(51.0)	108	(40.0)	79	(43.4)	31	(23.0)	38	(48.1)	28.68	0.000
Family doctor	77	(37.4)	98	(36.3)	72	(39.6)	97	(71.9)	42	(53.2)	56.72	0.000
Family nurse	126	(61.2)	141	(52.2)	94	(51.6)	38	(28.1)	41	(51.9)	36.83	0.000
Pharmacist	161	(78.2)	211	(78.1)	131	(72.0)	122	(90.4)	71	(89.9)	22.06	0.000
Friends	94	(45.6)	154	(57.0)	58	(31.9)	27	(20.0)	25	(31.6)	64.25	0.000
Native doctor	202	(98.1)	264	(97.8)	175	(96.2)	133	(98.5)	79	(100.0)	4.50	0.343
Street drug vendor	165	(82.1)	190	(72.5)	109	(64.1)	43	(32.8)	44	(57.1)	94.63	0.000
b) Use of:												
Anointing oil	142	(68.9)	193	(71.5)	101	(55.5)	46	(34.1)	36	(45.6)	67.43	0.000
Sanctified water	136	(66.0)	178	(65.9)	85	(46.7)	41	(30.4)	34	(43.0)	65.54	0.000
Mantle handkerchief	116	(56.3)	172	(63.7)	77	(42.3)	34	(25.2)	30	(38.0)	65.48	0.000
Spiritual deliverance	43	(20.9)	78	(28.9)	31	(17.0)	13	(9.6)	10	(12.7)	26.10	0.000
Self-medication	176	(85.4)	213	(78.9)	143	(78.6)	53	(39.3)	48	(60.8)	106.68	0.000
c) Visit to:												
Public Health centre	149	(72.3)	231	(85.6)	117	(64.3)	116	(85.9)	57	(72.2)	37.23	0.000
Public Teaching Hospital	132	(64.1)	223	(82.6)	123	(67.6)	116	(85.9)	56	(70.9)	35.53	0.000

Monthly Income (N)												
Variables	**≤10,000**		**10,001-20,000**		**20,001-30,000**		**30,001-40,000**		**>40,000**			
	N	**%**	**N**	**%**	**N**	**%**	**N**	**%**	**N**	**%**	**X2**	**P**
Maternity	184	(89.3)	249	(92.2)	168	(92.3)	125	(92.6)	74	(93.7)	2.27	0.686
Pharmacy	31	(15.0)	39	(14.4)	39	(21.4)	10	(7.4)	6	(7.6)	15.74	0.003
Herbal Center	84	(40.8)	149	(55.2)	92	(50.5)	96	(71.1)	37	(46.8)	32.18	0.000
Faith Healing Center	32	(15.5)	54	(20.0)	38	(20.9)	80	(59.3)	27	(34.2)	98.32	0.000
Private Clinic	141	(68.4)	195	(72.2)	108	(59.3)	112	(83.0)	56	(70.9)	21.61	0.000
Private Hospital	133	(64.6)	198	(73.3)	94	(51.6)	41	(30.4)	36	(45.6)	79.75	0.000
Family Nurse	94	(45.6)	137	(50.7)	93	(51.1)	103	(76.3)	42	(53.2)	34.58	0.000
Family Doctor	143	(69.4)	181	(67.0)	115	(63.2)	44	(32.6)	41	(51.9)	58.41	0.000
d) Others												
Free Medical Outreach	189	(91.7)	257	(95.2)	171	(94.0)	127	(94.1)	75	(94.9)	2.61	0.625

Source: Author's field work, 2022

The relationship between monthly income and health-seeking behaviour in North-central Nigeria was examined using chi-square analysis. A p-value of less than 0.05 indicates a significant association. Monthly income ranges from ₦10,000 to over ₦40,000, while health-seeking behavior variables include:(a) Drugs prescribed by various sources: Hospital, chemist, family doctor/ nurse, pharmacist, friends, native doctor, street drug vendor; (b) Alternative treatments: Anointing oil, sanctified water, mantle/ handkerchief, spiritual deliverance, self-medication; (c) Healthcare facilities: Public health centers, teaching hospitals, maternity facilities, pharmacies, herbal centers, faith healing centers, private clinics/hospitals, family nurse/doctor; (d)Other methods: Free medical outreach. Table 5.15 shows a significant relationship between monthly income and health-seeking behaviour (p-value 0.000-0.003) except for "drugs prescribed by native doctor" and "visits to maternity and free medical outreach," with p-values of 0.343, 0.686, and 0.625, respectively. This indicates a statistically significant association between monthly income and health-seeking behaviour for most variables.

6. CONCLUSION AND RECOMMENDATIONS

This study examined the relationship between informal settlements and residents' health in North-central Nigeria, specifically in FCT, Kogi, Benue, and Plateau states. The findings highlighted that poor physical and socioeconomic conditions in these areas negatively impact health and lead to unsustainable urban development. Despite their challenges, informal settlements contribute to urban growth by providing housing for the urban poor who cannot afford formal housing. However, the study concluded that, there is a notable link between residing in informal settlements and the prevalence of diseases among the inhabitants. Therefore, it is necessary to give these areas top priority for improvements, management, renewal and political action. In light of this, the following recommendations are highlighted with a view to reducing informal settlements and enhancing the livelihoods and health of the dwellers:

- Preventing the expansion and managing the informal settlements
- Improving the sanitation ad waste management
- Enhancing health infrastructure and accessibility
- Economic empowerment and livelihood improvements
- Housing quality and tenancy regulation
- Fostering community participation and awareness
- Integrated policy approach

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Notes