

Editorial Note

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Assessing Urban Neighbourhood Resilience to Covid 19 Pandemic in Jos, Plateau State, Nigeria, by ¹Hassan Y. Tifwa ²Jamila O. Edibo, ³Davidson S. A. Alaci, and ⁴Jacob Atser

Abstracts

The sudden incidence of COVID-19 at Wuhan in China in December 2019 with its significant death globally and other negative socio-economic impacts has awakened the need to make human settlements resilient to unforeseen tragedy. Nigeria and Jos the capital of Plateau State have had negative experiences with the incidence of covid 19. Considering this, the study aims at assessing the resilience of urban neighbourhoods in Jos North Local Government Area of Plateau State to COVID-19 pandemic. The study objective is to examine the pattern and characteristics of some selected neighborhoods within Jos the study area. In addition to examining the characterisation of infrastructural facilities and to evaluate the environmental challenges that impede adherence to non-pharmaceutical protocols to COVID-19. Two neighbourhoods, Angwan Rukuba and Fudawa were selected to represent the entire Jos North Local Government Area. Relevant literature related to the study was reviewed. The study adopted a direct observation method of the physical characteristics of the neighborhoods and a simple sampling technique of survey where a structured questionnaire was administered to 138 respondents in the two neighborhoods. Descriptive analysis using percentages and tables in relation to the data obtained was used to draw inferences and conclusions. The results obtained shows that the sampled neighborhoods are densely congested informal settlements with unorganized settlement pattern, lacking in basic neighbourhoods' infrastructure, and poor circulation, among others. These findings imply that the environmental setting of the study area makes compliance with non-pharmaceutical protocols during COVID-19. pandemic difficult. By implication, the neighborhoods lack the resilience capability to cope with the COVID-19. pandemic. The study recommends the need for planning and upgrading of the neighbourhoods' facilities along with stakeholder public enlightenment on the need to comply to COVID-19. non-pharmaceutical protocols as a step toward building resilient neighbourhoods in Jos North Local Government Area and the metropolis at large.

Keywords: COVID- 19 Pandemic; Resilience; Urban Resilience; Urban Planning; Neighborhood; Facilities

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Introduction

The need to make human settlements resilient gain currency following the sudden outbreak of COVID-19 at Wuhan in China in December 2019. According to a Sustainable Development Goal (SDG) report 2021, the pandemic was a serious drawback on the implementation of the 2030 Agenda, undermining decades of sustainable development efforts. It noted that over 100 million people were pushed back into poverty and hunger in 2020 alone, while over 100 million people fell into poverty and hunger, reinforcing and exacerbating inequalities, among others. One of the popular strategies adopted globally is non-pharmaceutical measures. According to the Royal society (2023), the principles behind non pharmaceutical measures are firmly grounded in prior knowledge about the epidemiology and biology of infectious diseases. It contended that transmission of an infection across people can be prevented if the transmission pathway can be blocked effectively. This understanding led to the push of the non-pharmaceutical approach to the spread of the virus. A review of the effectiveness of non-pharmacological interventions was carried out by Odusanya et al. (2020) which reveals that there are five such measures. These measures include social distancing, wearing of facemasks, use of hand sanitizer along with regular washing of hands, quarantine, and lockdown. Social distancing is a controlled and determined spatial distance between individuals to avoid contact

with each other which is a way of contacting the virus. This is achieved by avoiding groups and large gatherings and maintaining a distance of at least 2 meters from other people to reduce the risk of direct transmission of COVID-19. The size of groups or gatherings is determined by individual countries based on their local situations.

In addition to controlling the spatial distance, people were asked to wear surgical masks when outside as it is airborne. The correct and consistent use of face masks has now become one of the interventions to control COVID-19 Pandemic. The WHO has recently published a guide for the use of face masks in the context of the COVID-19 pandemic for public use and in healthcare settings. In community settings, the first consideration should be maintaining physical distancing. However, where physical distancing of 1 to 2 meters from other people cannot be maintained, it is recommended that any type of mask should be used. The masks serve as a form of source control in infected persons. However, without compliance with other protective measures, a mask offers limited protection against the disease.

The use of hand sanitizers, an alcohol-based solvent created to kill germs, and regular washing of hands using soap and running water is the third recommended non-pharmaceutical protocol to the COVID-19 Pandemic. This measure has shown a reduction in the contamination of the hands and respiratory infections in general. The WHO in 2015 recommended 80% concentration of ethanol and 75% concentration of isopropyl alcohol for “disinfectant: alcohol-based hand sanitizer” (WHO, 2021). Studies have been conducted in which viruses have been externally applied or put-on fingers and hand sanitizers have successfully reduced the viral particles (Dyer et al., 2000; Hammond et al., 2000). Given the exploding nature of the pandemic, the world health machinery suggested regular use of hand sanitizers as one of the protection measures against the coronavirus (Prajapati et al., 2022). Hand sanitizers help fight against the virus by damaging the cell membrane and therefore damage the components of the virus making it futile (Prajapati et al., 2022). Washing of hands should be done under running water. However, hand washing will not be effective in a neighbourhood where there is not a regular supply of water. Regrettably, public water supply has collapsed in most Nigerian cities (Ishaku et al; 2011).

Quarantine: this is the act of separating and restricting the movement of people who have been exposed to a contagious disease to ascertain their health status, thereby reducing the risk of transmitting the virus to others. Quarantine can be done voluntarily or mandatory using relevant public health laws. It is most effective and efficient where there is an effective system for contact tracing and early detection of cases. The first formal quarantine facility was built on an island in Venice in the year 1423 on the small island of Santa Maria di Nazareth (Tognotti, 2013). As further noted by Tognotti (2013), it was also used when ships arriving at the port of Venice from foreign travels were made to wait 40 days to disembark to allow time for any person infected with an infectious disease to manifest symptoms and thus be identified. The use of these measures helped in controlling the disease at that time.

Lockdown is a containment strategy done at the community-wide level which is carried out to reduce person-to-person interaction to a minimum. This involves the shutdown of government offices, businesses, schools, social and recreational facilities, and transportation services with an exemption of essential services and its workers such as health, security, and basic utilities. According to Murphy et al. (2023), lockdowns, refereeing to stay-at-home orders, were the most restrictive social distancing measures. This measure requires most of the population to stay at home. The exceptions were only granted for exercise and essential shopping. During the COVID-19 pandemic, restrictions were a common strategy used in places characterized by mass gatherings. This led to school closures, business closures and restrictions on human mobility (both within and across national borders) were implemented in most countries and in many cases for prolonged periods of time (Murphy et al., 2023). In the account of Block et al.

(2020), strategic social network-based reduction of contact strongly enhances the effectiveness of social distancing measures while keeping risks lower. The stringency of this measure varied across the world due to many reasons including avoiding large contractions of the economy or the breakdown of essential services, consequently the application of lockdown or stay at home is selective, Murphy et al. (2023).

Liu et al. (2020) did a study on the review of articles that covered 130 countries of the world on the level of compliance to non-pharmaceutical protocols to COVID-19. The focus of their study was to test the level of compliance with non-pharmaceutical preventive measures to COVID-19. Social distancing was seen to have a greater impact on the reduction of contracting the virus than the other measures that allowed for some form of contact. Some other studies however found that face mask was most effective in reducing COVID-19 (Cheng et al., 2020; Chu et al., 2020). The analysis of the reviewed literature suggests that a particular protocol that is accepted in one region may not be accepted in another. Several factors would have been responsible for the variation in responses. These may include differences in the socio-economic background of the respondents, environmental setting, and government policies among other considerations.

Bob et al. (2020) in Uganda evaluated adherence to COVID-19 prevention measures in the country when it was in its early phase, shockingly, the survey recorded that out of 100 percent of the results collected only about 29% of the participants adhered to all preventive measures, the only measures that recorded adherence of significant percentage is hand washing with soap. It is a known fact that in African countries, wearing the face mask was not done for any reason but was integrated into their systems as a response to the COVID-19 Pandemic.

A study carried out by Oyetunde et al. (2020) assessed the knowledge, perception, and adherence level of Nigerians on COVID-19 non-pharmaceutical protocols. Questionnaires were administered online to avoid physical contact. The survey was done to Nigerians living in Nigeria within the age range of 18 and above. The result of their research indicates that a high number of the people who participated had knowledge about the virus and its preventative measures. However, while a fraction of the respondents who are salary earners believe that the lockdown was a good measure in curtailing the spread of the virus, those in the private sector who depend on daily business appraised the lockdown measure from the negative point. Other strategies such as washing hands, use of sanitizers and social distancing were however seen as good measures.

Several academic disciplines have thought resilience to be the response of any given system to any form of disturbance (Vale, 2014). Most fields also recognize the distinction between positive resilience and negative resilience. While both types enhance the ability of the subject to cope with stress, negative resilience does so with undesirable externalities and long-term consequences that add vulnerability, risk, and undermine resilience. Efforts to bolster resilience across different disciplines therefore emphasize positive adaptation despite adversity (Fleming & Ledogar 2008). Aside from this, however, most academic disciplines have come up with a unique understanding of the concept. Given the fact that cities are multi-dimensional entities and fragility is also multifaceted, defining resilience in an urban context must include insights from multiple professions and disciplines.

The capacity or the ability of a city to cope with stress in a positive direction by adapting and transforming towards sustainability of its systems, communities and individuals is referred to as urban resilience. An unplanned settlement therefore cannot cope with challenges posed by sudden outbreaks of disease like COVID-19 Pandemic. COVID-19 of course has brought stress to communities globally that calls for a rethink on how best we can keep human settlements secure and safe on the account of sudden outbreaks of disease that may become epidemic or pandemic.

Although the studies reviewed addressed the level of knowledge and adherence level of the populace in various parts and regions of the world to preventive measures against COVID-19, they failed to look at how the environmental situation in terms of spatial arrangement aids or reduces the effectiveness of the non-pharmaceutical measures to COVID-19. This gap in knowledge is what this study intends to address. This is so because the spread of COVID-19 does not occur in a vacuum but within human settlements or neighborhoods. A Neighbourhood is referred to as a geographically localized community within a larger city, town, suburb, or rural area. It is looked at as a district or community within a town or city. Neighborhoods in developing nations are not as organized and planned as their counterparts in developed countries. Most neighbourhoods in developing countries are characterized by poor housing conditions, accessibility, and infrastructure, among others. The COVID-19 Pandemic has the tendency to spread faster in unplanned and disorganized neighborhoods than the ones planned. And this is where resilience and indeed neighbourhood resilience become central to fighting any pandemic.

According to Alaci, (2019), building resilient cities in Nigeria can be viewed from socio-economic and environmental approaches, while socio-economic resilience targets the recovery from situations that affect the income of the people in a place, environmental resilience is based on the recovery of the environment from the sudden shocks or situations that cause an imbalance in the environment's natural state; stating further that the environmental resilience is more straight forward and more tangible than socio-economic resilience. The resilience of a place is, however, determined by the level of development. Countries whose development level is low find it hard to build resilience. To build resilience, resilience planning is needed which can be done by building more cohesive communities where neighbors check on neighbors, improving transportation and mobility, improving air quality with a better-built environment and architecture. For this to be achieved, the planning of our urban areas is critical. Urban planning is therefore a critical tool that can be used in combating the spread of pandemics like COVID-19. If urban planning, design, and features of human settlement are tailored toward achieving social, economic, and health purposes, resilience to urban stress becomes manageable. The plan of an area influences the resilience level of the place. This is because urban planning entails the use of proper and well-approved standards to achieve resilience to different social, economic and health services.

The relationship between urban planning and health is historical, as every pandemic triggered the need for effective urban planning while exposing the deficiency in the existing setup. The cholera pandemic in 1832 that occurred in New York City was the first to initiate cities to begin to clean up their fouled nests (Wilford, 2008). The cholera outbreak in the United Kingdom at the height of Industrial Revolution led to the first Public Health Act of 1848 and 1875 also lay credence to the place of urban planning in addressing COVID-19 pandemic. In Nigeria, urban planning became institutionalized as a response to the outbreak of the cholera and bubonic epidemics in Lagos in 1928 (Oladiti & Idowu, 2017). In the two situations so narrated i.e., in Nigeria and the United Kingdom, urban planning was reactionary but targeted at improving the situation of basic urban amenities including water supply, sewerage, drought, sanitation, environmental health, slum clearance and urban renewal, among others.

The Urban system in Nigeria is highly characterized by extreme urban sprawl and informalities, poor and inadequate infrastructure, lack of water and electricity, high unemployment, and grievous underemployment which constitute major challenges to COVID-19 non-pharmaceutical measures. In fact, urban populations are mostly concentrated in overcrowded informal dwellings and slums with no access to running water facilities and other essentials needed for a decent urban life. The situation of the Nigerian urban system makes adherence to COVID-19 non-pharmaceutical measures difficult. This is because social distancing for example is difficult to carry out in congested neighbourhoods which are common characteristics of most Nigeria urban centers. The stay-at-home or lockdown is also difficult if one works in the informal sector with other means to meet needs which also is a common characteristic of

most urban areas in Nigeria. The exceptionally large population of Nigeria depends on day-to-day informal business activities for livelihood.

The availability of adequate infrastructural facilities boasts community resilience to disasters including diseases and epidemics. The situation of facilities in many urban neighborhoods in Nigeria suggests that resilience to the epidemic outbreak in general and COVID-19 pandemic can become a huge challenge, hence the reason for this study. There is a need to do an analysis of neighbourhood facilities to establish if the resilience strategies against COVID-19 pandemic are in place. The study therefore assesses the resilience of urban neighborhoods in Jos to the COVID-19 pandemic within the context of settlement patterns, characterization of neighborhoods facilities, utilities, and services, challenges inherent in the neighborhoods that limit adherence to COVID-19 protocols as well as providing insight on how urban planning can improve and enhance the health and well-being of the people in the light of the challenges posed by COVID-19 pandemic is the focus of this study.

The Study Area

The study area is Jos metropolis, the capital of plateau state in central Nigeria. It lies within latitudes 9°45'00"N to 09°57'00"N and longitudes 8°48'00"E to 8°58'00"E. The city is the administrative capital of Plateau State. Jos is at an altitude of 1,217m (3,993ft) above sea level. The estimated area of Jos metropolis is 249.7km². Jos and Plateau State enjoy more temperate climate compared to the rest parts of Nigeria. It experiences wet and dry climate; classified into tropical rainy climate with mean annual rainfall of 1,250mm at the peak between July and August. The mean annual temperature is about 22°C but mean monthly values vary between 19°C in the coolest month of December and 25°C in the hottest month of April.

Jos owes its origin to the introduction of tin mining on the Jos Plateau and the railway lines linking it with Port Harcourt and Lagos. The olden days tin mining activities attracted the influx of migrants into Jos, making it a highly cosmopolitan city. The climate in addition has made the city one of the economic hubs of the country and a tourist center attracting both indigenes and foreigners. Jos is the largest settlement in Plateau State.

Jos metropolis is a multi-cultural and multi-ethnic area, and the main ethnic groups include Berom, Anaguta and Afizere. The area has a rich cultural heritage in its diverse religious practices that is Christianity, Islam, African traditional religion, cultural festivals, and culinary, among others. Hausa is a major language spoken by most of the people due to the influence of the Hausa people. Non-farming activities practices in the state include mining and civil service with most of the government workers engaging in part-time farming. The city is also a host to many Federal and State own educational institutions. The Federal Government's presence is significantly felt in the city serving as a host to several Federal institutions, private organizations, and commercial banks, among others. Jos metropolis comprises two Local Government Areas (LGAs), Jos North and Jos South. The study is narrowed down to Jos North LGA because observation has shown that both urbanization and density of human activities are properly defined in Jos North LGA. This is expected since Jos North is the older of the two LGAs and accommodates the city's Central Business District (CBD) and indeed the hub of activities. (See Fig. 1).

Based on the 2006 national census, the estimated population of Jos North Local Government Area is 429,300 as at 2021 (Gwaison, et al., 2021). The local government comprises several neighborhoods. However, two neighbourhoods Angwan Rukuba and Fudawa were purposefully selected for surveys. It is believed that the outcome of the study from the picked study area will reflect the entire metropolis because of the similarities across all the neighbourhoods in the city.

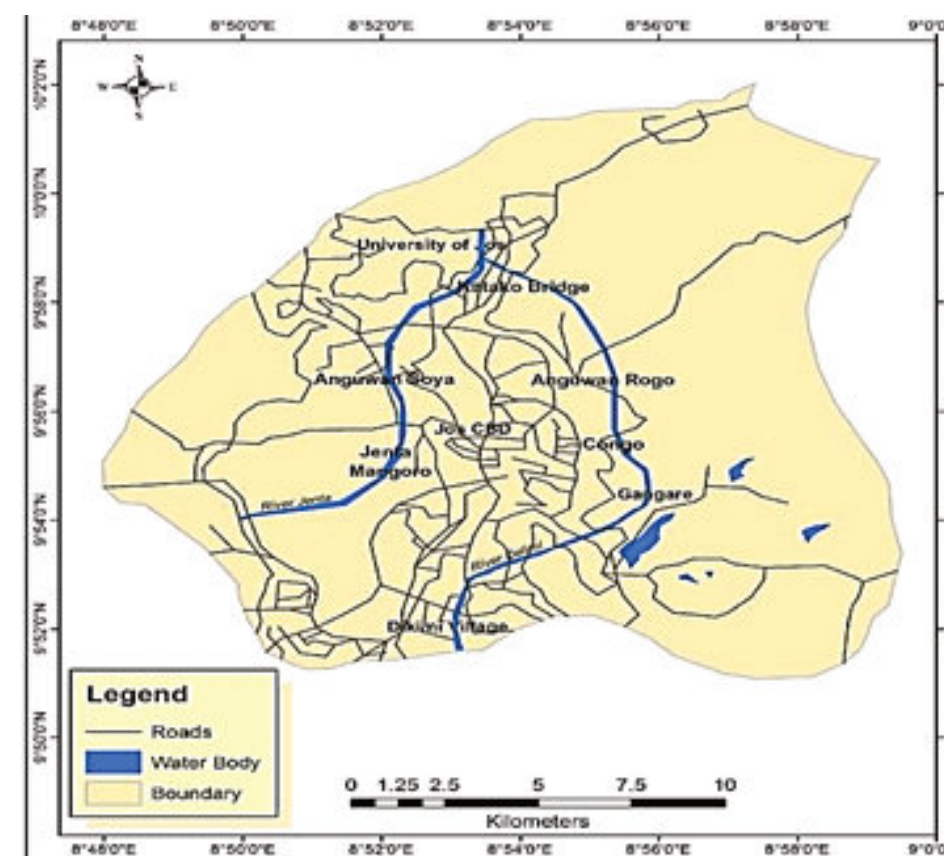


Figure 1: Jos North LGA
Source: ARCGIS, (2021)

Materials and Methods

The nature of data used in this study is purely primary; this includes population, income, and information on existing neighborhood facilities and the level of functionality. Data were sourced through a well-structured interview questionnaire. A descriptive research approach was used to describe the study area, its physical features, geographical location, presence and condition of facilities and services. Direct observations were employed to establish the availability of facilities and the condition of buildings, among others. This entails a survey of the two neighborhoods, to evaluate their infrastructural status and identify their challenges. The evaluation was carried out using physical observation by optics and the use of measuring instruments such as tape. The bulk of data used in this study came from questionnaires administered to residents of both neighborhoods. The questionnaires were administered at random to the household heads. The focus of the questions was on the socio-economic characteristics of the respondents and responses to research objectives. The information collected was later tabulated as deemed appropriate; multiple responses were allowed where deemed necessary. The essence was to cover as many as possible relevant facts on the COVID-19 pandemic and its resilience level within the neighborhoods of the study area in Jos as it might be helpful in achieving the overall objective of the research.

The target population in this study consists of government workers, private workers, and artisans. The total population figure of the sampled two neighborhoods is approximately 18,936 based on the 1991 population census report (NPC, 1991). Using an annual growth rate of 3.0%, the 2021 projected population of the study area is estimated to be 29,500 persons. The 1991 census report was used for the projection instead of the 2006 census report which is more recent because 2006 did not provide population figure at the neighbourhood level. This estimated population comprises both males and females. To obtain the sample size, the Frankfort

Nachimas formula was employed to determine the number of people to be issued a questionnaire resulting in one hundred and forty (140) out of the estimated projected population of the study area. Structured questionnaires were administered systematically to heads of households. The interval chosen was to ensure that there is spatial coverage of the study area. The data collected for the study were presented using simple tables, charts, and graphs while the analysis was done qualitatively drawing inferences from the tables, graphs, and charts. The analysis involves converting the frequency score into percentage score. This was to allow for ease of comparing within and across data set. Based on the analysis, inferences and conclusions were made.

Results and Discussions

Using a planned 160 survey respondents, valid data were collected from a total of 138 respondents against the targeted 140 samples for the study. This translates to a 98.6% response rate. This section presents the results of the analysis of data and findings from the samples and draws inferences for conclusion for the resilient of the studied neighbourhoods against COVID-19 pandemic.

Settlement Pattern, Housing Characteristics and Compliance to COVID-19 Protocols

Several physical attributes of the settlement pattern of the study area were examined in the context of the spread of the COVID-19 pandemic. This was done to determine the adaptability of the settlements to the non-pharmaceutical protocols to COVID-19. The attributes examined include settlement pattern, nature of congestion and availability of basic urban facilities amongst others.



Figure 2: Settlement Pattern of the Study Area

Source: Google Earth

In terms of settlement patterns, the area is unorganized. As shown in Figure 2, the neighborhoods in the study area are characterized by buildings that are closely knit together, exhibiting densely compacted structures. Although street networks can be seen, they do not address the goal of accessibility because several houses were found to be inaccessible. This is due to the congested nature of the buildings, in addition to the fact that buildings also show unmistakable evidence of poor structural materials. Several roofs were seen to have deteriorated as evidenced by the color of the roofs. The corrugated iron sheets have mostly turned brown. While some buildings have cracked walls exhibiting deterioration.

The analysis of results as presented in Table 1 shows housing characteristics in the study area in terms of housing type, household size and room size. The housing type in the study area comprises semi-detached, single rooms, and bungalow buildings in descending order in terms of percentages. In terms of population, the area is densely congested as over 50% of the residents live in an average household size of between 5-9 persons per room while over 20% is reported to have an average household size of above 9 in an average room size of 4.2 square meters (Table 1). The average household size found in this study is high. With this high number of people occupying a room, the control of the transmission of COVID-19 among residents within the neighborhoods becomes a difficult or impossible task. The result on the size of the room shows an average room size to be 4.2 square meters, this is obviously small. The results obtained in terms of average household size and the size of rooms in the study area are clear indications that compliance to social distancing and quarantine of the non-pharmaceutical protocols to COVID-19 becomes an impossible task. Non pharmaceutical measures for curtailing the spread of the COVID-19 pandemic such as social distancing cannot be adhered to where space for dwelling is small, making room for congestion or high occupancy rate. Congestion and high room occupancy poses significant risk and is a challenge in halting transmission and recovery from the pandemic.

Table 1: Housing Type and Household Size

Housing type	Household size			Total
	1-4	5-9	Above 9	
Single room	19	9	8	36 (26.1%)
Bungalow	9	12	10	31 (22.5%)
Semi detached	7	55	3	65 (47.1%)
Duplex	4	2	0	6 (4.3%)
Total	39(28.3%)	78 (56.5%)	21(15.2%)	138 (100%)

Source: Field Study, 2021

These findings imply that observing social distance as one of the non-pharmaceutical protocols for controlling COVID-19 as established earlier by Odusanya et al. (2020) will be an impossible task in the neighbourhoods of the study area. This is because compliance with non-pharmaceutical protocols of social distance becomes impossible with densely compacted structures, high household sizes and small room sizes as found in the study area. The transmission of diseases is very possible even with the COVID-19 virus as it is an airborne disease, a congested environment makes it difficult to comply with the non-pharmaceutical measures of social distancing, quarantine among others as control measures against the spread of the COVID-19 virus.

Neighborhood Facilities

The neighborhood facilities, utilities, and services were found to be inadequate (Table 2). The facilities are very few and inadequate to serve the residents, as some of these facilities have a

wide range of service radius. Available facilities were found to be inadequate to cater to the population of the area as shown in Table 2. With just two clinics, to take care of the health needs of residents is not possible to curtail the spread of the COVID-19 pandemic. Moreover, clinics as primary health care centers are not designed for the treatment of pandemic diseases like COVID- 19. The recommended health facilities for the treatment of COVID- 19 are tertiary health centers. As can be seen from the result of Table 2, there is no single secondary or tertiary healthcare facility in the neighborhoods of the study area.

Table 2: Facilities Available in Study Area

S/N	Facility	Frequency
1	Police outpost.	1
2	Mini- Markets	1
3	Churches	8
4	Schools	10
5	Restaurants	5
6	Pharmaceutical shops	4
7	Open spaces	2
8	Clinics	2
9	Bars	4
10	Transformers	2

Source: Field Study, 2021

Compliance with Non-pharmaceutical COVID-19 Protocols

The second objective of the study hinges on identifying challenges impeding the observation of the non-pharmaceutical protocols to COVID-19 in the study area. To achieve this, the provision and adequacy of some facilities and services that have direct bearings with the adherence to non-pharmaceutical protocols were x-rayed. These include three critical areas such as water supply, waste disposal facilities and spacing/circulation within the neighborhoods. The outcome of findings in relation to these variables is as presented.

Water Supply

In terms of the availability of basic urban facilities such as water, the public water supply has collapsed completely. There are no laid-down water pipes for pipe-borne water and places with the pipes cannot boast of getting water from the same source. This collaborated with Ishaku et al. (2011) earlier assertion on the collapsed of public water supply in most Nigerian cities. Residents therefore make private self-efforts in sourcing water for their domestic consumption as presented in Table 3. Water is not readily available from some of these sources, as residents are often subjected to long-distance walk-ins to get water. The main sources of water are wells, private boreholes, and vendors. However, water from the well has remained the major source of water. Wells as a source of water supply are mostly available during the rainy season because in the dry season, the water table goes down and several of the wells dry up. Therefore, during the dry season, the residents resort to buying water from the water vendors. Some of these available sources are not very hygienic for human use, especially from water vendors, rivers, and streams.

Table 3: Sources of Water

Source	Frequency	Percentage (%)
Well	57	41.3
Bore-hole	38	27.5
Vendor	37	26.8
River	6	4.4
Stream	0	0.0
Total	138	100

Source: Field Study, 2021

Water plays a key role in hand washing as a non-pharmaceutical protocol for the prevention of COVID-19 pandemic transmission. The result of the quantity of daily water available per person shows an average of 41-80 liters per person per day. This is below the National Water Policy Standard of 60 liters and 120 liters respectively for semi-urban and urban areas in Nigeria (FGN, 2000). The income of most residents in the area is below Eighteen Thousand Naira (US\$36) per month. This amount is too meager for the residents to think of buying extra water for regular washing of hands in place of basic needs of water for drinking, cooking, and washing clothes. As earlier mentioned, pipe-borne water is not available in the study area. Based on the above-mentioned challenges, residents in the study area find it difficult to undertake regular washing of hands as one of the recommended COVID-19 protocols. Residents use the available water to meet the basic needs of cooking, drinking, and washing. Using water for hand washing therefore becomes secondary to most residents when they do not have enough to meet the basic primary need for water. Table 4 presents data on the quantity of available liters of water per head daily.

Table 4: Quantity of Water Usage per Person

Quantity per day in liters	Number of households	Percentage (%)
0-40	36	26.1
41-80	64	46.4
81-120	28	20.3
Above 120	10	7.3
Total	138	100

Source: Field Study, 2021

The quantity of water per person as presented is in an average range of between 41-80 liters per day. This low level makes adherence to regular washing of hands difficult as there is not enough to cater to the daily consumption needs of residents.

Waste Disposal Facilities

In terms of sanitary conditions, a poor condition can be observed in the study area. This is evidenced by the lack of waste disposal facilities as residents dispose of their waste in non-designated available open space (See Fig. 3). The waste disposal points in the study are neither organized nor adequate. This exposes the environment to parasites serving as breeding grounds



Figure 3: Non-designated Open Dumping Site

Table 5 shows the statistics on the method of waste disposal in the study area. The result indicates that over 50% of the households dump their domestic waste into streams and rivers followed by those who practice open dumping while few others burn their waste. These practices have cumulative negative effects on the people and the environment.

Table 5: Method of Waste Disposal

Method of Disposal	Frequency	Percentage (%)
Opening dumping	46	33.3
Open burning	16	11.6
Dumping into streams and rivers	76	55.1
Total	138	100

Source: Field Study, 2021

The practices of waste disposal in the study area as presented makes people more susceptible to diseases, as disease tends to breed faster in the unhygienic environment. About COVID-19 pandemic, improper disposal of waste can create channels through which the virus can be transmitted easily among residents. Improper disposal of waste can lead to environmental pollution and an elevated risk of infection among residents, especially during the period of pandemic. Etim et al. (2022) reported on previous studies conducted in the Jos metropolis which shows that hospital waste management practices fell below WHO's guidelines and other regulatory agencies. Although the report focuses on medical waste management issues, by implication it translates to solid waste management practice in Jos metropolis. Control of the spread of the COVID-19 pandemic among the residents will not be effective in unsanitary environmental conditions as found in the study area. There is a broad agreement that the neighborhood environment must be considered for public health approaches to effectively improve physical activity (Kepper et al., 2019; Sallis et al., 2006). This is supported by the fact that a conducive physical environment supports health status.

Spacing Within the Residential Areas and Circulation

Most of the buildings in the study area are found to be congested as shown in Figure 4. Spacing within and around the residential areas is very tight as can be seen in the Figure. This suggests that the physical environmental setting of the neighborhoods will not enhance the enforcement of social distancing as non-pharmaceutical protocols for the prevention of COVID-19.



Figure 4: Spacing within Residential Areas

Road networks within the study area are mostly untarred with no drainages and lack proper organization. Most roads lead to a dead end as they widen at the beginning and narrow towards the end. Assessing some locations within the neighborhoods in case of providing emergency health care services is a challenge.

Conclusion and Recommendations

The identified challenges of poor settlement pattern, lack of proper space for social distancing within the house, lack of water supply, and unsanitary facilities among other challenges in the studied neighborhoods will negate adherence to COVID-19 non-pharmaceutical protocols. It is believed that the findings of this study are true reflections of the characteristics of most urban informal settlements in Jos with few exceptions to planned government residential areas. By

implication, there is a need to take environmentally proactive measures that will make residential areas in Jos resilient to incidences of COVID-19 or any future occurrence of any form of the pandemic. The outcome of this study suggests that the neighborhoods in the study area are informal settlements that are not adequately planned to combat sudden outbreaks of diseases like COVID-19. Therefore, physical planning is imperative for developing resilient strategies that would control the spread of sudden disease. The aim of planning is to create an environment that is resilient to any form of damage be it urban decay, pandemics, natural or manmade disease. Unless planning is given the desired recognition, many problems would linger for an extended period without having adequate and efficient solutions. With the increasing reports of new variants of the COVID-19 virus, it is important that steps are taken to increase the chances of resilience.

Upgrading the neighbourhoods in the study area is another way to go to build neighbourhoods that would be resilient to COVID-19. The studied neighbourhoods being informal settlements are lacking in basic amenities that require the upgrade of the entire environment. This is recommended to reduce the risks and problems clearly seen in the area without having to displace the inhabitants or incurring prohibitive costs as seen in the case of comprehensive redevelopment of the area as slums. The state government and private bodies can collaborate to upgrade the neighborhoods. This can be accomplished through the upgrading and the provision of more neighborhood facilities, utilities, and services. In the area of public transport for instance, Tareke and Ashebir (2023) study on the impact of COVID 19 pandemic on the people's choice of urban public transportation modes in Ethiopia, recommend the need to focus on policies that could be implemented for safe and sustainable public transportation and mobility during and after the COVID 19 pandemic period. They recommend pandemic-sensitive, public transportation-priority policies that include subsidies, high service levels, a focus on passengers' safety, and the promotion of innovation, digital solutions, and e-payment.

In addition, there is a need for adequate provision of clean and safe water supply to the residents. This will aid compliance with regular hand washing as one of the recommended non-pharmaceutical protocols for the prevention of COVID-19. Provision and widening of the streets with an adequate drainage system that is connected to a central collection point for stormwater are also recommended. Due to the absence of adequate drainage, the area is susceptible to flooding with the likelihood of the destruction of buildings. The provision of waste collection points in the study area as well as public dustbins and enhanced health facilities are integral parts of the upgrading process.

Public campaigns and enhanced publicity on the need to comply with non-pharmaceutical protocols for COVID-19 are also recommended. Planning as a tool for public advocacy has a greater role in educating the public on the need to comply with the non-pharmaceutical preventive protocols for COVID-19. This can be achieved through community, traditional, and religious leaders. The inherited northern culture in Nigeria has profound respect for elders and religious leaders. The heads or leaders have an influence on their followers. Hence, the government, the planners, and health workers among others can collaborate and partner with these leaders on educating their subjects on the need to keep their environment secure, safe, and healthy. Collective efforts are needed by government, private sectors, and individuals' groups at all levels of the society to develop multiple mitigation measures to combat global environmental crisis (Bouman et al., 2021), which in the opinion of this paper COVID-19 has become one. This collaborated effort is needed to make Jos North, the entire Jos metropolis and by implication Nigeria at large to make our settlements resilient to unforeseen human, natural and environmental disasters. The study's limitation was the initial suspicion from residents of plan for demolition from government and unwillingness to provide some basic information thinking it was government's sponsored research. Further study on engaging the communities on how to make their settlements resilient against any future pandemic is recommended.

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