

Determining the State of Water Deprivation among the Residents of Informal Settlement in Jos Metropolis, Nigeria

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Abstract

This study employs the quantitative method to determine the real situation of residents access to improved/unimproved water sources in connection to water collection time and water quantity in four informal settlements of Jos Metropolis Nigeria. Three hundred and eighty-two (382) questionnaires were randomly administered to a sample population of mostly women and girls. Findings revealed that though most residents have access to improved sources, access is however not restricted to only one source but a combination of different sources, which account for 31.7% of the responses. 43.6% of the respondents spent more than 30mins on water fetching, which corresponds to the JMP drinking water ladder's limited category. 35% of the total responses have daily access to at least eight jerry cans (160 liters) of water, which falls short of Gleick's recommended water standard of at least 50litres/capita/person daily, considering an average household size of seven persons per household. Residents of Jos Metropolis' informal settlements lack adequate access to water. As a result, policymakers must pay attention to the unique water needs of informal settlements.

Keywords: Informal Settlements, Water Collection Time, Water Quantity, Water Access, Nigeria.

Introduction

Water is necessary for all living species because it plays an important part in the life of man. It is a useful resource that is essential for the survival of human life (Nkemdirim et al., 2017). Hence it is not an exaggeration to say that water is life (Adeleye et al., 2014). However, there is general recognition that a rising water problem is affecting millions of the world's poorest population (Fonjong & Ngekwu, 2014). One major issue of the twenty-first century is insufficient access to safe and drinkable water that is affordable (Gleick et al., 2002). It is equally observed that because of the unplanned nature of informal settlements, they are rarely equipped with reliable water supply as such; the demand for water does not match the availability and residents are denied access to such essential public amenities, infrastructures and services (Daniel et al., 2015). Goal 6 of the SDGs is 'Clean Water and Sanitation'. The first target of goal six is 'Ensure availability and sustainable management of water and sanitation for all by 2030' (WHO/UNICEF, 2017). The Joint Monitoring Programme of WHO and UNICEF has been tracking progress since 1990 using improved drinking water sources to create national, regional and global population estimates, it is endorsed by the UN for monitoring MDGs and SDGs progress (Pérez-Foguet et al., 2017).

Smiley (2013) argues in this context that estimates of urban coverage do not correctly represent the level of water scarcity in informal communities, mostly ignoring supply inconsistencies, intra-urban inequalities and other complexities. Inequalities in water availability within cities are particularly prominent in peri-urban and informal settings and global water access indicators fall short of capturing such disparities (Dagdeviren & Robertson, 2011; Dos Santos et al., 2017). Furthermore, statistics usually concentrate on rural or urban access, having little to no knowledge of informal settlements. As a result, recurrent water shortages and disparities within cities in water availability are concealed (Adams, 2017). Moreover, because of the difficulties and limitations connected with perfectly determining the percentage of the world population lacking access, it's possible that the number of people considered to have access is greatly exaggerated (Nganyanyuka et al., 2014 ; Satterthwaite, 2016 ; Adams, 2017) and most at times peri urban and informal communities are frequently absent from formal statistics. As a result, coverage of urban water sources on paper appears to be better than it is in reality (Martinez-santos, 2017). Additionally, the traditional indicators that were employed to evaluate clean water availability progress as reported by the WHO/UNICEF Joint Monitoring Program (JMP) hide intra-urban, intra-rural, and other critical disparities in the water sector (WHO & UNICEF, 2015), and target 6.1 stresses the need of equal access to clean and affordable drinking water for all while also drawing emphasis to appropriately managed water sources. It is necessary to analyse detailed information on informal settlements which make up the majority of the population in sub-Saharan urban regions among other key characteristics such as; the availability of sufficient amounts of water for domestic usage (WHO & UNICEF, 2013). It is crucial to highlight however that majority of past empirical studies on water access in Nigeria and the study area have been holistic in character, with little direct attention paid to informal settlements in respect to the JMP's ladder for drinking water sources and water quantity (Chia et al. 2014; Lekwot et al. 2015; Ryeshak et al. 2015; Ahile et al. 2015). In these few studies on urban water supply, informal settlements are only mentioned marginally. As a result, nothing is known about the situation of people in terms of their access to the various types of water recommended by the WHO/UNICEF Joint Monitoring Program (JMP), and the amount or quantity of water available for household use. The study aims to investigate and understand the actual access to improved/unimproved sources of water in informal communities, relating it to the indicators of water collection time and quantity. This will help to create awareness about the status of water in informal settlements of Jos metropolis, establishing the groundwork for a pragmatic all-inclusive solution.

Research Questions

What extent do residents have access to water in informal settlements?

Research Objectives

1. To identify the various sources of water available for residents use.
2. Determine the level of residents deprivation in terms of water collection time and water quantity.

Sustainable Water Access Indicators

Sustainability indicators are seen to be signs of progress or lack, and are exhibited in the complete growth of a neighbourhood, community, town or city (Musakwa & Van Niekerk, 2015). According to Meji'a et al. (2012) these indicators are known as indicators of performance; such are the qualitative and quantitative variables that provide a straightforward and dependable method of measuring success. It also reveals changes associated with an intervention or aids in assessing an organization's performance as it relates to the stated goals. That is to say, performance indicators are used to analyse and measure progress toward a desired outcome or an aspect of it, as well as to determine the extent to which beneficiaries/target groups have been reached (UNESCO, 2011). The United Nations has recognised and accepted sustainability criteria and indicators as critical tools for measuring the status of sustainable development (Latip et al., 2015). For example, quantity, quality, accessibility, and reliability are the four categories that make up the IRC ladder (Kayser et al., 2013). Majuru et al. (2012) employed three access indicators in the same way as: quality of water, distance, and consumption of water, while Obeng-Odoom (2012) presents a water-access index with respect to pricing, water quality, distribution of water, and reliability of water. This research will simply employ two indicators: water collection time and water quantity as required by the Joint Monitoring Program (JMP) of WHO/UNICEF, and Glieck's requirement of water quantity respectively to establish whether informal residents have access to water.

Water Collection Time Indicators

Water access has typically been evaluated on a worldwide scale in terms of the percentage of the population with improved access to water sources (Adams, 2017). An adequate water supply should be available in the immediate neighbourhood of the dwelling (Kayser et al., 2013). In respect to JMP water categories we have the improved sources as:

- water piping systems: water from the tap in the house, plot or yard, public stand posts.
- water supply that is non-piped: tube wells or boreholes, wells that are protected and springs, water that is packaged, tanker trucks and small carts distributed water.
- The unimproved facilities: this category includes water sources that are non-piped such as; springs and unprotected wells.
- No facility : this category is limited to surface water (WHO/ UNICEF), 2017).

Sustainable Development Goal 6 Target 1, considers the first two categories as improved sources of drinking water and that they have the potential to deliver clean water due to their

design and construction (WHO/UNICEF), 2017). More recently, the JMP drinking water ladder is divided into the following service categories:

- Safely managed: water that is portable from an improved on-site water supply and always accessible when needed
- Basic: water that is portable from an improved source, provided the round-trip collection time is shorter than 30 minutes, including queuing
- Limited: water that is portable from an improved source where the round-trip collection time, including queuing exceeds 30 minutes
- Unimproved: Using unprotected dug well or unprotected spring water as a drinking water source
- Surface water: directly consuming water from a river, dam, lake, pond, stream, canal, or irrigation canal (WHO/UNICEF 2017)

Previous studies showed that residents of informal settlements have access to improved water sources such as well water, pipe - borne water (direct connection, neighbour's home connected with piped water, water kiosk) and water from trunk (Abaje et al., 2009; Olajuyigbe, 2010; Sorenson et al. 2011; Smiley, 2016; Abdullahi & Abdu, 2018; Oskam et al., 2021; Victor et al., 2022). It is however important to note that though the findings of these studies indicates that people have access to water sources that are improved. In several other studies, evidence shows that residents of informal settlements rely on mixed water sources because a single water source is not reliable (Peloso & Morinville, 2014; Chidya et al. 2016; Kayaga et al. 2018). In terms of water collections time; in some informal settlements, the time spent on fetching water is relatively short; less than 10minutes, less than 15minutes and less than 30minutes (Olajuyigbe, 2010; Sorenson et al. 2011; Davis et al., 2012; Nzengya & Aggarwal, 2013). On the contrary, other studies revealed that residents of informal settlements spent more than 30minutes fetching water. For example, water collection time ranges from 40 minutes in abundance season to two and a half hours during scarcity, and many women spending greater than four hours on a long and exhausting trek to fetch water (Buor 2003; Adeleye et al., 2014).

Indicators of Water Quantity

Water adequacy is critical to ensure human survival, and a vital precondition for social and economic growth (Howard & Bartram, 2003; Karthe et al., 2015). When water availability is constrained by natural factors, there is physical water shortage (Molle & Mollinga, 2003). This is a circumstance in which there is insufficient water to meet all of the population's needs (Ahile et al., 2015). Each person's water supply ought to be adequate and continuous for the sake of a person's hygiene and other home purposes (Karthe et al., 2015). Its amount (availability) for individuals must be adequate and continuous for personal and household applications such as drinking, clothing washing, hygienic conditions, preparation of food as well as family cleanliness (Kayser et al., 2013). Nkemdirim et al. (2017) argue that access to safe drinking water can be assessed or defined by the number of persons who have a

reasonable means of obtaining an acceptable amount of safe drinking water. However, problems of water quantity arise from having an inadequate amount of water (Subbaraman et al., 2015). If water demand cannot be met due to the situation and challenges existing, consumption is anticipated to fall (Dana, 2011) and to suit the needs of the home, different supplies will be required (Thompson et al., 2000 ; Okotto et al., 2015). The World Health Organization (WHO) recommends a minimum of 20 Litres/person/ day, with a maximum of 100 L/person/day required to meet consumption and sanitation requirements (Gilman et al., 1993). Along the same line, the United Nations Human Right General Assembly on Water and Sanitation, specifies that every person should have sufficient water for individual and household purposes (In the range 50 and 100 litres/person/day). World Health Organization suggested a benchmark listed in Samson (2013) as 120 litres/ person/day for residential water utilisation and functions. Gleick in 1992 established a fundamental water requirement that is often used, stating that a person's daily water entitlement should be 50 litres: drinking water is 5 litres , water for sanitation 20 litres, bathing water 15 litres , and water for food preparation 10 litres (Gleick & IWRA, 1996).

Previous studies indicate that water consumption in informal settlements is low. For example, the majority of families in Bwaise III Parish and Kawempe Division utilise 3–4 jerry cans of water; approximately 80 litres of water each day (Nakawunde et al., 2010). Similarly, the median water amount in Mumbai slums is woefully inadequate, at less than 20 litres/capita/day (Subbaraman et al., 2015). According to Abdullahi & Abdu (2018) most of the respondents (33.8 percent) have water access of 251-300 litres (12-15 jerry cans), which is still insufficient in comparison to an average of 12 people in a family within the research area. On the contrary, a report from Dustho Shatho Kendro (DSK) in Dhaka shows that 50 percent of families typically consume 200-250 litres of water per day and only approximately 30% of families face extreme water shortages for their daily needs (Dana, 2011). Likewise, a study conducted by Kayaga et al. (2018) in Godey town Ethiopia, revealed that most respondents constituting 68% have access to 200litres of water per day.

Research Method

Study Area

The study area lies within Longitudes 8°50'00"E to 9°00'00"E and latitudes 9°40'00"N to 10°00'00"N (see Fig 1). Jos Metropolis covers part of the Local Government Areas of Jos North and Jos South (LGAs), it has a coverage area of 249.7km² and a height (altitude) of 1,217 metres (3,993 feet) above sea level (Adzandeh et al., 2015). Jos Plateau's geology includes a mix of ancient granite and basement complex rocks, this dates back respectively to the Cambrian and Precambrian times in addition to the younger granite that forms inselbergs and mountainous places(Alford et al., 1979). As a result of the topography of the area getting access to groundwater (through wells) is a problem. There are currently over 30 slums in Jos, the home to more than 70% of city dwellers (Dung-Gwom, 2007). Three types of slum locations are in existence: intermediate slums, central area slums, and

peripheral slums (Dung-Gwom & Oladosu, 2004). Kabong, Jenta Adamu, Mado/Sabon-Gari, and Angwan Rukuba are the research areas out of the fifteen (15) intermediate slums in Jos -Bukuru Metropolis (see fig.1)

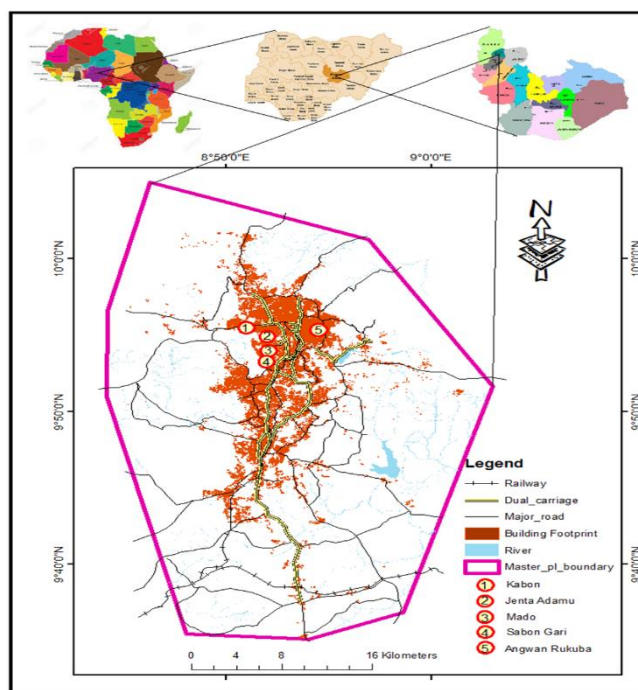


Figure 1: Geographical Location of the Study Area

Source: Ministry of Lands, Survey and Town Planning, Jos Nigeria

Population and Sampling

This study employed the simple random sampling technique. In this method, every member of the population has an equal chance of being chosen as a subject (Creswell, 2014). From a sample frame of 72,597 people (NPC, 2019) the sample size was determined using the sample table produced by Krejcie & Morgan (1970). They are of the opinion that the table can be used to ascertain the appropriate sample size in a finite population, and no calculation is needed to use the table. From the sample table, a suitable sample size for the population of 72,597 people is 382 people. In the distribution pattern, each settlement was divided into five clusters and a total of 382 questionnaires were administered as follows: Kabong, 151: Jenta Adamu, 117: Angwan Rukuba, 54: Tudun Wada/Mado, 60.

Data Collection and Analytical Procedure

Questionnaires are used in gathering quantitative data, which is most prominent in a survey strategy (Taylor et al., 2011). The questionnaire used was separated into two parts: the first is the biodata section and the second captures the questions that relate to the water sources, water collection time and water quantity. The research used interval and nominal

scales for the measurement. Since most of the respondents are not internet- inclined, questionnaires were administered to them in person by the researcher assisted by some other researchers using the respondent's preferred language (Hausa or English). Questionnaires were administered manually during visits to the sites, and collected at the peak of water scarcity during the dry season month of March 2020. Descriptive statistics was used to analyse the data collected in the form of frequencies and percentages using the Statistical Package for Social Sciences (SPSS), version 23.

Results and Discussions

Demographic characteristics

Table 1: Demographic characteristics of the respondents (n-382)

Variables		Frequency	Percentage
Educational Level	Primary		
	Secondary Tertiary	21	5.7
	Non-Formal	169	45.8
		166	45.0
		13	3.5
Occupation			
Civil Servant	Business/Private	35	14.4
Farming Student		172	46.6
Others		9	2.4
		123	33.3
		12	3.3
Income Level			
Less than #5,000		131	35.5
#6,000 – 10,000		102	27.6
#11,000 -15,000		50	13.6
#16,000 – 20,000		28	7.6
#21,000 and above		58	15.7
Household size			
2-5 persons		207	56.1
6-9 persons		132	35.8
10-14 persons		26	7.0
>14 persons		4	1.1
Gender			
Male		63	17.1
Female		306	82.9

Source: Authors Field Survey, 2020

Major Water Sources

The figure below shows the various sources of water used by residents.

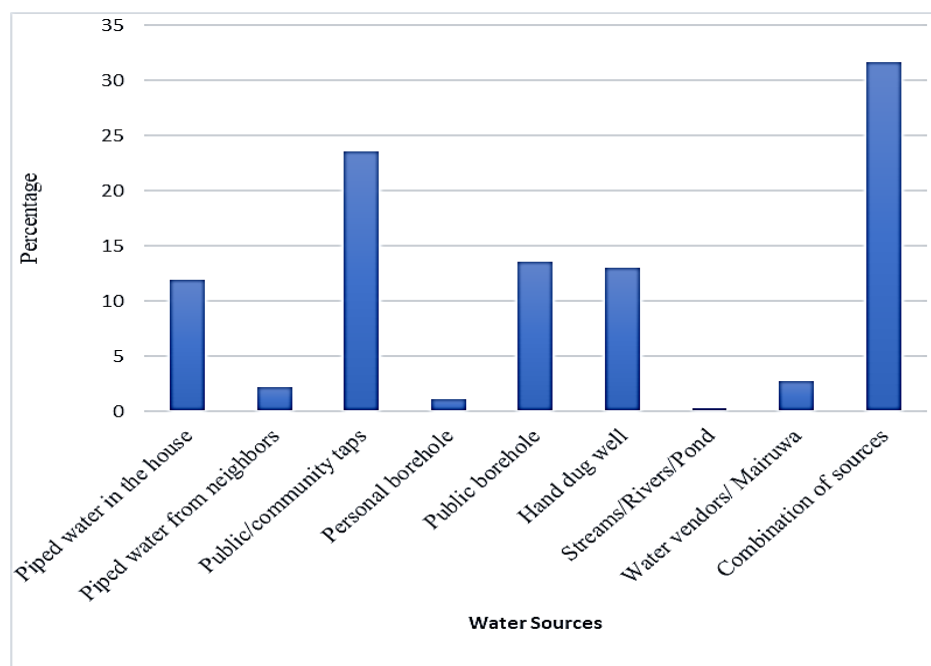


Figure 2: Water Sources Available for Household Use

Source: Authors Field Survey, 2020

The results of the main water sources accessible for households demonstrate that getting water is generally through the combination of all available sources, which account for 31.7 percent of all responses, public/community taps are the second most popular, accounting for 23.6 percent of all responses. Only 0.3% of the respondents get their water from streams/rivers and ponds (see fig 2). According to this study, majority of residents have improved water supplies. This is however in agreement with what previous studies also discovered (Oskam et al., 2021; Victor et al., 2022). Similarly, other studies demonstrate that the majority of the people get water access through different types of improved sources of water such as tap water and water from trucks (Abaje et al., 2009 ; Abdullahi & Abdu 2018). Even though this survey reveals that households have greater access to water sources that are improved, but would have to combine them to meet their daily water needs, which is in agreement to other related studies (Nzengya & Aggarwal 2013; Chidya et al. 2016 ;Peloso & Morinville, (2014). Additionally, though studies conducted in Nigeria revealed greater access to water sources that are improved. However, each of the research differs concerning the sort of improved water source. This is because the nature of Nigeria's hydrology is such that consolidated sedimentary rock underpins around 20% of the country and crystalline rock underpins 60% (FGN, 2004). Areas defined by crystalline rocks are mainly found in the country's north, where groundwater is scarce, as a result well water yields are not predictable (Akpobio, 2012). On the contrary, places in the south have access

to ground water; that is why well water is the most common source of water in Nigeria's southern regions. Furthermore, the peculiarity in Jos Metropolis in terms of improved water source is because the informal settlements sampled are located on terrain that is rocky. As a result, getting water access from wells is difficult. The rocky terrain therefore is an impediment to accessing ground water sources, which can complement network water connection.

Water Collection Time

Below is a chart that shows the time spent by the residents on fetching water.

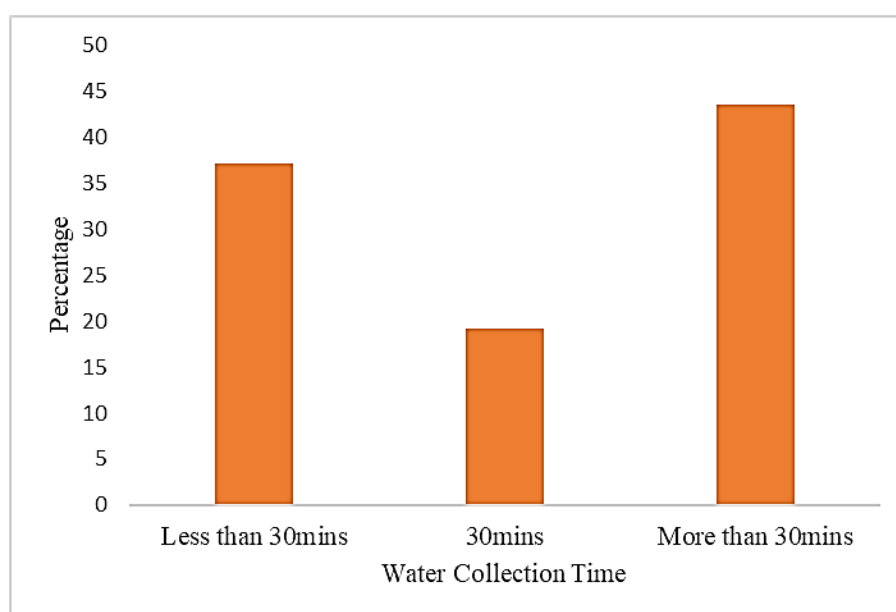


Figure 3: Water Collection Time

Source: Authors Field Survey, 2020

Even though households have greater access to water sources that are improved, the time it takes to fetch water exceeds 30 minutes. This phenomena however agrees with other previous result (Buor, 2003; Adeleye et al., 2014 ;Ellis Adjei Adams et al., 2016). Considering the JMP drinking water ladder, which classifies improved water sources according to water collection time as: safely managed category, basic category, limited category, unimproved category, and surface water. Majority of residents in Jos metropolis informal settlements fall under the limited group.

Water Quantity

The figure below shows the quantity of water available for resident's consumption.

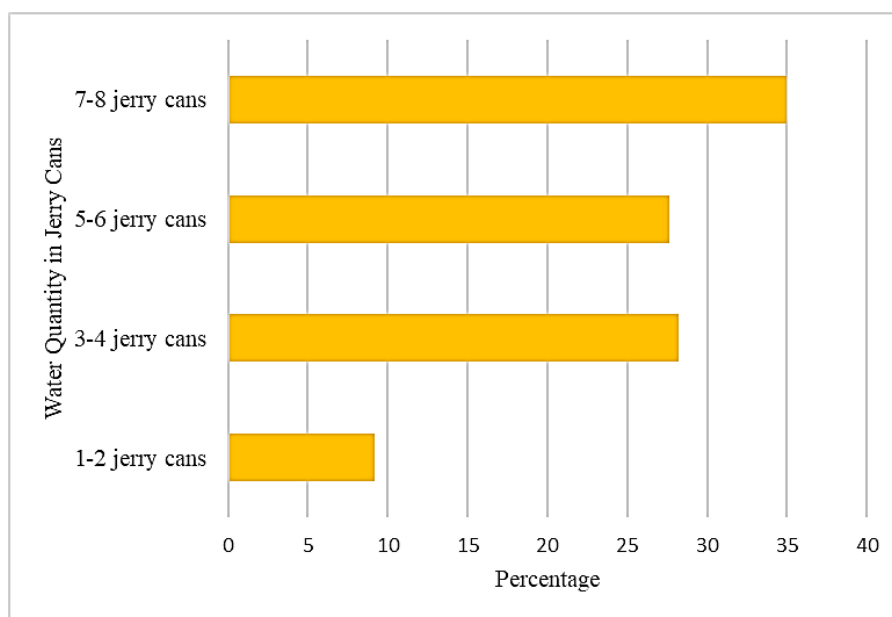


Figure 4: Water quantity available for household use

Source: Authors Field Survey, 2020

According to the results of the water quantity accessible, most residents have access to seven to eight jerry cans (at most 140-160 litres) of water each day for household use, which account for 35.0 percent of all responses. 28.2 percent of residents have access to between three and four jerry cans (maximum 80 litres) of water daily. Few respondents (9.2% of total responses) have daily access to one or two jerry cans (maximum 40 litres). Even though majority of respondents have at least eight jerry cans of water available daily. But when the Gleick's suggested water guideline of 50 litres per person per day is compared to the average household size of four to seven people (see table 1). This indicates that, on a daily basis, at least 200-350 litres of water are required to meet the demands of households, as opposed to the 160 litres (eight jerry cans) supplied to most houses (approximately 23litres per capita per head). This means that the amount of water available to households is substantially insufficient for everyday consumption. The result of this study however agrees with other previous studies (Nakawunde et al.2010;Karthe et al., 2015; Subbaraman et al. 2015; Abdullahi & Abdu 2018) .

Conclusion

Considering the SDG Goal No.6, Target 1: "Water should be available and managed sustainably". The issue of availability comprises access of households to water sources that are improved in terms of both the quantity, and the time it takes to collect water. The majority of informal settlement dwellers in Jos metropolitan have access to water sources that are improved, but rely on more than one source of water to meet their daily needs and not a single water source. When it comes to water collection time and quantity, the findings of this research reveal that a single round trip for the majority of the residents takes more

than 30 minutes, and majority of household have access to at least eight jerry-cans of water daily, but when compared to the average household size of seven people, and 50 litres per capita per head recommended by Gleick, it is still insufficient. There is several health, social and economic implications associated with the findings of this study. The longer time spent on water fetching by the main water fetchers (women and children) has implications on their productivity; this then means that less time is used for other productive activities that could be of utmost importance to the individuals and the nation at large. In addition, inadequate water available for household use has health implications; this invariably suggests that issues concerning the health and hygiene of the people will equally be affected, especially when water is obtained from sources that are not potable.

Recommendations

- This study therefore highlights the need for policy makers attention to be drawn to these issues that are most specific to the water supply as it affects informal settlements.
- There is a need for the government agencies concerned to produce a more comprehensive estimate that will reflect the actual state of water access in these settlements.
- Lastly, when tracking the progress of water access, JMP should take into account the water quantity indicator which is equally paramount in determining adequate access

Limitations and Further Studies

It is important to note that this study has limitations. The limitations of this study may be relevant for future scholars to conduct additional research. First, this study only examines a small number of informal communities in the central parts of Jos Metropolis: further research is necessary to determine the state of informal settlements outside the city centre. In addition, the timing of the research is constrained because the fieldwork was done during the dry season, there is a need to confirm the situation during the rainy season.

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