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Evaluation of Inner-City Residential Neighborhood's Capacity to Respond to Health-Related Shocks in Ondo State, Nigeria

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Abstract

Inner-city residential neighbourhoods in developing countries are crucial urban systems that influence the social and spatial dynamics of health outcomes. Their exposure and ability to react to health-related challenges are influenced by their historical, physical, and socio-environmental characteristics. This study employs a mixed-methods approach to investigate the ability of inner-city neighbourhoods in selected cities in Ondo State, Nigeria, to respond to health emergencies. Data was gathered through questionnaires administered to randomly selected 440 consenting respondents and in-depth interviews with 20 family heads and members of neighbourhoods' associations. Descriptive analysis reveals that malaria is the most prevalent health-related challenge (mean = 4.16), while tuberculosis is the least reported (mean = 1.12) across the selected neighbourhoods. Mann-Whitney U test reveals significant spatial variations in the distribution and incidence of health-related challenges across the selected inner-city residential neighbourhoods. This reflects underlying socio-spatial disparities in the neighbourhoods. Furthermore, ordinal logistic regression analysis shows that the effects of green space characteristics on health outcomes are context-dependent, impacted by their quality, accessibility, safety, and level of organization. Results further indicate that inadequate infrastructure, unfavourable environmental conditions, and limited access to healthcare hinder the neighborhood-level response capacity during health emergencies. These increase the neighbourhoods' vulnerability to recurrent health-related challenges. This study suggests, among other things, the need for urban design strategies that prioritize safe, functional, and well-maintained neighbourhoods' structure, infrastructure, and environmental management.

Keywords: Inner-City Neighborhood's, Urban Health, Green Spaces, Neighborhood's Effects

1. Introduction

Public health security is threatened by the health-related concerns of the twenty-first century [1]. Health shocks such as infectious diseases, pandemics, epidemics, and environmentally induce health hazards, and impact health outcomes. They occur at the global and local levels with varying magnitudes and impacts. For instance, at the individual, neighbourhood, and city levels, the incidents of health-related shocks undermine the full potential of infrastructure, weaken socioeconomic standing, diminish quality of life, and degrade environmental systems. Notably, the challenges heighten the vulnerabilities of the inner-city residential neighbourhoods. They reconfigure spatial and functional structures, and erode social ties [2,3].

The capacity of the neighborhoods to respond effectively to these challenges is directly linked to the physical characteristics, such as housing conditions, social structures, and environmental characteristics [4]. These characteristics significantly impact the ability of the neighbourhoods to endure and operate during emergencies [5-9]. They play an important role in shaping urban stability, equity, development, and resilience while also informing health equality and public health advancement [6,7].

Additionally, growing attention has been drawn to the roles of urban greenery in promoting urban health [10,11]. Epidemiological research identifies that greater self-rated health is associated with both the perceived quality and accessibility to green spaces [12]. Emerging studies, however, draw attention to the discrepancies in the demographic factors and analytical techniques of neighbourhoods' green spaces and health-related outcomes [13,14]. Furthermore, studies highlight unequal distribution of the health benefits of green spaces, particularly between cities in the Global North and Global South. These disparities contribute significantly to persistent urban health challenges in the inner-city residential neighbourhoods of the developing countries [15].

Over time, public health challenges and health-related shocks in Ondo State take various dimensions and different manifestations. For instance, in 2022, the state was classified as Nigeria's thirteenth most cholera-affected state, and currently experiencing Lassa fever outbreak. These occurrences highlight the vulnerability of urban neighbourhoods and underscore the need for neighborhood-level responses that shape the environmental quality, urban sustainability, and well-being [16-18]. Literature suggests a paucity of appropriate frameworks and techniques that fortify inner-city residential neighbourhoods against health-related shocks. Furthermore, the need for empirical studies that systematically analyse the potential of inner-city residential neighbourhoods in Ondo State to resist, respond, and cope with health-related challenges cannot be overemphasized.

This study examines the responsive capacity of inner-city residential neighbourhoods in Ondo State, Nigeria, to health emergencies. It provides valuable insights into the spatial and social discrepancies in residential and neighbourhood conditions towards a targeted urban and neighbourhood reform. Findings contribute to the growing discussions on urban resilience and public health. It also offers evidence-based recommendations for context-sensitive planning and public health interventions in the rapidly urbanizing neighborhoods.

1.1. Literature Review

1.1.1. Public Health Challenges in Ondo State

Public health in Ondo State has experienced different dimensions over time. The state has seen a variety of health-related challenges that constitute a wide range of effects on the livelihoods, means of subsistence, and general well-being, particularly in the inner-city residential neighbourhoods. For instance, between 2011 and 2018, the State recorded 1,599 cases of cholera. This corresponds to about 200 cases annually on average throughout the state. Furthermore, 236 cases of the disease were reported in 2022, making the State the thirteenth most cholera-affected State in Nigeria. Furthermore, COVID-19, a highly contagious disease with significant effects on human lives, national economies, and the spatial organization spread across nations, continents, and the entire world [9]. Worldometer (2024) and the NCDC (2022) COVID-19 condition report show that Ondo State recorded 5173 cases and 109 deaths, Emerging literature identifies Lassa fever as a common viral hemorrhagic illness in West Africa, with severe and acute challenges. According to confirmed that cases of Lassa fever in Ondo State increased steadily each year between 2020 and 2026 (Table 1). The Table reveals that in 2023, the State recorded 433 confirmed cases, which designated the state a national hotspot of the health challenge. In 2025, 30 deaths and 249 more cases were reported. Argue that Lassa fever occurrences in Nigeria exhibit notable spatial clustering, with the highest number of cases occurring in Owo LGA. The authors project the possibility of a future increase in the occurrences of Lassa fever with consequent expansion of public health concerns. This pattern emphasises the critical need for improved early warning systems, increased community involvement, and focus on the socio-environmental determinants of urban health (Cadmus et al., 2023; Akindokun, Adeleye, & Olorunlowu, 2024; Al-Mustapha et al., 2024).

Year	Confirmed Cases	Suspected Cases	Deaths	Case Fatality Rate
2020	423	1502	83	19.6
2021	175	1006	47	26.9
2022	348	1683	54	15.5
2023	433	2665	50	11.6
2024	400	2613	27	6.8
2025	367	2767	51	13.9
2026	16	89	1	6.3
Source: NCDC, (2023); (2025); Adewumi et al., 2025				

Table 1: Reported Annual Cases of Occurrences and Deaths from Lassa fever In Ondo State

Epidemiological studies identify malaria as a major source of morbidity and mortality across sub-Saharan Africa. Malaria constitutes a public health concern in Nigeria, especially in neighbourhoods with poor and inconsistencies in the socioeconomic status, access to healthcare, and climate effects. Ondo State demonstrates a notable malaria burden, with approximately 30 out of every 100 residents affected. Studies identify rapid urbanisation, environmental circumstances, demographic pressures, and wider ecological variables as the major factors driving transmission in the health challenges.

Table 2 reveals that the malaria outbreak in Ondo State was highest in 2010 when the State recorded 378,650 cases and 150,070 deaths, whereas the lowest case of occurrences was recorded in 2022 with 281,360 cases and 95,300 deaths. point to spatiotemporal inequalities such as unsuitable land-use policies, restricted access to healthcare services, and poor environmental cleanliness as the contributing factors for the annual increase in case numbers. More so, literature identifies vulnerable cities such as Owo, Ondo, Akure, and Akoko. The cities face heightened urbanisation pressures, inadequate urban planning, unsuitable land-use patterns, and poor neighbourhood conditions.

Year	Incidence Rate (Cases per Thousand)	Infection Prevalence (per Hundred)	Mortality Rate (Death per 100 Thousand)
2010	378.65	41.31	150.07
2011	359.26	38.91	139.11
2012	343.38	36.70	133.81
2013	328.01	34.63	126.05
2014	316.48	33.12	123.05
2015	305.47	31.50	117.21
2016	294.92	30.13	114.31
2017	300.54	31.23	109.28
2018	305.80	32.25	108.18
2019	304.51	32.49	106.65
2020	312.12	33.74	107.83
2021	296.26	31.55	104.56
2022	281.36	30.55	95.30
Source: Akinnubi et al. (2025)			

Table 2: Longitudinal Trends of Malaria Burden in Ondo State (2010 – 2022)

Measles is another contagious viruses that affects many individuals worldwide. It is widely recognised as the eighth most common cause of death in children under five (Cagney, 2006; Ibrahim, Usman, Mohammed, Datti, Okunromade, Abubakar, & Nguku, 2019). In 2019, Ondo State accounted for 18.3% of all confirmed cases of measles in Nigeria, and has since been on the increase, as shown in Table 3. The Table reveals that the State had the highest number of measles cases in 2023, with the possibility of an increase in future outbreaks (NCDC, 2022). Furthermore, Odeyemi & Simon-Oke (2023) report the prevalence of tuberculosis among symptomatic individuals and the risk areas in Ondo State.

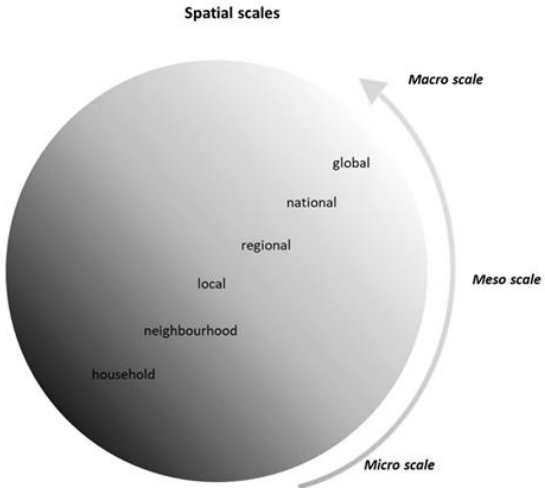
Year	Suspected Cases	Confirmed Cases	Percentages of Occurrences
2019	467	51	18.3%
2020	169	15	15.4%
2021	331	41	12.4%
2023	538	55	10.2%
2024	399	32	8.0%
2025	299	19	6%
Source: Compiled from NCDC measles situation reports			

Table 3: Measles Cases in Ondo State from 2019 To 2025

In sum, the occurrences of health-related challenges in Ondo State transcend regional traditions, belief systems, political power structures, environmental circumstances, and general health practices. Geographical variety, sociocultural and political drivers, and spatiotemporal elements are all evident in the occurrences. According to Kaduru, Godwin, Akeboi, Cyril-Egware, Uzoma, Vivian, and Gayawan (2025), neighbourhood connectedness, accessibility, and ineffective innate characteristics are key factors in the spread and general health susceptibility. More so, socioeconomic inequality, sanitation standards, housing quality, and general neighbourhood circumstances are other significant factors.

1.1.2. Neighborhood's Characteristics and Health

There is a long history of research on the connection between social and geographic neighbourhood features and health, with findings showing strong but inconsistent relationships [19]. This confirms that global health crises are strongly associated with neighbourhood characteristics [20]. Dimian, Apostu, Vasilescu, Aceleanu, & Jablonsky, 2021; Akindokun, Adeleye, & Olorunlowo, 2024; Payi, Abaver, & Apalata, 2025). As illustrated in Figure 1, authors contend that health-related shocks are spatial phenomena that take place at micro (households and neighbourhoods), meso (local and regional), and macro (national and global) levels (Augustin, Andrees, Walsh, Reintjes, & Koller, 2023; Favarão Leão, Gierbolini-Rivera, Franco Silva, Shaw, O'Connor, Salvo, & Siqueira 2025).



Source: Augustin, et al (2023).
Figure 1: Spatial Scales in Health

Empirical findings highlight how environmental, social, and spatial elements interact intricately to affect the occurrence, severity, impacts, and results (Campbell & Jovchelovitch, 2000; Baker, Mahmud, Miller, Rajeev, Rasambainarivo, Rice ... & Metcalf, 2022; Rai, Adhikary, Ghosh, Samaddar, Chowdhury, & Si, 2025). Particularly, the spatial hierarchy, among other factors, is an essential tool for neighborhood-level health visualisation (Maede & Emch, 2010; Bourke, Humphreys, Wakerman, & Taylor, 2012). Abdullahi and Gunawardena (2021); attribute the effectiveness and reactions to health-related challenges to poor quality and accessibility of neighborhood-level services and amenities [21]. For instance, early disease identification, treatment, and containment are hampered by poor road connectivity, low access to medical services, and inadequate water and sanitation systems. Furthermore, Raghupathi and Raghupathi (2020) assert that citizens' health status is influenced by socioeconomic activities. This imply that residents with lower socioeconomic status are more susceptible to infectious diseases. Inner-city residential neighbourhoods' exposure and ability to respond to pandemics are impacted by differences in income, education, and social and physical resources [22].

In sum, neighbourhoods' socio-physical characteristics are found to exhibit a significant impact on health outcomes. This illustrates how unequal health possibilities are shaped by enduring differences in both spatial and aspatial neighbourhood features (Bell, Wilson, Bissonnette, & Shah, 2013). When taken as a whole, these findings highlight the necessity of addressing the contextual and structural aspects of health-related shocks in inner-city residential neighbourhoods as part of larger plans to promote resilient, egalitarian, and healthier neighbourhoods. Improving neighbourhood quality through improved housing, inclusive neighbourhood design, equitable service delivery, and greater social cohesion remains vital for reducing health disparities and building resilient urban environments (Acklin, Graham, & Benjamin-Chung, 2025) [23].

2. Neighbourhood Green Spaces

Urban green spaces are the critical component of urban systems [24,25]. They are the natural or semi-natural places within the cities, such as parks, gardens, street trees, green corridors, and vegetated areas that offer good air quality, thermal regulation, and psychological well-being [26,27]. They are multifaceted urban assets with spatial, environmental, social, and perceptual dimensions. As part of urban infrastructure, neighbourhoods' green spaces showcase social services, the environment, and the ecosystem capacities. It contributes to a sustainable and livable urban environment, provides benefits to the environment and the urban population [28-30].

Neighbourhoods in the developing countries depend on the dynamics of green spaces for a health-supportive urban environment [31]. This determines the capacity of neighbourhoods to foster resilience, environmental sustainability, improve wellbeing, and

promote health [13,31-35]. In the face of diverse urban challenges, urban vegetation provides opportunities for achieving local and global sustainable development goals [36].

Furthermore, urban greenery is directly linked to a number of positive health effects, such as lower levels of stress, better cardiovascular health, improved mental health, and stronger social cohesion [10,11]. In a similar vein, epidemiological research shows that greater self-rated health is associated with both the perceived quality and accessibility to green spaces [12]. Other studies, however, draw attention to the discrepancies in the demographic factors and analytical techniques of neighbourhoods' green spaces and health-related outcomes [13,14].

However, studies highlight unequal distribution of the health benefits of green spaces, particularly between cities in the Global North and Global South. According to the World Health Organization, inequalities such as socioeconomic disparities, spatial disparities, and variations in quality and accessibility all contribute to the recurrent urban challenges in the inner-city residential neighbourhoods of developing countries. Consequently, the contradictory results highlight the necessity for context-sensitive, multifaceted, and equity-focused methods to comprehending and planning neighbourhoods' green spaces [15].

Annear, Cushman, & Gidlow et al. argue that people who live in areas with subpar social and physical environments seem to interact with the environment less frequently [37]. More so, lower-quality green space may not be as helpful for promoting physical activity or a healing experience. Neighbourhood green space quality indicators typically constitute predictive value for health. The naturalness of residential neighbourhoods is associated with greater overall wellbeing [38]. Thus, the quality of green space tends to be a more accurate indicator of health obtained through direct and indirect use of neighbourhoods' green spaces [39,40]. Thus, the need to investigate the availability and use of neighbourhood green spaces for responses to health-related shocks. More so, this study aligns with the UN Sustainable Development Goal Number 11, which strives to provide everyone with secure, inclusive, and accessible green and open places [41].

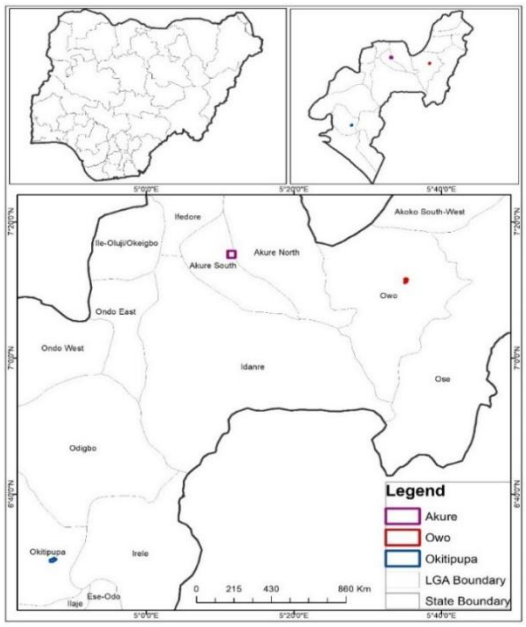
3. Materials and Methods

Ondo State has a projected population of 5,499,334 inhabitants distributed across 18 Local Government Areas and three senatorial districts of the State. Three (3) cities, namely: Akure, Owo, and Okitipupa, each from the senatorial districts of the State, were randomly selected for the study (Figure 2). The selected cities significantly contribute to the overall population and growth dynamics of the State. Additionally, they exhibit documented experiences of health-related crises over the past decade.

In Akure, the selected inner-city residential neighbourhoods are those located within the Ijomu/Obanla political wards of the city [42,43]. In Owo, the Iloro political ward comprises the most culturally significant inner-city neighbourhoods. Similarly, in Okitipupa, the inner-city residential neighbourhoods located within Okitipupa Ward II represent the historical origin of the city and hold other cultural significances. A total of twenty-seven (27) inner-city residential neighbourhoods were randomly selected for the study. These comprise twelve (12) in Ijomu/Obanla political ward in Akure, nine (9) in Iloro political wards in Owo, and six (6) in Okitipupa ward II in Okitipupa.

A mixed-methods approach was deployed to achieve the study's objective. Quantitative data were collected using closed-ended questionnaires administered to 440 respondents with 95.5% retrieval rate. Respondents comprise household heads or the willing adult respondents selected using simple random sampling across the inner-city residential neighbourhoods. The questionnaire was sequentially organized, easy to follow, and standardized for consistency. More so, qualitative data that comprised 6 key sub-theme variables through 20 semi-structured interviews was collected.

Descriptive analysis of the socio-demographic characteristics of the respondents was conducted. Mean ranking was also conducted for the occurrences of health-related challenges in the selected residential neighbourhoods. Variances and similarities in the occurrences across the selected neighbourhoods were established through the Mann-Whitney U test. More so, the impact of socio-physical and green space features on a neighborhood's ability to react to health-related shocks was investigated using ordinal logistic regression. Quantitative data were analysed using Statistical Package for Social Sciences (SPSS version 25), while qualitative data were analyzed using thematic content analyses.



Source: Researcher's work 2025

Figure 2: Map of Ondo State Showing the Study Areas

4. Results and Discussions

4.1. Socio-Demographic Characteristics

As shown in Table 4, the socio-demographic characteristics of respondents throughout the selected inner-city residential neighbourhoods in the study locations offer insights into the socioeconomic profiles and population composition of neighbourhoods. The table shows that a higher percentage of male respondents, 231 (55.0%), participated in the survey, while female respondents accounted for 189 (45.0%). These results supports earlier research on higher levels of male participation in housing and neighbourhood decision-making in Nigeria [9,44]. According to the age distribution of the respondents, 146 (34.8%) were between the ages of 18 and 30, followed by 86 (20.5%) who were between the ages of 31 and 40, 78 (18.6%) were between the ages of 41 and 50, 71 (16.9%) were between the ages of 51 and 60, and 39 (9.3%) were over 60years of age. These findings imply that the majority of the respondents are of working age and engaged in the economy. This corroborates the findings of Virk et al. that classify population composition in Nigeria as potentially young, productive, and capable of resilient and adaptable behaviours [20].

Educational attainment of the respondents across the selected neigbourhoods indicates that 32 (7.6%) of the respondents had no formal education, 27 (6.4%) completed primary education, 221 (52.6%) possess secondary school leaving certificates, and 138 (32.9%) had tertiary education. This distribution shows that respondents have a good grasp of neighbourhood conditions as well as a comparatively high level of literacy and awareness. Consistent with Gülsoy et al., results demonstrate the beneficial impact of education on awareness, readiness, and adaptability to challenges within neighbourhood contexts [21].

The Table also shows respondents' employment status as 86 (20.5%) were unemployed, 142 (33.8%) worked in the public or private sector, 170 (40.5%) were self-employed, and 22 (5.2%) were retired. Accordingly, 171 (40.7%) of the respondents earn less than the minimum wage of ₦70,000 monthly, 98 (23.3%) earn between ₦71,000 and ₦100,000 monthly, another 98 (23.3%) earn between ₦101,000 and ₦200,000 monthly, 39 (9.3%) earn between ₦200,000 and ₦500,000, and 14 (3%) earn above than ₦500,000 monthly. These findings highlight the dominance of informal economic activity in inner-city residential neighbourhoods in Ondo State. The findings justify socioeconomic inequality, economic instability, and vulnerability in the neighbourhoods. These results are also consistent with Dagunduro and Jiboku's findings that although the informal sector provides employment opportunities and income for the urban poor, persistent economic fragility and inequality deepen neighbourhood vulnerability [18].

Marital status of the respondents reveals that 238 (56.7%) were married, 78 (18.6%) were single, 27 (6.4%) were divorced, and 49 (11.7%) were widows or widowers. This implies that robust family and household structures can impact social vulnerability in neighbourhoods and promote social cohesiveness. The results in agreement with Okedare and Fawole suggest the existence of comparatively strong family and household systems that maintain social support networks within inner-city residential neighbourhoods [3].

Housing tenure across the study areas indicates that 133 (31.7%) of the respondents live in self-owned houses, 169 (40.2%) live in rented apartments, 84 (20.0%) live in family-owned houses, and 34 (8.1%) live in inherited houses. Results reveal that the majority of the residents of inner-city residential neighbourhoods are semi-

permanent residents. According to Qi et al., residential stability, social cohesiveness, investment, and participation, all of which contribute to neighbourhood survival, are significantly influenced by house tenure systems [4].

Household size varies across the study areas, with 134 (31.9%) of households comprising 1–3 members, 178 (42.4%) comprising 4–6 members, 78 (18.6%) comprising 7–10 members, and 30 (7.1%) comprising more than 10 members. This indicates the dominance of medium-sized households within the study area. Analysis of length of residence shows that 168 (40.0%) of respondents had lived in their neighbourhoods for less than five years, 135 (32.1%) for 5–10 years, 56 (13.3%) for 11–20 years, and 61 (14.5%) for more than 20 years.

The size of households varies among the respondents across the selected inner-city residential neighbourhoods. Results reveal that 134 (31.9%) of respondents belong to families of 1-3 persons living together, 178 (42.4%) belong to 4-6, 78 (18.6%) belong to 7-10, and 30 (7.1%) are more than 10. This shows that medium-sized households predominate the study areas. More so, analysis of length of stay in the neighbourhoods shows that 168 (40.0%) of the respondents had lived in their neighbourhoods for less than five years, 135 (32.1%) had lived between 5 -10 years, 56 (13.3%) had lived between 11-20 years, while 61 (14.5%) had lived more than 20 years. These results reflect a considerable level of residential mobility and relatively low long-term settlement stability. These adversely affect neighbourhood responses to health-related challenges. The findings align with Gepty et al. that high rates of residential turnover weaken social cohesion, neighbourhood ties, and collective efficacy [23].

Variables	**Selected neighborhoods in Akure (n = 158) Freq. (%)**	**Selected neighborhoods' in Owo (n =127) Freq. (%)**	**Selected Neighborhoods in Okitipupa (n =135) Freq. (%)**	**Total Freq. (%)**
Gender				
Male	107(67.7)	48(37.8)	76(56.3)	231(55.0)
Female	51(32.3)	79(62.2)	59(43.7)	189(45.0)
Age Range				
18yrs -30yrs	46(29.1)	73(57.5)	27(20.0)	146(34.8)
31yrs-40yrs	32(20.3)	22(17.3)	32(23.7)	86(20.5)
41yrs – 50yrs	32(20.3)	15(11.8)	31(23.0)	78(18.6)
51- 60yrs	31(19.6)	7(5.5)	33(24.4)	71(16.9)
Above 60yrs	17(10.8)	10(7.9)	12(8.9)	39(27.0)
Level of Education				
No formal education	24(15.2)	4(3.1)	6(4.4)	32(7.6)
Primary	16(10.1)	2(1.6)	9(6.7)	27(6.4)
Secondary	84(53.2)	56(44.1)	81(60.0)	221(52.6)
Tertiary	34(21.5)	65(51.2)	39(28.9)	138(32.9)
Employment Status				
Unemployed	37(23.4)	24(18.9)	25(18.5)	86(20.5)
Employed	55(34.8)	28(22.0)	59(43.7)	142(33.8)
Self-Employed	58(36.7)	72(56.7)	40(29.6)	170(40.5)
Retired	8(5.1)	3(2.4)	11(8.1)	22(5.2)
Average Monthly Income				
Below N70,000	50(31.6)	82(64.6)	39(28.9)	171(40.7)
N71,000 – N 100,000	46(29.1)	22(17.3)	30(22.2)	98(23.3)
N101,000 - N 200,000	35(22.2)	16(12.6)	47(34.8)	98(23.3)
N200,000 – N 500,000	17(10.8)	5(3.9)	17(12.6)	39(9.3)
Above N 500,000	10(6.3)	2(1.6)	2(1.5)	14(3.3)
Marital Status				
Single	41(24.0)	34(26.8)	31(23.0)	78(18.6)
Married	92(58.2)	67(52.8)	79(58.5)	238(56.7)
Divorced	12(7.6)	4(3.1)	11(8.1)	27(6.4)
Widow/Widower	13(8.2)	22(17.4)	14(10.4)	49(11.7)
Housing Tenure Status				
Self-owned	47 (29.7)	44 (34.6)	42 (31.1)	133 (31.7)
Rented	77 (48.7)	37 (29.1)	55 (40.7)	169 (40.2)
Family House	23 (14.6)	26 (20.5)	35 (25.9)	84 (20.0)
Inherited House	11 (7.0)	20 (15.8)	3 (2.2)	34 (8.1)
Household Size				
1-3	52 (32.9)	35 (27.6)	47 (34.8)	134 (31.9)
4-6	62 (39.2)	52 (40.9)	64 (47.4)	178 (42.4)
7-10	31 (19.6)	34 (26.8)	13 (9.6)	78 (18.6)

Above 10	13 (8.3)	6 (4.7)	11 (8.1)	30 (7.1)
Length of Stay in the neighborhood's				
Below 5yrs	67 (42.4)	50 (39.4)	51 (37.8)	168 (40.0)
5 – 10yrs	47 (29.7)	45 (35.4)	43 (31.9)	135 (32.1)
11-20yrs	26 (16.5)	15 (11.8)	15 (11.1)	56 (13.3)
Above 20yrs	18 (11.4)	17 (13.4)	26 (19.3)	61 (14.5)

Table 4: The Socio-Demographic Characteristics of Respondents

4.2. Self-Reported Occurrences of Health-Related Shocks

Table 5 presents the mean ranking results of the frequency of health-related shocks across the selected inner-city residential neighbourhoods. Findings on the occurrences provide information on the public health challenges in Ondo State. According to the table, COVID-19 scored lowest (mean = 1.1266) among health-related challenges in the selected inner-city residential neighbourhoods of Akure. Results across the selected inner-city residential neighbourhoods in Owo reveal the prevalence of malaria (mean = 4.4016), while tuberculosis (mean = 1.0630) ranked the least. Furthermore, the results show that Lassa fever rated lowest (mean = 1.0593) and malaria ranked highest (mean = 3.6667) among health-related issues in the selected inner-city residential neighbourhoods of Okitipupa.

The overall ranking shows that across all selected inner-city residential neighbourhoods in Ondo State, malaria was reported as the most noticeable (mean = 4.1619), whereas tuberculosis cases were the least noticeable health-related challenge (mean = 1.1238). Other health-related challenges ranked are Typhoid fever (mean = 3.0476), measles (mean = 2.2667), cholera (mean = 1.7286), diarrhoea (mean = 1.7238), chickenpox (mean = 1.5333), unnamed (mean = 1.4476), Lassa fever (mean = 1.2857), and COVID-19 (mean = 1.2381).

Results point to a significant prevalence of malaria cases in the inner-city residential neighbourhoods in Ondo State. This corroborates the findings of Ekpa et al. (2023) and Akinnubi et al. (2025) that report high rates of malaria in Ondo State between 2010 and 2022 with a possible annual increase. It is also consistent with the findings of Simon-Oke and Akinbote (2020) and Ajayi et al. (2015) that typhoid fever and malaria are the most common infectious diseases in Ondo State. Poor sanitation, insufficient water supplies, environmental deterioration, and socioeconomic vulnerabilities in inner-city communities are all strongly associated with the occurrence.

Furthermore, this study supports the National Center for Disease Control (NCDC, 2022), Ijaware (2024), and Akingbola et al. (2025) by highlighting the increased susceptibility of densely populated urban inner-city residential areas in Ondo State to a number of physical and health challenges. This corroborates Adewole's (2016) that health-related challenges in inner-city residential neighbourhoods constitutes global concern. Findings provide more insight into the findings of Isere et al. (2021), Cadmus et al. (2023), and Adewumi et al. (2025) about the incidence of Lassa fever in Ondo State and its projections [45].

	Selected Neighborhoods in Akure (n=158)		**Selected Neighborhoods in Owo (n=127)**		**Selected Neighborhoods in Okitipupa (n=135)**		**Total (n = 420)**	
Health-Related Challenges	**Mean**	**Rank**	**Mean**	**Rank**	**Mean**	**Rank**	**Overall Mean**	**Rank**
Malaria	4.3924	1	4.4016	1	3.6667	1	4.1619	1
Typhoid Fever	3.3291	2	2.7953	2	2.9556	2	3.0476	2
Measles	2.5949	3	1.8819	3	2.2444	3	2.2667	3
Diarrhea	2.1392	4	1.0945	8	1.8296	5	1.7238	5
Cholera	1.9494	5	1.7244	5	1.4741	6	1.7286	4
Chickenpox	1.9367	6	1.2835	7	1.2963	7	1.5333	6
Others	1.4051	7	1.0945	9	1.8296	4	1.4476	7
Tuberculosis	1.2025	8	1.0630	10	1.0889	9	1.1238	10
Lassa Fever	1.1266	9	1.7244	4	1.0593	10	1.2857	8
Covid -19	1.1266	10	1.5039	6	1.1185	8	1.2381	9

Table 5: The Self-Reported Occurrences of Communicable Health-Related Shocks in the Study Areas

4.3. Comparative Analysis of Self-Reported Occurrences of Health-Related Challenges across the Study Areas

Table 6 presents the Mann-Whitney U analysis of the variations in health-related challenges across study areas. Results reveal statistically significant differences in the occurrences of cholera (U = 5350.50, Z = −7.48, p = 0.00), Covid-19 (U = 9086.50, Z = −3.03, p = 0.002), lassa fever (U = 8533.50, Z = −4.21, p = 0.000), measles (U = 8244.50, Z = −3.20, p = 0.001), diarrhoea (U = 7412.50, Z = −5.85, p = 0.000), chickenpox (U = 8394.500, Z = -3.718, p = 0.000) in the selected inner-city residential neighbourhoods of Akure and Owo. On the other hand, tuberculosis (p= 0.112) and malaria (p= 0.957) exhibit similarities in the rate of occurrences.

The Table also reveals statistically significant differences in the occurrence of cholera (U = 4538.50, Z = −9.50, p = 0.000), malaria (U = 8730.00, Z = −3.64, p = 0.000), chickenpox (U = 8957.50, Z = −3.72, p 0.000), and other health-related shocks (U = 9533.00, Z = −2.53, p = 0.011) in the selected inner-city neighbourhoods in Akure and Okitipupa. Nonetheless, the selected inner-city residential neighbourhoods showed similar rates of occurrences of COVID-19 (p = 0.921), Lassa fever (p = 0.348), tuberculosis (p = 0.203), typhoid fever (p = 0.111), measles (p = 0.120), and diarrhoea (p = 0.127).

The prevalence of COVID-19 (U = 7746.50, Z = -2.93, p = 0.003), Lassa fever (U = 7147.00, Z = -4.57, p = 0.000), malaria (U = 6997.50, Z = -3.45, p = 0.001), diarrhoea (U = 6997.00, Z = -4.59, p = 0.000), and other health issues (U = 6997.00, Z = -4.59, p = 0.000) differ statistically significantly between the neighbourhoods in Owo and Okitipupa. On the other hand, comparable rates of occurrences of cholera (p = 0.156), tuberculosis (p = 0.702), typhoid fever (p = 0.517), measles (p = 0.098), and chickenpox (p = 0.920) were also noted in the neighbourhoods.

The findings indicate that different inner-city residential neighbourhoods have different rates of health-related challenges. This result emphasises the significance of clear regional differences in the trends and frequency of incidents within the neighbourhoods. It also illustrates the complexity and diversity of urban health issues. Consistent with UN-Habitat , public health is regionally structured, especially at the neighborhood level [1].

	Selected Neighbourhoods in Akure vs Owo			**Selected Neighbourhoods in Akure vs Okitipupa**			**Selected Neighbourhoods in Owo vs Okitipupa**		
Health-Related Challenges	**U**	**Z**	**Sig.**	**U**	**Z**	**Sig.**	**U**	**Z**	**Sig.**
Cholera	5350.500	-7.484	**0.000**	4538.500	-9.503	**0.000**	8036.000	1.420	0.156
Covid -19	9086.500	-3.025	**0.002**	10643.500	-0.100	0.921	7746.500	2.930	**0.003**
Lassa Fever	8533.500	-4.206	**0.000**	10485.500	-0.939	0.348	7147.000	4.570	0.000
Tuberculosis	9683.000	-1.588	0.112	10362.000	-1.273	0.203	8517.000	0.382	0.702
Typhoid Fever	8694.000	-2.238	**0.025**	9669.000	-1.596	0.111	8229.000	0.648	0.517
Malaria	10010.000	-0.054	0.957	8730.000	-3.642	**0.000**	6997.500	3.453	**0.001**
Miseasle	8244.500	-3.203	**0.001**	9730.500	-1.556	0.120	7795.500	1.654	0.098
Diarrhea	7412.500	-5.846	**0.000**	9839.500	-1.524	0.127	6997.000	4.594	**0.000**
Chickenpox	8394.500	-3.718	**0.000**	8957.500	-3.716	**0.000**	8545.000	0.100	0.920
Others	9254.000	-2.607	**0.009**	9533.000	-2.531	**0.011**	6997.000	4.594	**0.000**

Table 6: Mann-Whitney U Test of the Self-Reported Occurrences of Communicable Health-Related Challenges across the Study Areas

4.4. Contents Analysis of Residents' Opinions on Health-Related Challenges

The multifaceted variance in perceived health-related challenges across the selected inner-city residential neighbourhoods is confirmed by thematic analysis (Table 7). The Table supports the discoveries that urban health outcomes vary geographically, especially in secondary cities. Results show that poverty, neglected infrastructure, and structural environmental factors all contribute to disproportionate health burdens in the selected neighbourhoods. This agrees with the literature on urban health penalty that emphasizes occurrences of health-related challenges across the disadvantaged residential neighbourhoods [17].

Furthermore, collective neighbourhood experiences of health-related occurrences recorded in this study support Cutter et al.'s findings. Consequently, noticeable social vulnerability in the selected inner-city residential neighbourhoods are localized [16]. The underprivileged residents are more vulnerable because of their lack of resources and ability to cope. Importantly, findings provide empirical supports for the study on the occurrences of health-related shocks in the inner-city residential neighbourhoods.

A cohesive and mutually reinforcing understanding of health-related challenges in the selected inner-city residential neighborhoods of Ondo State is provided by the triangulation of findings. Quantitative results show a distinct patterns of infectious disease burden in

the neighbourhoods. These trends indicate environmental health concerns associated with inadequate water supplies, poor sanitation, and crowded living conditions. The qualitative findings expand the understanding by detailing the underlying structural causes of the challenges, specifically, poverty, deteriorating infrastructure, and environmental neglect. These determine unequal exposure and vulnerability of the neighbourhoods to disease. Taking together, the two lines of data show that health-related challenges across the selected neighbourhoods in the stud area are not dispersed randomly but rather are socially and physically distinct, suggesting localised conditions of hardship and restricted potential for adaptation. This alignment emphasises that the high frequency of occurrences of health-related challenges is both a symptom and a result of ingrained socio-physical inequalities.

The study suggest that addressing health-related shocks in Ondo State necessitates interventions that concurrently target environmental conditions, infrastructure deficiencies, and socioeconomic disparities. This offers strong empirical support for the existence of multidimensional and place-based health vulnerabilities in inner-city residential neighbourhoods in the urbanizing cities.

Theme	Sub-Theme	Description	Illustrative Quotes	Interpretation
Occurrences of Health-Related challenges	Health Status	General health conditions in the neighbourhoods	"…people normally fall sick…" (Male, Akure) "…yes, at least one person in this house visits a health facility within 6 months…" (Male, Owo) "…people here are averagely healthy …" (Male, Okitipupa)	Reflection of variations in perceived health-related status
	Common Health-Related Challenges	Experiences of health-related challenges in the neighbourhoods	"…malaria, typhoid, and measles are common here…" (Female, Akure) "…yes, we heard Lassa fever affects people, but…" (Male, Owo) "…we don't pray for sickness, but common sicknesses like malaria, typhoid, measles, cholera, diarrhea come and go…" (Male, Akure)	Presence of health-related challenges
	Causes	The possible reasons for the occurrences	"…most times the environment is too poor that…" (Male, Akure) "… mosquito bites, water sources, and poor environment cause sickness…" (Male, Owo)	Structural environmental challenges heighten exposure
	Extent of effects	What is the extent of the effects of the occurrences?	"…sickness fairly affected us in the neighbourhood…" (Male, Akure) "… it affects everyone…" (Male, Owo) "… many people were affected…" (Female, Okitipupa)	Possibility of collective neighbourhood experiences of health-related occurrences
	Availability of Healthcare	The availability of health services in controlling health-related challenges	"…the hospitals have been trying in all regards…" (Female, Akure) "…the hospitals around are in short supply of manpower except…" (Female, Owo) "…government hospitals did not attend to us…" (Female, Okitipupa)	Spatial disparities in healthcare capacity
	Needed Improvement	The likely healthcare improvement	"…provide more doctors…" (Male, Akure) "…there is the need for more hospital facilities…" (Male, Owo)	Reflection of context-specific gaps in the health system

Table 7: Contents Analysis of Occurrences of Health-Related Challenges across the Study Area

4.5. The Green's neighborhood's Characteristics and Variation in Health-Related Challenges

Ordinal regression analysis reveal varied impacts of neighbourhoods' green space variables on several communicable health-related shocks across the selected inner-city residential neighbourhoods. The models for cholera ($\chi^2 = 166.409$, $p < 0.00$, $R^2 = 0.392$), COVID-19 ($\chi^2 = 61.279$, $p = 0.003$, $R^2 = 0.347$), Lassa fever ($\chi^2 = 63.618$, $p = 0.002$, $R^2 = 0.349$), typhoid fever ($\chi^2 = 60.706$, $p = 0.003$, $R^2 = 0.179$), malaria ($\chi^2 = 62.236$, $p = 0.002$, $R^2 = 0.215$), measles ($\chi^2 = 54.532$, $p = 0.014$, $R^2 = 0.171$), diarrhea ($\chi^2 = 68.025$, $p < 0.001$, $R^2 = 0.244$), and chickenpox ($\chi^2 = 68.923$, $p = 0.006$, $R^2 = 0.278$) demonstrate statistically significant association with moderate explanatory power of green space characteristics. Variables such as availability of green spaces, availability of

trees, availability of lawns, availability of open playing grounds, availability of parks, nearness of green spaces to homes, frequency of visitation to green spaces, awareness of health benefits, lack of maintenance, lack of safety of green spaces, lack of access, lack of organization, and readiness to support green initiatives significantly predict the occurrences. On the other hand, tuberculosis (χ^2 = 2.511, p = 1.000, R^2 = 0.250) and other diseases (χ^2 = 40.960, p = 0.192, R^2 = 0.184) categories show a statistically non-significant association and poor model fit.

Findings indicate poor institutional management, poor design, and inadequate maintenance of the neighbourhood's green spaces in the selected study areas. This offsets the anticipated health benefits of neighbourhoods' green spaces in the neighbourhoods in the developing countries. Consistent with Kuo and Roe and McCay, the perceived usability and socio-environmental factors, rather than just physical presence, affect the health-promoting potential of green spaces [28,29]. More so in agreement with Tulchinsky and Varavikova, green spaces that are unsafe or poorly managed tend to discourage public use, limit chances for physical activity, and could turn into unofficial dumping grounds, all of which increase the hazards to environmental health [32].

According to WHO, the inner-city neighbourhoods in developing countries exhibit poorly maintained green spaces that form the breeding grounds for vectors, waste accumulation, and stagnant water [25]. This increases the vulnerability of the neighbourhoods to vector-borne and waterborne health challenges like Lassa fever and cholera. This highlights the importance of environmental factors, including ecosystem management and sanitation, in determining the spread of infectious diseases. This is also consistent with models for urban resilience, which highlight how environmental, social, and institutional elements interact to determine an urban system's ability to respond to health shock.

Overall, the study shows that green spaces' effects on health are influenced by their state, accessibility, and socio-environmental context. This suggests that urban planning initiatives for inner-city residential communities, especially in developing nations, should concentrate on quality, safety, upkeep, and functional utility rather than just providing green spaces. This highlights the importance of neighbourhood environmental characteristics in determining the incidence of health-related challenges, particularly in rapidly urbanising inner-city residential neighbourhoods where exposure pathways are reinforced.

Dependent Variables	**Significant Predictors**	**B**	**SE**	**Wald**	**P-value**	**95%CI**	**Model χ^2**	**Model Sig**	**Pseudo R^2**
Cholera	Availability of green spaces	0.213	0.107	3.977	0.046	0.004 - 0.442	166.409	**0.000**	0.392
	Availability of trees	11.899	0.149	521.282	0.000	10.878 – 12.921			
	Availability of playing grounds	-1.524	0.498	9.379	0.002	-2.499 – (-0.549)			
	Lack of safety in green spaces	-1.121	0.548	4.188	0.041	-2.195 – (-0.047)			
	Lack of organization of green spaces	1.538	0.633	5.913	0.015	0.298 - 2.778			
Covid-19	Availability of trees	14.211	1.681	71.432	0.000	10.915 - 17.506	61.279	**0.003**	0.347
Lassa Fever	Availability of green spaces	0.569	0.206	7.650	0.006	0.166 - 0.972	63.618	**0.002**	0.349
	Awareness of health benefits	-1141.910	9.599	14151.330	0.000	-1160.724 – (-1123.096)			
Tuberculosis	Availability of green spaces	0. .469	0. 228	4.207	0. 040	0.021 – 0.917	2.511	1.000	0.250
	Availability of shrubs	-3.128	1.542	4.114	0.043	-6.151 – (-0.105)			

	Availability of parks	-27.625	1.342	423.636	0.000	-30.255 – (-24.994)			
	Lack of access to green spaces	-2.455	1.180	4.325	0.038	-4.768 – (-0.141)			
	Lack of organization	1.615	0.777	4.323	0.038	0.093 - 3.138			
Typhoid Fever	Availability of green spaces	-0.210	0.098	4.567	0.033	-0.403 - 0.017	60.706	**0.003**	0.179
	Availability of parks	-13.732	0.643	455.619	0.000	-14.993 – (-12.471)			
	Lack of safety in green spaces	-1.644	.572	8.269	0.004	-2.765 – (-0.524)			
	Lack of access to green spaces	1.701	0.713	5.697	0.017	0.304 - 3.098			
Malaria	Availability of parks	-12.047	1.085	123.343	0.000	-14.173 – (-9.921)	62.236	**0.002**	0.215
Measles	Availability of trees	13.808	0.497	772.848	0.000	12.835 - 14.782	54.532	**0.014**	0.171
	Availability of parks	16.019	0.697	528.850	0.000	14.654 - 17.384			
Diarrhea	Availability of trees	12.304	0.597	424.572	0.000	11.134 - 13.475	68.025	**0.000**	0.244
	Availability of lawns	-2.030	0.938	4.683	0.030	-3.868 – (-.191)			
	Availability of parks	14.642	0.778	353.960	0.000	13.117 - 16.167			
Chickenpox	Availability of trees	14.352	0.712	406.570	0.000	12.957 - 15.747	68.923	**0.006**	0.278
	Availability of lawns	-3.331	1.144	8.476	0.004	-5.573 – (-1.088)			
	Availability of parks	13.652	.914	222.898	0.000	11.859 - 15.444			
	Lack of safety in green spaces	-2.678	1.048	6.528	0.011	-4.732 – (-.624)			
Others	Frequency of visitation to green spaces	0.392	0.150	6.831	0.009	0.098 – 0.685	40.960	**0.192**	0.184
	Availability of trees	13.442	.831	261.604	0.000	11.814 - 15.071			
	Availability of parks	15.705	0.946	275.748	0.000	13.851 – 17.559			
Predictors: Availability of green spaces, Availability of trees, Availability of lawns, Availability of shrubs, Availability of open playing grounds, Availability of parks, Nearness of green spaces to homes, Frequency of visitation to green spaces, Awareness of health benefits, Lack of maintenance, Lack of safety of green spaces, Lack of access, Lack of comfort, Lack of organization, Readiness to support green initiatives									

Table 8: Ordinal Logistic Regression Analysis of Neighborhood's Socio-Physical Characteristics Predictors On Health-Related Challenges across the Study Areas

5. Conclusion and Recommendations

The study establishes that health-related challenges in inner-city residential neighborhoods in Ondo State are place-based and possess socio-spatial disparities. Variations in the occurrences across neighborhoods underscore the importance of localized planning strategies that take into consideration differences in infrastructure, environmental quality, and institutional capability. Findings demonstrate the capacity of the neighborhoods' to respond to health-related challenges. It highlights the significant influence of neighborhood's environmental factors, green space features, healthcare accessibility, and health-related shocks. It reveals the varying effects of neighborhoods' green spaces on urban health outcomes. Particularly, findings demonstrate that poorly maintained, unsafe, and inaccessible neighborhoods green spaces increase the risk of contracting infectious diseases rather than improving residents' health. Conversely, by promoting healthier settings and facilitating beneficial human environment interactions, well-managed and used green areas increase neighborhoods capacity to resist health-related challenges. A holistic and intentional policy that places an emphasis on accessibility, quality, safety, maintenance, and effective healthcare services is required to increase neighborhoods' response capacity to urban health challenges. This is essential to reduce vulnerability to recurring health-related shocks in rapidly urbanizing inner-city residential neighborhoods'.

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Conflict of Interest

The authors declare no conflict of interest.

Ethical Approval (if applicable)

Not Applicable

Author Contributions

Olubi, A. R.: Conceptualization, project administration, resources, methodology, investigation, formal analysis, data curation, visualization, writing-original draft, writing-review & editing
Ayoola, H. A.: Validation, supervision, writing-review & editing.
Fadamiro, J. A.: Validation, supervision, writing-review & editing.

Data Availability Statement

All data and models generated and used to support the findings of this study are available from the corresponding author upon reasonable request.

AI Usage Statement

Generative AI tools such as ChatGPT and Quillbot were used for language editing only

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