International Journal of Innovative Research and Advanced Studies (IJIRAS)
Volume 9 Issue 8, August 2022

ISSN: 2394-4404

Analysis Of Spatial Inequality In Access To Public Water Supply In Minna

Yahaya., Usman

Department of Urban and Regional Planning, School of Environmental Studies, Federal Polytechnic Bida, Nigeria

Aremu Reuben

Akande Sheerifdeen Olaide

Department of Urban and Regional Planning, Kogi State Polytechnic Lokoja, Nigeria

Abstract: ***Everyone has the right to sufficient, safe, liveable, acceptable, physically accessible, and reasonably priced water for personal and domestic use. Hence, it is the responsibility of government to provide her citizens with potable water for drinking and domestic use. However, many people do not have access to water in our urban centres, particularly in Nigeria. Access to potable water is skewed along socioeconomic power of the people. This study therefore examined the spatial variation in access to public water supply in Minna, the State Capital of Niger State Nigeria. Access to public water supply across the 32 neighbourhoods in Minna was evaluated based on five key indicators of water access. Twenty households were randomly sampled in each of the 32 neighbourhoods to arrive at a total of 640 households. The data were collected using questionnaires and direct observations. The data collected were screened and cleaned to remove bad response and outliers before analysis. The data gathered were subjected to descriptive (frequency/mean) and inferential analytical (Analysis of Variance) tools and mapped using ARCGIS 10.8 environment. The study revealed that although 25 of the 32 neighbourhoods are connected to the public water mains, only 38% of the households had access to public water supply within their neighbourhood. Access to public water ranges from 25% - 90% across all the neighbourhoods. The study also established that there is statistically significant variation (p< .001) in the level of access to public water supply in Minna neighbourhoods. The study recommends improved access across all the neighbourhoods regardless of the socioeconomic background of the inhabitants to ensure sustainable development of the city.***

I. INTRODUCTION

Safe, reliable, and universal water access is critical to human health and livelihoods, a principle enshrined by the United Nations Human Right to Water and Sanitation. Despite progress toward United Nations Sustainable Development Goal 6 (the goal of water and sanitation for all by 2030), an estimated 785 million people worldwide still lack basic water access in their homes (UNESCO, 2019). Unreliable water access hinders essential practices like drinking and cooking (Rosinger and Brewis, 2020); causes physical ailments such as dehydration, injury, and diarrhea (Adams et al., 2020); triggers stress, anxiety, and mental health problems (Brewis *et al.*, 2019); and impedes basic hygiene practices, such as frequent and thorough handwashing, that are essential to good health and disease prevention (Prüss-Ustün *et al.*, 2019). Transmission of highly contagious diseases, such as COVID-19, can be accelerated simply because people do not have secure access or adequate supply of tap water at home (Staddon *et al.*, 2020)

While water scarcity is a global concern, it remains pervasive in Africa, a continent with over 800 million people. It has been observed that 54% of the entire continent is arid, and over 300 million of its inhabitants are living in water scarce environments (Rached *et al.*, 1996; NEPAD, 2006; Akpor and Muchie, 2011). More than 2/3 of African households (especially women and children who are considered vulnerable) are also considered "water poor" as they trekked over 1 hour from their home per water collection trip to fetch water for consumption purposes (Montgomery and Elimelech, 2009; Sorenson *et al.*, 2011; Pickering and Davies, 2012). Evidence has further shown that only 58% of African dwellers have access to improved water sources, and these levels are declining in many cities (World Bank, 2014a;

ISSN: 2394-4404

World Bank, 2014b). The unbalanced nature of water scarcity in African countries is also worrisome, as regional disparities exist in terms of water supply and distribution. The WHO-UNICEF (2010) for instance, identified water scarcity to be more pronounced in Sub-Saharan region relative to other regions in Africa, with piped water into dwellings, plots or yards declining between 1990 and 2008 from 43% to 35% in urban areas.

As a nation in Africa, Nigeria with over 180 million inhabitants, also suffers from acute water supply. This dimension of water scarcity is alarming and has been well documented. For example, Nigerians represent one in every ten persons in the world who suffers from unimproved water supply (WHO-UNICEF/JMP, 2017; MICS, 2017). The Wash-Norm survey (2018) conducted by the Federal Government of Nigeria in conjunction with the National Bureau of Statistics reported that between 2000 and 2017, only 21% of Nigerian population had access to drinking water from improved source, provided collection time is not more than 30 minutes for a round trip including queuing. Progress in access to improved water supply in Nigeria has been on the decline for nearly two decades, with access to reliable water sources in Nigeria's urban centres dropping from 78% in 1990 to barely 64% in 2017 (WHO-UNICEF/JMP, 2017; MICS, 2017). Given the ever-increasing population growth of the country at 3.8% (NPC, 2006) the constant growing demand for water is bound to outstrip water availability soon. It has therefore been envisaged that if this current situation remains unabated, only 15-20% of urban residents in Nigeria will be able to enjoy direct water supply in their residence by the year 2025 (Macheve *et al.*, 2015).

In view of the fore goings, previous estimates of access have been reported primarily at the national level, as well as at the subnational level across Africa and for a subset of other countries (Lozano et al., 2018; He et al., 2018). The WHO and United Nations Children's Fund (WHO–UNICEF) Joint Monitoring Programme (JMP) has analysed inequality of access to water by wealth quintile and urban-rural status, as well as within subnational regions for select locations (WHO/UNICEF, 2018). These analyses, however, do not provide comprehensive estimates over space and time across low-income and middle-income countries (LMICs) at fine spatial scales. Understanding variation in water and sanitation access in second administrative level units (eg, wards, districts, counties; henceforth termed units) is imperative to identifying low-access areas at heightened risk of disease transmission within the urban or rural areas (Wolf et al., 2018; Golding et al., 2017). This study departs from these prior studies by using spatial estimation and mapping of water inequality at neighbourhood level at a different geographical area (Minna, Niger State) to provide insight into areas of improvement. This is the research gap for which this study attempts to address.

II. LITERATURE REVIEW

A. WATER AS A HUMAN RIGHT

The human right to safe drinking water was first recognised by the UN General Assembly and the Human Rights Council as part of binding international law in 2010. (UN, 2010). The human right to sanitation was explicitly recognised as a distinct right by the UN General Assembly in 2015 (UN, 2016). The human right to water falls within the body of economic, social, and cultural (ESC) rights recognised by international treaties. ESC focused more on quality-of-life issues (right to health, water, education, etc.); ESC rights can face unique implementation challenges (UN, 2016). Together with, many civil and political rights (or rights that guarantee a person's ability to contribute to their state's political life without discrimination) originated at the national or domestic level and then evolved over time to become codified within international law.

Many socioeconomic rights, however, have followed the opposite path, as they were first conceived of at the international level, with the expectation that they would later be translated "in a meaningful way into national laws." (Robertson, 1994). Thus, the right to water is classified within international law as an ESC, but it is important to note that it contains specific characteristics that distinguish it from many other rights (either civil/political or socioeconomic). Most specifically, water provision requires "tangible contingency" (Jeffords & Shah, 2013). Since water is a physical, tangible resource, environmental conditions must ensure that a certain amount of water exists in order for states to provide the human right to water in the first place. Other rights do not necessarily require this type of tangible component. For instance, there is no environmental resource one needs to physically access or enjoy "the right to be free of genocide, the right to vote, or the right to work." (Jeffords & Shah, 2013). While the idea of a human right to water has been included in some international treaties since the 1970s, the right gained its current form and definition in November 2002, when the influential Committee on Economic, Social, and Cultural Rights (CESCR) defined formally the right to water at the international level by reading GC 15 into the International Covenant on Economic, Social and Cultural Rights.

GC 15 defines the human right to water as the right of everyone to "sufficient, safe, acceptable and physically accessible, and affordable water for personal and domestic uses." (United Nations Committee on Economic, Social, and Cultural Rights, 2003,) This is certainly an expansive definition, and upon its consideration, one begins to understand the challenge of creating indictors to monitor progress with every aspect of the right. In terms of sufficiency, for instance, GC 15 stipulates that the water supply for each person must be enough to cover personal and domestic uses, including "drinking, personal sanitation, washing of clothes, food preparation, [and] personal and household hygiene" (United Nations Committee on Economic, Social, and Cultural Rights, 2003). Water must also be safe, and in this respect, water quality is paramount water must be "free from microorganisms, chemical substances, and radiological hazards that constitute a threat to a person's health." (United

ISSN: 2394-4404

Nations Committee on Economic, Social, and Cultural Rights, 2003).

Additionally, water must also be of acceptable colour, odour, and taste for each personal or domestic use. (United Nations Committee on Economic, Social, and Cultural Rights, 2003) Accessibility remains an important consideration also, and "water and water facilities and services have to be accessible to everyone without discrimination, within the jurisdiction of the state party." (United Nations Committee on Economic, Social, and Cultural Rights, 2003). Within accessibility falls the idea of financial affordability, as "water, and water facilities and services must be affordable for all." (United Nations Committee on Economic, Social, and Cultural Rights, 2003). It is also worth noting that although GC 15 focuses specifically on the human right to water, constituent treaties and resolutions have evolved over the years to also include a focus on sanitation, as the provisions of clean water and functional sanitation are inextricably linked to human health.

B. ACCESS TO WATER: AN OVERVIEW

The most recent reports on progress towards achieving the MDGs confirm that there is still a long way to go regarding the universalisation of water supply and basic sanitation services worldwide (WHO, UNICEF, 2014). Although progress has been made and the MDG target of halving, by 2015, the proportion of the population without sustainable access to safe drinking water and basic sanitation has been met by 116 and 77 countries, respectively, the challenges facing the sector remain daunting (WHO, UNICEF, 2014). The poor continue to be marginalised from many of the improvements that have been documented in recent years. Thus, the inhabitants of developing countries, those living in rural areas, the poor, ethnic and religious minorities, and women are more likely not to have access to improved water sources and to basic water supply and sanitation services (WHO; UNICEF, 2014). As Shaheed *et. al*. (2014) has noted, there are notable differences, over time and space, in terms of the availability, safety and accessibility of drinking water services worldwide, even among WSS that are considered safe.

In terms of spatial inequalities, there is a stark contrast in access to WSS according to the region of the world one inhabits: while there is virtually universal coverage in the developed world, the coverage drops to 74% in urban areas and 25% of the rural areas of developing regions and reaches only 33% in urban areas and 4% in the rural areas of the world's least developed countries (WHO; UNICEF, 2014). Furthermore, access to drinking water is greater in urban than in rural areas, so that of the 750 million people without access to an improved drinking water source, 616 million (approximately 83%) reside in rural areas (WHO; UNICEF, 2014). Similar dynamics can be observed in Latin America and the Caribbean, where a significant portion of the population remains without adequate access to water and sanitation services.

In 2012, around 36 million people worldwide who still relied on unimproved sources of drinking water lived in Latin America and the Caribbean (around 6% of the region's total population) (JMP, 2014). There are also substantial disparities in access to safe drinking water between urban and rural areas, not only in terms of the size of the deficit but also in terms of the accessibility of the available sources: the deficit in coverage in the region's rural areas, is six times greater than in urban areas; and only 66% of the rural population, in contrast with 95% of urban dwellers, get their drinking water through pipes in their homes (JMP, 2014).

This picture is even direr if we consider the WSS's availability and safety, which are often characterised by intermittent supply, low pressure, and high-water losses. Some studies have estimated that around 60% of the population with access to drinking water in LAC do not have continuous access (Rojas *et al.*, 2005). Furthermore, although the official statistics assume that improved drinking water sources imply having access to safe drinking water, it is increasingly evident that not all improved sources provide drinking water that is free from contamination and thus, safe for human consumption. In fact, 12% of the LAC population with a piped connection at home consume water contaminated with excreta (WHO; UNICEF, 2014).

In many low- and middle-income countries, water and sanitation services are still severely lacking. An estimate shows that Access to improved water sources ranges from 56% in sub-Saharan Africa to about 70% in Asia to almost universal Access in high-income countries (Skolnik, 2012; UNICEF, 2014). In terms of sanitation, access to improved sanitation is estimated to range from about 80% in South America to only about 30% in sub-Saharan Africa (World Resources Institute, 2009). With respect to developing countries in Asia and Oceania regions, even though Access to water supply and sanitation has been steadily improving over the past two decades, the regions still lag behind some other developing regions. In South-eastern Asia, the coverage rate for access to improved drinking water gained has increased from 17% in 1990 to 30 % in 2012. Access to improved sanitation has risen from 47% to 71% from 1990 to 2012 (WHO/UNICEF, 2014).

Conversely, in Oceania countries, the coverage of improved drinking water source gained from piped on to premises has declined from 27% in 1990 to 25% in 2012. In contrast, the sanitation coverage has remained the same at 35% from 1990 to 2012 (WHO/UNICEF, 2014). As a result of these measures, it seems that some countries in Asia and Oceania region are unlikely to meet the MDGs of halving the share of the population without access to safe drinking water and sanitation between 1990 and 2015. There are, however, large disparities among countries in low- and middle-income status and between the urban and rural areas within the regions.

C. INEQUALITIES IN ACCESS TO DRINKING WATER AND SANITATION SERVICES

Many people worldwide, including women, children, the elderly, indigenous peoples, and people with disabilities, have lower access to safe drinking water, hygiene or sanitation facilities than other groups (UN-Habitat, 2011). While access to safe drinking water and sanitation is recognised as a fundamental human right. Discrimination based on ethnicity, religion, economic class, social status, gender, age, or physical

abilities often restricts people from accessing land and water resources and related services (WHO, 2014). Such exclusion has long-term social and economic effects, as the disadvantaged are more likely to remain poor, lacking opportunities for education, employment, and social engagement.

Population dynamics also affect access to water. High urbanisation rates in many countries have not been matched by governments' ability to provide adequate drinking water and sanitation infrastructure and improved service delivery (UN-Habitat, 2011). Human migration from rural to urban areas poses a continuous challenge to the provision of drinking water and sanitation services. Especially in poor peri-urban and slum areas and to public health, particularly to prevent outbreaks of cholera and other water-related diseases (WHO and UNICEF, 2014). In the rural context, which require different systems to those generally found in urban settings, providing adequate drinking water and sanitation is challenging. The lack of infrastructure and services means that many people do not have access to adequate sanitation and must rely on unsafe water supplies. The lack of access to safe drinking water and other shortages of basic services, scarce resources, and limited income-generating possibilities, can further entrench vulnerability.

In general, inequality has been described as a wide gap or unequal access to water and sanitation. Factors associated with inequalities such as access to better water and sanitation can include geographic areas (region, urban/rural), social groups (rich and poor), race, ethnicity, and gender (Dannenberg *et al.*, 2011). While important and meaningful progress has been made towards achieving several goals set out in the MDGs (UN, 2014), there are apparent gaps or inequalities in access to water and sanitation, between urban and rural areas, and between rich and poor and marginalised. In addressing this issue, few academic studies and various government and non-government projects have been introduced to emphasize these inequalities in access to water and sanitation in developing countries.

At the global level, gaps in access to improved water and sanitation can persist at the regional and socio-economic level (UNICEF, 2014). The research was conducted using DHS to evaluate the relationship between socio-economic status (SES) and lack of access to improved water and sanitation (Blakely *et al.*, 2005). A good relationship was found in the study between socio-economic determinants such as income status and Access to improved water and sanitation services, and the presence of inequalities in economic lines has been suggested. In addition to disparities along socio-economic lines, differences in access to improved water and sanitation are also visible along geographical lines. Almost half of the two billion people on a regional scale and four out of ten people who have had access to improved drinking water and sanitation live in China and India. However, coverage is lowest in sub-Saharan Africa and Oceania (WHO / UNICEF, 2014).

In terms of urban/rural inequalities, access to better drinking water and sanitation is far higher in urban areas than in rural areas. Worldwide, 1.1 billion people who have gained access to potable water from piped water are living in urban areas, compared to 438 million in rural areas (WHO / UNICEF, 2014). There are a billion more people without better sanitation in rural areas (1767 million) than in urban areas (756 million) (WHO / UNICEF, 2014). In South-East Asia, the coverage for improved water sources is 92%, while the coverage for improved drinking water supplies in rural areas is 81% (WHO / UNICEF, 2014). Similarly, coverage for access to efficient sanitation in the country is higher in urban areas (78%) than in rural areas (58%) (WHO / UNICEF, 2014). Also, there are inequalities in access in intra-urban settings with those living in low-income, informal, or illegal settlements likely to have lower levels of Access to potable water and sanitation (WHO / UNICEF, 2014). Urban communities are expected to have greater access to improved drinking water and sanitation. Compared to rural communities because they are remote and difficult to locate in rural areas.

Urban communities are likely to have greater access to improved drinking water and sanitation compared to rural communities. Because basic infrastructures, such as highways, are the key obstacles for linking rural areas within rural areas, which are remote and difficult to reach populations for these potable water and sanitation systems. Indeed, the rise in community-based research has identified the inequalities in Access Improved water and sanitation in low-and middle-income countries. Pullan *et al.* (2014) carried out a mapping and spatial study of cross-sectional survey data to explore regional differences in sub-Saharan Africa. The study found that countries with higher levels of inequality concerning the use of improved drinking water have faced higher levels of inequality in the use of improved sanitation. The research concluded that there had been Significant regional differences in the expected use of water and sanitation that surpassed urban-rural gaps (Pullan *et al.*, 2014).

III. STUDY AREA AND METHODOLOGY

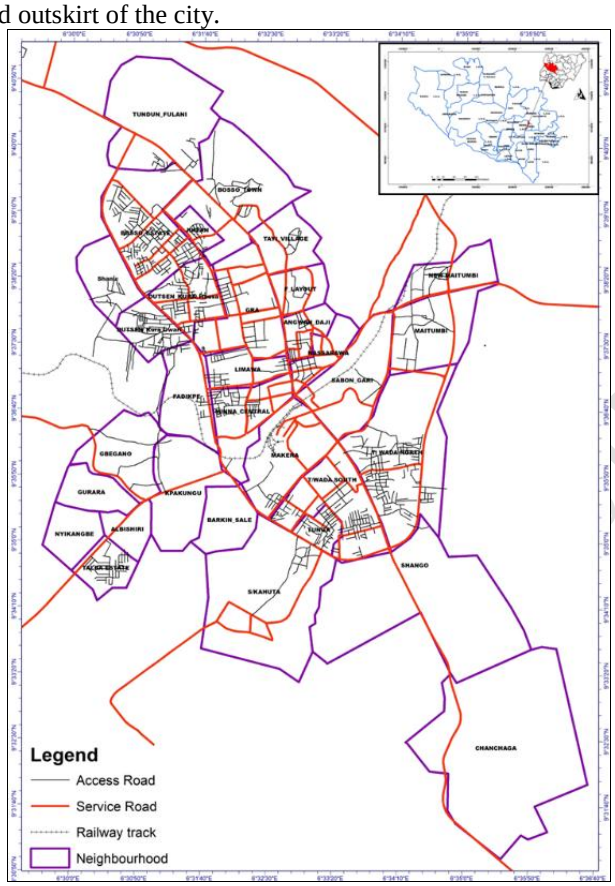
A. PROFILE OF THE MINNA, NIGER STATE NIGER

The city of Minna acts as both the state and administrative capital of Niger state in Nigeria and covers an approximate land mass of 88 km^2. It lies on latitude 9^0 25' N and 9^0 40' N of the equator and longitude 6^0 24' E and 6^0 36' E of the meridian (Figure 1). In terms of regional location, the city is in the North-Central geopolitical zone of Nigeria and provides the gateway to the northern and southern part of Nigeria. Geographically, it is located apart from other bordering cities. By roads, Minna is approximately 112km apart from FCT, 300km from Kaduna, 90km from Bida and 100km to Suleja (Sanusi, 2006).

The geomorphology of the city is characterized by undifferentiated basement of many complexes of gneiss and magnetite. The city lies on a highland with major elevations within the city ranging from 240m – 270m, though the highest level of elevation in the city is 443m which corresponds to Paida hill (Sanusi, 2006). The city is topographically diverse, with a range of steep hills stretching from north-eastern part of Minna westwardly towards Bosso and Tudu-Fulani neighbourhoods and some pockets of rock outcrops within the flat and developable area of the city. This freezes land supply, hence limiting residential developments to the southeast and southwest part of Chanchaga and Kpakungu corridors

respectively. The city is segmented into 32 neighbourhoods, which serve as the basis of the unit of analysis in this study (Figure 1).

Freshwater availability and run-off in the city take the form of river Chanchaga, Tagwai, Suka and their tributaries. In the southeast part of the city is river Chanchaga which takes its source from the north central highlands and thereafter flowing to meet river Kaduna at a point south west of Minna. The major tributaries of river Chanchaga are rivers Wana, Shaho, Godina and Dunalape, which flow from their respective highlands and isolated areas such as Gwam, Kpewi, Zuru and Tsauran Nabi hills (Dalil *et al.*, 2015). The lower part of the city is slice up by river Suka and its tributaries providing flood plains for rice cultivation (Sanusi, 2006). The city is however drained by many drainage channels with a major drainage outlet fed by other secondary drainages, flowing from the centre of the city towards the southwest part and outskirt of the city.



Source: Digitized by the Author

Figure 1.1: Minna in Niger State

IV. METHODOLOGY

The study adopts the descriptive survey research design approach to gather quantitative data required for the study. A well-structured closed ended digital questionnaire on Kobocollect was used to gather data quantitative data, while secondary data on the water mains network in Minna was collected from Niger State Water Board. The population of the neighbourhoods were not available, hence, determine the household population in each neighbourhood was difficult. The study therefore sample 20 households in each of the 32 neighbourhoods, to arrive at a total of 640 households sampled in Minna. One household was selected randomly in each neighbourhood using the street system. Where household was not available in a particular building, the next building was sampled. Access to public water supply in this study was assessed using six key indicators. The indicators are availability of public water mains within a neighbourhood, number of households that have access to pipe water, location of public water source, duration of public water source, distance travelled to water source and time spent collecting water (Table 1). The data collected were screened and cleaned to remove bad response and outliers before analysis. The data gathered were subjected to descriptive (frequency/mean) and inferential analytical (Analysis of Variance) tools, and mapped using ARCGIS 10.8 environment.

S/No	Indicators	Inference
1	Availability of Public Water Mains	Public Water Mains is Available within the Neighbourhood
2	Access to Pipe Water	Number of Households that have access to Pipe Water
3	Location of Public Water Source	Number of Households whose public water source is within the house/compound
4	Distance Travelled to Fetch Water	Household members travel 200m or less to get water
5	Duration of Public Water Supply	Daily duration in hours and weekly duration in days of public water access
6	Time Spent to Collect Water	Number of households that spend 30 minutes or less to collect water from source

Source: Author 2022

Table 1: Indicators of Water Access

V. RESULTS AND DISCUSSION

A. SOCIOECONOMIC CHARACTERISTICS OF THE RESIDENTS

The gender distribution of respondents is presented in Table 1. The result shows that female respondents accounted for 63% (403) of the respondents, while their male counterparts accounted for 37% (237). This shows that both genders are adequately represented in the study. Women in most households are responsible for water collection and use for domestic purposes, hence, their experiences will be vital for this study. The study revealed that majority of the respondents were between the age bracket of 36-55 years (52%). Married persons accounted for 64% of the respondents which were the majority. Table 1 also shows that 68% of the respondents had attained tertiary education, while 19% had attained secondary education. This shows that 87% of the respondents are literate (secondary school qualification or more), which implies that the respondents will find it easy to comprehend the issue of water access under investigation.

The study revealed that respondents for the study comes from different works of life. For example, 27% of the

ISSN: 2394-4404

respondents are traders, 13% are civil/public servant, 11% are retirees, 7% are farmers, 3% are artisan, while 10% are engaged in other livelihood activities. However, 29% of the respondents are unemployed. Households with 5-8 household members accounted for 50% which is the majority, while households with more than 8 persons accounted for 8% which is the least.

Variables	Frequency	Percentage
Gender		
Male	403	63
Female	237	37
	640	**100**
Age of Respondents		
18-35	256	40
36-55	333	52
Above 55	51	8
	640	**100**
Marital Status		
Single	122	19
Widower	58	9
Separated	45	7
Married	416	65
	640	**100**
Education Attainment		
No formal	58	9
Primary	26	4
Secondary	122	19
Tertiary	435	68
	640	**100**
Occupation		
Unemployed	186	29
Retiree	70	11
Trader	173	27
Artisan	19	3
Civil servant	83	13
Farmer	45	7
Others	64	10
	640	**100**
Household Size		
4-Jan	269	42
8-May	320	50
Above 8	51	8
	640	**100**

Table 1: Socioeconomic Characteristics of Respondents

B. AVAILABILITY OF PUBLIC WATER MAINS AND ACCESS TO PUBLIC WATER SUPPLY

The availability of public water supply mains within the neighbourhood and the number of households that have access to public water supply in the neighbourhoods within Minna is presented in Table 3. The result shows that seven of the thirty-two neighbourhoods are not connected to the public water supply mains. This neighbourhoods are Albishiri, Gurara, Talba Estate, Nyikangbe, New Maitumbi, and Gbegano. This neighbourhoods are among the new neighbourhoods developed within the last two decades due to the expansion of Minna and population growth. The distribution pattern of the public water mains is depicted in Figure 2.

The distribution of households with access to public water supply in the neighbourhoods ranges from as low as 0% in Albishiri, Talba Estate, and Gbagano among others to as high as 85% in Bosso estate and 90% in GRA, Minna. The shows that there is significant difference in access to public water between the neighbourhoods with the lowest and highest number of households with access to public water supply.The study also shows that only 38% of the households sample across Minna had access to public water supply.

S/N	NEIGHBOURHOOD	Availability of Public Water Main	Access to Public Water	
			Frequency	Percent
1	ALBISHIRI	No	0	0
2	ANGWAN_DAJI	Yes	14	70
3	BARKIN_SALE	Yes	5	25
4	BOSSO_ESTATE	Yes	17	85
5	BOSSO_TOWN	Yes	4	20
6	CHANCHAGA	Yes	5	25
7	DUTSEN_Gura Gwari	Yes	12	60
8	DUTSEN_KURA_Hausa	Yes	15	75
9	F_LAYOUT	Yes	13	65
10	FADIKPE	Yes	12	60
11	GBEGANDO	No	0	0
12	GRA	Yes	18	90
13	GURARA	No	0	0
14	IJIKPAN	Yes	5	25
15	KPAKUNGU	Yes	4	20
16	LIMAWA	Yes	7	35
17	MAITUMBI	Yes	6	30
18	MAKERA	Yes	7	35
19	MINNA_CENTRAL	Yes	10	50
20	NASSARAWA	Yes	10	50
21	NEW MAITUMBI	No	0	0
22	NYIKANGBE	No	0	0
23	S/KAHUTA	Yes	6	30
24	SABON_GARI	Yes	7	35
25	SHANGU	Yes	11	55
26	SHANU	Yes	6	30
27	T/ WADA NORTH	Yes	13	65
28	T/WADA SOUTH	Yes	15	75
29	TALBA ESTATE	No	0	0
30	TAYI_VILLAGE	Yes	8	40
31	TUNDUN_FULANI	Yes	0	0
32	TUNGA	Yes	12	60
	Total		**242**	**38**

Table 3: Available of Public Water Mains and Access to Public Water Supply

ISSN: 2394-4404

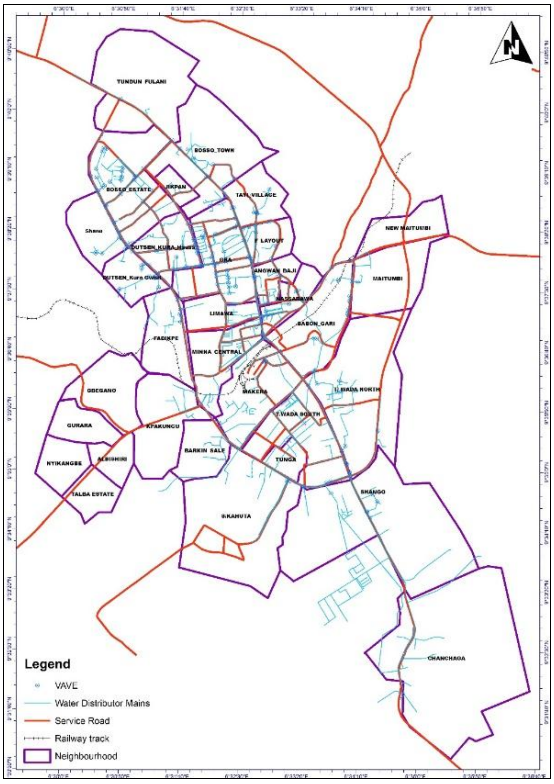


Figure 2: Distribution of Public Water Mains

S/N	NEIGHBOURHOOD	Location of Water Source	
		Frequency	Percent
1	ALBISHIRI	0	0
2	ANGWAN_DAJI	5	25
3	BARKIN_SALE	2	10
4	BOSSO_ESTATE	11	55
5	BOSSO_TOWN	0	0
6	CHANCHAGA	2	10
7	DUTSEN_Kura Gwari	6	30
8	DUTSEN_KURA_Hausa	9	45
9	F_LAYOUT	10	50
10	FADIKPE	7	35
11	GBEGANO	0	0
12	GRA	18	90
13	GURARA	0	0
14	JIKPAN	0	0
15	KPAKUNGU	0	0
16	LIMAWA	2	10
17	MAITUMBI	1	5
18	MAKERA	3	15
19	MINNA_CENTRAL	3	15
20	NASSARAWA	4	20
21	NEW MAITUMBI	0	0
22	NYIKANGBE	0	0
23	S/KAHUTA	3	15
24	SABON_GARI	3	15
25	SHANGO	5	25
26	SHANU	2	10
27	T/ WADA NORTH	7	35
28	T/WADA SOUTH	11	55
29	TALBA ESTATE	0	0
30	TAYI_VILLAGE	4	20
31	TUNDUN_FULANI	0	0
32	TUNGA	9	45
	Total	**127**	**20**

Table 4: Location of Public Water Supply Source

C. LOCATION OF WATER SOURCE

The location of public water sources is presented in Table 4. The analysis shows that only 20% of the households had access to public water supply within the house or compound. The proportion ranges from 0 to 90% across the neighbourhoods.

D. DAILY AND WEEKLY DURATION OF PUBLIC WATER ACCESS

The average daily duration of public water access reported in Table 5 is between 0 and 5.5 hours across the entire neighbourhoods. The average daily duration for Minna city in 3.03 hours daily. Tudun Wada north had the highest daily average duration of 5.5 hours against the least reported in neighbourhoods that are not connected to the public water mains (Table 5). The weekly duration of water access in the neighbourhoods is 0 to 4 days. GRA, Tudun Wada North and South were among the neighbourhoods that reported the highest number of accesses to public water per week, while Albishiri and other neighbourhoods outside the public water mains network were ebbed at the bottom of the ladder.

S/N	Neighbourhood	Duration of Access	
		Weekly Duration	Daily Access
1	ALBISHIRI	0	0
2	ANGWAN_DAJI	2	4
3	BARKIN_SALE	3	3.5
4	BOSSO_ESTATE	3	4.5
5	BOSSO_TOWN	2	5
6	CHANCHAGA	3	4.5
7	DUTSEN_Kura Gwari	3	3.5
8	DUTSEN_KURA_Hausa	3	4.5
9	F_LAYOUT	4	4.5
10	FADIKPE	3	3.5
11	GBEGANO	0	0
12	GRA	4	4.5
13	GURARA	0	0
14	JIKPAN	2	4
15	KPAKUNGU	2	4
16	LIMAWA	2	3
17	MAITUMBI	3	3.5
18	MAKERA	3	4
19	MINNA_CENTRAL	3	2.5
20	NASSARAWA	3	3
21	NEW MAITUMBI	0	0
22	NYIKANGBE	0	0
23	S/KAHUTA	3	2.5
24	SABON_GARI	3	3
25	SHANGO	3	4.5
26	SHANU	2	2.5
27	T/ WADA NORTH	4	5.5
28	T/WADA SOUTH	4	4.5
29	TALBA ESTATE	0	0
30	TAYI_VILLAGE	2	4

31	TUNDUN_FULANI	0	0
32	TUNGA	3	4.5
	Total	**2.3**	**3.03**

Table 5: Duration of Water Access in Minna Neighbourhoods

E. DISTANCE TRAVEL AND TIME SPENT TO COLLECT WATER

The study assessed the number of households that travel for less than 200 metres to have access to public water and the time taken to collect the water and back. Table 6 shows that the proportion of households that travel 200 metres or less to have access to public water is 15%-90% across the neighbourhoods. In general, it was observed that only 220 (34%) households of the 640 sampled travelled for 200 metres or less to access public water. Table 6 also revealed that 38% of the households spent 30 minutes or less to collect public water and back. The proportion of households that spends 30 minutes or less collecting water and back ranges from 20% in Kpakungu and Bosso Town respectively to as high as 90% in GRA.

S/N	Neighbourhood	Distance Travel (=< 200m)		Time Spent (=< 30 Min)	
		Frequency	Percent	Frequency	Percent
1	ALBISHIRI	0	0	0	0
2	ANGWAN_DAJI	11	55	14	70
3	BARKIN_SALE	4	20	5	25
4	BOSSO_ESTATE	17	85	17	85
5	BOSSO_TOWN	2	10	4	20
6	CHANCHAGA	3	15	5	25
7	DUTSEN_Kura Gwari	12	60	12	60
8	DUTSEN_KURA_ Hausa	15	75	15	75
9	F_LAYOUT	13	65	13	65
10	FADIKPE	12	60	12	60
11	GBEGANO	0	0	0	0
12	GRA	18	90	18	90
13	GURARA	0	0	0	0
14	JIKPAN	3	15	5	25
15	KPAKUNGU	4	20	4	20
16	LIMAWA	6	30	7	35
17	MAITUMBI	3	15	6	30
18	MAKERA	5	25	7	35
19	MINNA_CENTRAL	10	50	10	50
20	NASSARAWA	10	50	10	50
21	NEW MAITUMBI	0	0	0	0
22	NYIKANGBE	0	0	0	0
23	S/KAHUTA	5	25	6	30
24	SABON_GARI	5	25	7	35
25	SHANGO	9	45	11	55
26	SHANU	6	30	6	30
27	T/ WADA NORTH	13	65	13	65
28	T/WADA SOUTH	15	75	15	75
29	TALBA ESTATE	0	0	0	0
30	TAYI_VILLAGE	7	35	8	40
31	TUNDUN_FULANI	0	0	0	0
32	TUNGA	12	60	12	60
		220	34	242	38

Table 6: Distance Travel and Time Spent to Collect Water

F. LEVEL OF PUBLIC WATER ACCESS IN MINNA NEIGHBOURHOODS

The level of public water access in Minna neighbourhoods was computed from six key indicators: availability of public water mains within a neighbourhood, Access to public water supply by households, location of the public water, duration of the water source (Daily/weekly), distance travelled, and time spent. These indices were aggregated to estimate the level of access enjoyed by households in the neighbourhoods. Table 7 shows the pattern of access to public water supply in Minna neighbourhoods. The result shows that six neighbourhoods (Albishiri, Gbegano, new Maitumbi, Gurara, Nyikangbe, and Talba Estate) had no access to public water supply from all dimensions. GRA had very good access to public water with an index of 0.83 on a scale of 0-1. Tudun Fulani on the other hand had a very poor access to public water with an index of 0.17. Table 7 also shows that 11 neighbourhoods had poor access, 8 neighbourhoods had fair access, while 5 neighbourhoods had good access to public water supply in Minna. The spatial distribution pattern of access to public water by indicators across the neighbourhoods is depicted in Figure 3.

Neighbourhood	NPW	HPW	LWS	DWS	DTW	TS	Water Access	Remark
ALBISHIRI	0	0	0	0.00	0	0	0.00	N.A
ANGWAN_DAJI	1	0.7	0.25	0.23	0.55	0.7	0.57	Fair
BARKIN_SALE	1	0.25	0.1	0.29	0.2	0.25	0.35	Poor
BOSSO_ESTATE	1	0.85	0.55	0.31	0.85	0.85	0.73	Good
BOSSO_TOWN	1	0.2	0	0.25	0.1	0.2	0.29	Poor
CHANCHAG	1	0.25	0.1	0.31	0.15	0.25	0.34	Poor

ISSN: 2394-4404

A								
DUTSEN_Kura Gwari	1	0.6	0.3	0.29	0.6	0.6	0.56	Fair
DUTSEN_KURA_Hausa	1	0.75	0.45	0.31	0.75	0.75	0.67	Good
F_LAYOUT	1	0.65	0.5	0.38	0.65	0.65	0.64	Good
FADIKPE	1	0.6	0.35	0.29	0.6	0.6	0.57	Fair
GBEGANO	0	0	0	0.00	0	0	0.00	N.A
GRA	1	0.9	0.9	0.38	0.9	0.9	0.83	Very Good
GURARA	0	0	0	0.00	0	0	0.00	N.A
JIKPAN	1	0.25	0	0.23	0.15	0.25	0.31	Poor
KPAKUNGU	1	0.2	0	0.23	0.2	0.2	0.30	Poor
LIMAWA	1	0.35	0.1	0.21	0.3	0.35	0.38	Poor
MAITUMBI	1	0.3	0.05	0.29	0.15	0.3	0.35	Poor
MAKERA	1	0.35	0.15	0.30	0.25	0.35	0.40	Poor
MINNA_CENTRAL	1	0.5	0.15	0.27	0.5	0.5	0.49	Fair
NASSARAWA	1	0.5	0.2	0.28	0.5	0.5	0.50	Fair
NEW MAITUMBI	0	0	0	0.00	0	0	0.00	N.A
NYIKANGBE S/KAHUTA	0	0	0	0.00	0	0	0.00	N.A
SABON_GARI	1	0.3	0.15	0.27	0.25	0.3	0.38	Poor
SHANGO	1	0.35	0.15	0.28	0.25	0.35	0.40	Poor
SHANU	1	0.55	0.25	0.31	0.45	0.55	0.52	Fair
T/WADA NORTH	1	0.3	0.1	0.19	0.3	0.3	0.37	Poor
T/WADA SOUTH	1	0.65	0.35	0.40	0.65	0.65	0.62	Good
TALBA ESTATE	1	0.75	0.55	0.38	0.75	0.75	0.70	Good
TAYI_VILLAGE	0	0	0	0.00	0	0	0.00	N.A
TUNDUN_FULANI	1	0.4	0.2	0.23	0.35	0.4	0.43	Fair
TUNGA	1	0	0	0.00	0	0	0.17	Very Poor
	1	0.6	0.45	0.31	0.6	0.6	0.59	Fair
	0.81	0.38	0.20	0.22	0.34	0.38	0.39	Poor

Note: NPW= Neighbourhood access to Public Water Mains; HPW= Household Access to Public Water; LPW= Location of Public Water Source; DWS= Duration of Water Supply; DTW=Distance Travelled to Water Source; TS=Time Spent collecting Water

Table 7: Level of Public Water Access in Minna Neighbourhoods

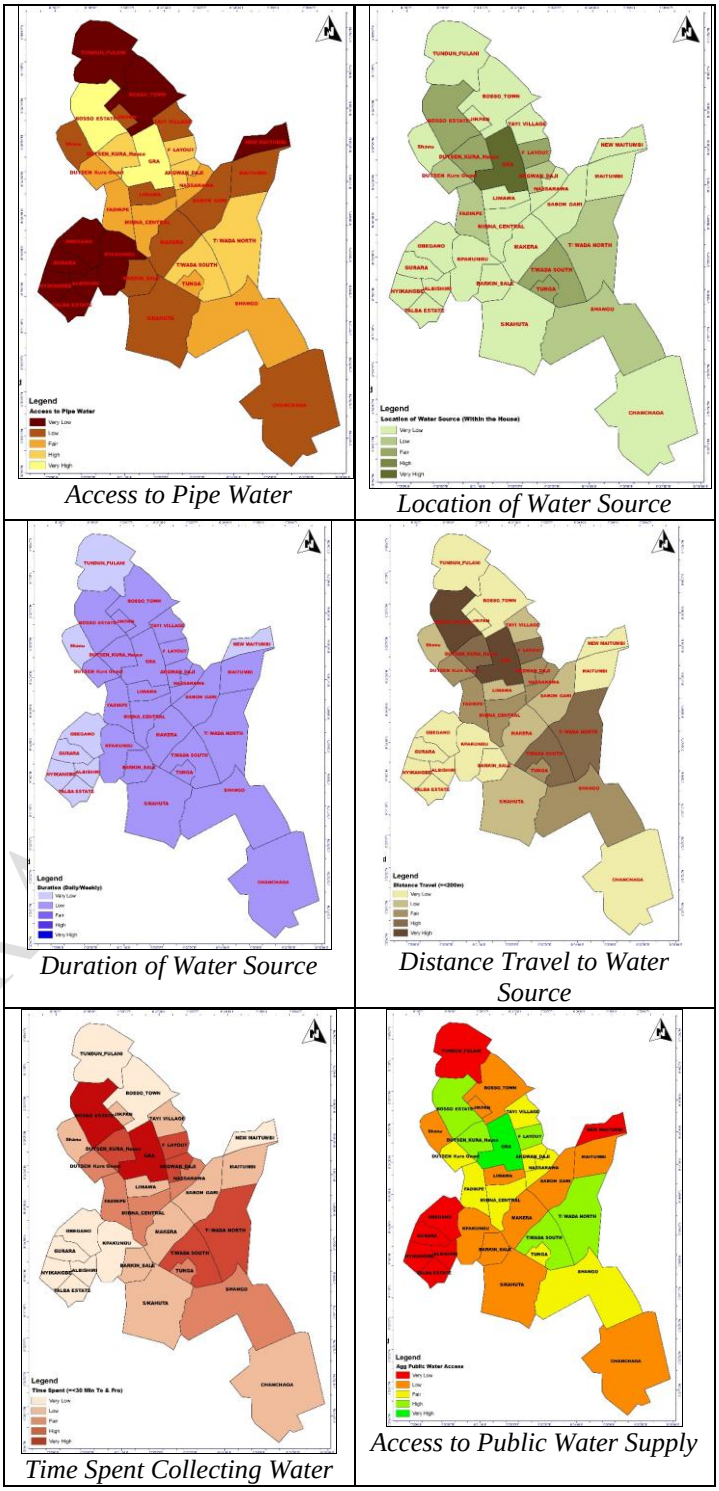


Figure 3: Spatial Distribution Pattern of Neighbourhood Access to Public Water by Indicators

G. VARIATION IN ACCESS TO PUBLIC WATER SUPPLY IN MINNA

The variation in access to public water supply in Minna neighbourhoods was assessed using ANOVA. The result of the ANOVA is presented in Table 8. The ANOVA recorded and F value of 6.78, critical F-value of 1.51 and a P-value of <.001. Hence, this implies that there is a statistically significant difference in the level of public water access

enjoyed by neighbourhoods in Minna. This further confirms the level of spatial inequality exhibited in respect to provision of public water and public water infrastructures in the neighbourhoods.

	Sum of Squares	df	Mean Squares	F	p	Critical F-Value
Between Groups	12.36	31	0.4	6.78	<.001	1.51
Within Groups	11.3	192	0.06			
Total	23.66	223				

Table 8: Variation in Access to Public Water Supply in Minna

VI. CONCLUSION AND RECOMMENDATIONS

An essential component of sustainable and healthy communities is secure access to water. It is also a fundamental human right. Efforts to stop the spread of infectious diseases like COVID-19 will fail if everyone or certain group of people lacks access to clean water, thereby undermining global health progress while favouring some communities over others. In urban regions of the Minna, our analysis demonstrates ongoing discrepancies in the availability of piped water, a finding that is closely related to the population's varied socioeconomic characteristics. Access to public water should not be based on socioeconomic background of the people, it must be universal and comprehensive. The study recommends that adequate attention must be devoted to the connection of all neighbourhoods and households to public water supply to improve the health and sanitation practices of the people.

REFERENCES

[1] Adams, E. A., Stoler, J., & Adams, Y. (2020). Water insecurity and urban poverty in the Global South: Implications for health and human biology. American Journal of Human Biology, 32(1), e23368.
[2] Brewis, A., Choudhary, N., & Wutich, A. (2019). Household water insecurity may influence common mental disorders directly and indirectly through multiple pathways: Evidence from Haiti. Social Science & Medicine, 238, 112520.
[3] Golding N, Burstein R, Longbottom J, et al. Mapping under-5 and neonatal mortality in Africa, 2000–15: a baseline analysis for the Sustainable Development Goals. Lancet 2017; 390: 2171–82.
[4] Hadley, C., & Freeman, M. C. (2016). Assessing reliability, change after intervention, and performance of a water insecurity scale in rural Ethiopia. Food Security, 8(4), 855-864.
[5] He, W. J., Lai, Y. S., Karmacharya, B. M., Dai, B. F., Hao, Y. T., & Xu, D. R. (2018). Geographical heterogeneity and inequality of access to improved drinking water supply and sanitation in Nepal. International journal for equity in health, 17(1), 1-14.
[6] Lozano R, Fullman N, Abate D, et al. Measuring progress from 1990 to 2017 and projecting attainment to 2030 of the health-related Sustainable Development Goals for 195 countries and territories: a systematic analysis for the Global Burden of Disease Study 2017. Lancet 2018; 392: 2091–138.
[7] Prüss-Ustün, A., Wolf, J., Bartram, J., Clasen, T., Cumming, O., Freeman, M. C., ... & Johnston, R. (2019). Burden of disease from inadequate water, sanitation and hygiene for selected adverse health outcomes: an updated analysis with a focus on low-and middle-income countries. International journal of hygiene and environmental health, 222(5), 765-777.
[8] Rosinger, A. Y., & Young, S. L. (2020). The toll of household water insecurity on health and human biology: current understandings and future directions. Wiley Interdisciplinary Reviews: Water, 7(6), e1468.
[9] Rosinger, A. Y., & Brewis, A. (2019). Life and death: Toward a human biology of water. American Journal of Human Biology, 32(1).
[10] Rosinger, A. Y. (2018). Household water insecurity after a historic flood: Diarrhea and dehydration in the Bolivian Amazon. Social Science & Medicine, 197, 192-202.
[11] Rusca, M., Alda-Vidal, C., Hordijk, M., & Kral, N. (2017). Bathing without water, and other stories of everyday hygiene practices and risk perception in urban low-income areas: The case of Lilongwe, Malawi. Environment and Urbanization, 29(2), 533-550.
[12] Staddon, C., Everard, M., Mytton, J., Octavianti, T., Powell, W., Quinn, N., ... & Mizniak, J. (2020). Water insecurity compounds the global coronavirus crisis. Water International, 45(5), 416-422.
[13] Stevenson, E. G., Greene, L. E., Maes, K. C., Ambelu, A., Tesfaye, Y. A., Rheingans, R., & Hadley, C. (2012). Water insecurity in 3 dimensions: an anthropological perspective on water and women's psychosocial distress in Ethiopia. Social science & medicine, 75(2), 392-400.
[14] Sultana, F. (2011). Suffering for water, suffering from water: Emotional geographies of resource access, control and conflict. Geoforum, 42(2), 163-172.
[15] UNESCO World Water Assessment Programme, "The United Nations world water development report 2019: Leaving no one behind" (UNESCO, 2019). https://en.unesco.org/themes/water-security/wwap/wwdr/2019. Accessed 15 October 2020.
[16] WHO UNICEF Joint Monitoring Programme. JMP methodology: 2017 update & SDG baselines. World Health Organization and UNICEF: Geneva, 2018. https://washdata.org/sites/default/files/documents/reports/2018-04/JMP-2017-update-methodology.pdf (accessed March 10, 2020).
[17] Wolf, J., Hunter, P. R., Freeman, M. C., Cumming, O., Clasen, T., Bartram, J., ... & Prüss-Ustün, A. (2018). Impact of drinking water, sanitation and handwashing with soap on childhood diarrhoeal disease: updated meta-analysis and meta-regression. Tropical medicine & international health, 23(5), 508-525.
[18] Wutich, A., Brewis, A., & Tsai, A. (2020). Water and mental health. Wiley Interdisciplinary Reviews: Water, 7(5), e1461.

ISSN: 2394-4404

[19] Wutich, A., & Brewis, A. (2014). Food, water, and scarcity: toward a broader anthropology of resource insecurity. Current Anthropology, 55(4), 444-468.
[20] Wutich, A. (2009). Intrahousehold disparities in women and men's experiences of water insecurity and emotional distress in urban Bolivia. Medical anthropology quarterly, 23(4), 436-454.
[21] Wutich, A., & Ragsdale, K. (2008). Water insecurity and emotional distress: coping with supply, access, and seasonal variability of water in a Bolivian squatter settlement. Social science & medicine, 67(12), 2116-2125.