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WATER-USER PREFERENCES INFLUENCED BY QUALITY OF WATER SUPPLIED TO HOUSEHOLDS' IN OBUNGA INFORMAL SETTLEMENT OF KISUMU CITY, KENYA

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Abstract

The human right to water entitles everyone to sufficient, safe, acceptable, physically accessible and affordable water for personal and domestic uses. Indeed the sustainable development goal (SDG No.6) explicitly calls for full coverage of safely managed drinking water by 2030. However, approximately 80% of the estimated 844 million people without access to safe water live in rural areas or urban informal settlement particularly in sub-Saharan Africa. In Kenya, around 15% of the country's urban population lives in informal settlements with Kisumu having the highest proportion at (47%). It has been argued that quality of water available for domestic use depends on the preferred user practices of each household. Nonetheless, limited information has been documented regarding this theory among households' living in the informal settlement in Kisumu: Obunga. This paper sought to explore how water-user preferences are influenced by quality of water supplied to households' in Obunga informal settlement of Kisumu city, Kenya. The study adopted Ex post facto research design on a target population of 2,507 households' from the four administrative units in Obunga informal settlement, whereby through stratified sampling technique 331 respondents were sampled using questionnaire administration. Purposive sampling method was used to select 3 key informants for key informant interview using interview guides. Descriptive statistics and chi square test were used to analyze quantitative data on study variables. The study found that although water supplied to the area has moderate quality, most households' in Obunga informal settlement have poor water-user preferences. The study also revealed that there is no significant difference ($\chi^2_o = 6.577 < \chi^2_{c\ (4,\ .05)} = 9.488$) in household water-user preference based on the quality of water supplied: the difference is small hence could be explained by chance. It is concluded that household water-user preference in the study area is dependent on the quality of water. That the way water is used depends on its quality as perceived by the households' in Obunga informal settlement. The study

recommends that households' in the informal settlement should be sensitized to improve their attitudes towards use of clean water so as to enhance availability of the commodity.

Key words: *Water-user preference; Quality of water; Households'; Informal settlements; Obunga informal settlement; Access to safe water*

1.1 Introduction

The target task of the Millennium Development Goal (MDG) 7.C was to halve the number of the population with no access to safe drinking water and basic sanitary facilities by the year 2015 (Clasen, 2012; Shaheed, Orgill, Montgomery, Jeuland and Brownd, 2014; UN, 2018; UN – Water, 2018). Through implementing this target, the proportion of people who have access to a basic drinking water service grew from 81% to 89% from 2000 to 2015 (UN – Water, 2018; UNICEF, 2015). However, a weakness of the MDGs monitoring was an insufficient attention to water safety (Bain et al, 2012; Clasen, 2012), which became a key element of the target task for water supply and sanitation upon design of the Sustainable Development Goals (SDG 6). The human right to water entitles everyone to sufficient, safe, acceptable, physically accessible and affordable water for personal and domestic uses (Shaheed et al, 2014; UN, 2010). Therefore, SDG 6.1 call for full coverage of safely managed drinking water by 2030. The "Safely managed drinking water" indicator includes the three following conditions: accessible on premises, available when needed and free from contamination (Hutton, 2016; WHO & UNICEF, 2017).

This goal is a huge challenge for all countries, not only for low- and middle-income ones (Omarova, 2018). The commitment to "leave no one behind" requires a focus on rural areas, which is typically neglected (Kabeer, 2016; Satterthwaite, 2016; UNDP, 2018; UN – Water, 2018; WHO, 2017). About 844 million people on Earth still do not have access to basic water supplies and 79% of them are rural residents (WHO, 2017). At the same time, 2.1 billion people have no safely managed drinking water supply system service. This means that 14.9% of the urban- and 45.2% of the rural population need improved services (UNICEF, 2017).

The UN's Water global analysis and assessment of sanitation and drinking-water (GLAAS, 2019) asserts that whereas approximately half of countries have set drinking-water targets that aim for universal coverage at levels higher than basic services by 2030, there is a funding gap of 61% between identified needs and available funding to reach national WASH targets. Moreover, only 40% of countries with 2.2 billion people, have achieved adequate measures of financing safe water coverage for their poor citizens, in spite of the fact that over two thirds of countries have measures in policies and plans to reach these categories of their populations (UNICEF/WHO, 2019).

A person needs 50 to 100 litres of water per day to meet physiological and hygienic needs (Rumalongo, Nathengwe and Musyoki, 2017; UN Human Rights, 2018; WHO, 2018). People facing a limit of 20 litres per capita per day will therefore be exposed to a high level of health concerns. Rural residents usually live

in worse economic conditions than urban ones and this affects the volume of water use (Bain, Wright, Christenson & Bartram, 2014; WHO, 2018). An average developed-country household uses 500 kg of water per day where larger amounts are used in agriculture (Muller & Christophe, 2016). Household water use refers to a given quantity of water used at home for drinking, cooking, laundry, gardening, car-washing and bathing among others (Mohammed & Sanaullah, 2017; Olufayokemi, 2017; Shan, Yang, Perren & Zhang, 2015). Dietrich and List (2012) argue that preferences could be conceived as an individual's attitude towards a set of objects, typically reflected in an explicit decision to use a particular commodity for a specific use as opposed to the other. In this study, preference is considered as a tendency of household to choose one use of water as opposed to the other, and allocating to use water for particular purposes as opposed to others based on the presumptive quality of the particular water, as enthused by Muller and Christophe (2016). According to Wada et al (2016), water can be used renewably and non-renewably. However, focus on how water-user preference is determined by quality of available water in the resource constraint areas like informal settlements seem to have received scanty documentation.

The United States Environmental Protection Agency (2006) explains that water quality entails the physical, chemical and biological characteristics of water. This is a measure of the condition of water relative to the requirements of one or more biotic species and or to any human need or purpose. Diersing (2009) is of the view that the quality of water remains a challenge in most areas. Consumer perception of drinking water quality has existed for thousands of years. In the past, people have believed that good drinking water should be cold, nutritive, transparent and potable, but their perception of biological and chemical water quality was not remarkable (Sajjadi, Alipour, Matlabi & Biglari, 2016). Nowadays, since the link between drinking water quality and human health is evidently identified, the WHO and UNICEF (2017) have been emphasizing that all people, whatever their stage of development or social and economic conditions, have the right to have access to a quality supply of safe drinking water. Water is however considered as an infinite resource to be used with sufficient decorum. Water-user preferences in most areas particularly in informal settlements where acute stress of the commodity is often experienced ought to be looked at under the lenses of water quality parameters.

According to Mansour, Oyaya and Owor (2017) urban areas of Kenya face unequal distribution of essential services, an issue which in informal settlements remains rampant given that densely populated low-income urban informal settlements are underserved by utility service providers. This is because service providers view slum areas as lacking formal land ownership, are commercially unviable, and poorly planned (Siakilo, 2014; Werchota, 2013). In Kenya, it is estimated that the coverage of formalized water supply services to informal settlements are often as low as 20% (Republic of Kenya, 2012). According to the Water Services Regulatory Board (WSRB, 2013), the inequality in urban water provision in Kenya has its roots in poor planning, presence of informal settlements, networked designs

favoring high-end users, design demand structures and supply *vs.* demand management. It was thus critical to explore how considerations of water quality supplied to households' influences preferences for water use particularly in cities with high populations in informal settlements such as Kisumu.

Kisumu is situated in the western region of Kenya, within Kisumu County. The city has a population of approximately 520,000 people (Republic of Kenya, 2018). Over the years, Kisumu has experienced a growth in its population, with a resultant growth of informal settlements that are situated close to the city center. Of the cities in Kenya, Kisumu is estimated to have one of the highest proportions of residents living in informal settlements estimated at 49% (Mansour et al, 2017: NCPD 2018). These settlements led by Obunga, include Bandani, Nyalenda A, Nyalenda B, Manyatta A, Manyatta B, Manyatta Arab, Kaloleni and Kibos.

According to Blaustein (2010), over 60% of households' in Kisumu do not have access to fresh water, and about 53% of the households' lack adequate water supplies. About 62.3% of the water sources are not sustainable, and the quality of water is generally poor and not suitable for household use (Afullo & Danga, 2010). Studies (Odhiambo, 2016; Simiyu, Cairncross & Swilling, 2019) that have been carried out in Obunga informal settlement have revealed that essential services like water and sanitation are significantly inadequate. However, as UN (2007), UNESCO (2006), and several other authors indicate, water security is the responsibility of both the user and the provider. In view of this, it was imperative to investigate how water-user preferences are influenced by quality of water supplied to households' in Obunga informal settlement of Kisumu city, Kenya.

Statement of the Problem

The human right to water entitles everyone to sufficient, safe, acceptable, physically accessible and affordable water for personal and domestic uses. Sustainable Development Goal (6) articulates full of safely managed drinking water by 2030 a call that looks farfetched in most regions with high populations residing in informal settlements. In most urban areas, supply of quality water is unequal, whereby residents of informal settlements are seriously deprived of this essential commodity. Kisumu is estimated to have one of the highest proportions of residents living in informal settlements estimated at 49%. Led by Obunga, residents rely on shallow wells which are in most cases situated near drainages containing waste water and pit toilets. This in turn exposes residents to consumption of low quality water, which is a serious health hazard. In this vein, water remains an infinite resource which only prudent user preference is the only panacea. Nonetheless, limited information has been documented regarding this theory among households' living in Obunga informal settlement in Kisumu.

Objective of the Study

The objective of the study was to explore how water-user preferences are influenced by the perception of water quality in Obunga informal settlement of Kisumu City, Kenya. The specific objectives of the study are to:

i. Determine the state of water-user preference among household in Obunga informal settlement of Kisumu City, Kenya
ii. Analyze how water-user preference is influenced by quality of water supplied to households' in Obunga informal settlement of Kisumu City, Kenya

Literature Review

Literature covering quality of water among households' in low-income areas such as informal settlements has been adequately documented. However, focus on how quality of water influences household water-user preferences seems to have been neglected. Sajjadi, Alipour, Matlabi and Biglari (2016) assessed the consumer perception of tap water quality and other drinking water sources in Gonabad city of Iran. Results showed that demographic variables had a significant relationship with consumer satisfaction ($p< 0.05$). Similarly, Hanasaki et al (2019) assessed the status of the current access to and the perceived water quality in villages with various types of water supply in central Kazakhstan. The results revealed that even though villagers were provided with tap water, significant numbers used alternative sources due to doubts regarding the tap water quality and use of other sources out of habit as well as availability of cheaper or free sources. In another study, Subbaraman et al (2015) conducted a mixed method study in a slum of 12,000 people in Mumbai, India to measure deficiencies in a broader array of water service delivery indicators and their adverse life impacts on the slum's residents. Findings revealed that in addition to negatively affecting health, the qualitative findings reveal that water service delivery failures have a constellation of other adverse life impacts; on household economy, employment, education, quality of life, social cohesion, and people's sense of political inclusion. In a multivariate logistic regression analysis, price of water is the factor most strongly associated with use of inadequate water quantity (less than 20 litres per capita per day).

In the African region, Boateng, Tia-Adjei and Adams (2013) assessed the factors that influence water quality in the Tamale metropolis, Ghana, using randomly selected 250 respondents. The study results shows that majority of samples tested had fecal coliforms. Water from 83% of studied samples tested positive for the presence of E coli in household water. Source of water, distance to water source, placement and duration of water storage influenced household water quality. Households' with water source outside homes were less likely to have quality water ($OR=0.19$; $p<0.01$). Olufayokemi (2017) analyzed the sources of water supply and household water consumption pattern in Lokoja metropolis of Nigeria. The study revealed that the largest percentage of total water consumption was used for washing

clothes. Kidanie (2015) assessed the current status of the water supply system in slum areas of Addis Ababa and to research how they are supported by the existing water sector policies. The results of a survey found that 62% of the households' do not have a piped connection and that their main water sources are public taps (29%), vendors (12%), kiosks (4%) and the balance (17%) get water from unimproved water sources. The service that majority of the households' receive is highly interrupted and the availability of water is on average 5 days per month with an average duration of 5.2 hours per day.

In Kenya, Kithinji (2015) investigated the factors that influence access to clean drinking water by households' in Imenti south. A total of 90 households' were randomly selected, 10 from each of the three villages selected from each sub location. The findings show that demographic, economic and social characteristics of a household influence its water sourcing behaviour and access to clean drinking water. Cherunya et al (2015) compared user perceptions and preferences on water-service provision options, particularly the viability of decentralized models, such as the Safe Water Enterprise (SWE), as sustainable safe drinking water sources. Results showed that among a number of water-service provision options available, the majority of households' regularly sourced their domestic water from more than one source. A majority of households' perceived their water sources to be unsafe to drink. For this reason, drinking water was mainly chlorinated or boiled. Similarly, Koech (2016) assessed the magnitude of household water demand as key factors influencing the magnitude of water demand and distribution and the effectiveness of the current water use management strategies in Nyangores sub-catchment, Kenya. Results indicate that income, household size and distance from homesteads to water sources are major determinants of domestic water demand. Wagner, Cook and Kimuyu (2018) explored the preferences of households' demand for water in rural Kenya with regard to relative importance of price, distance and quality in households' choice of use. It found that households' are sensitive to the price and proximity in choosing among sources, but are not sensitive to other source qualities including taste, color, health risk, availability, and risk of conflict.

Locally in Kisumu, Simiyu, Cairncross and Swilling (2019) explored living conditions and deprivations in informal settlements of Kisumu, Kenya. Results indicate that deprivation is widespread at the individual and housing unit level. Approximately, only 8% of the compounds had water connections and households' in the rest of the compounds depended on nearby water points, to which they mostly walked for less than 5 minutes, paying on average KES 3 for a 20 litre jerrican. The studies done in Obunga also revealed lack of adequate essential services in the area of water and sanitation. Odhiambo (2016) examined the state of sanitation conditions and the existing sanitation infrastructure in Obunga. Findings indicated that factors like overcrowding, lack of proper sanitation facilities, mismanagement and lack of toilet waste disposal were on the forefront of major causes of poor sanitation. In another study, Ongere, Otor and Afullo (2017) examined the effect of water-user preference on the sustainable supply of safe water in Obunga slums of Kisumu Municipality, Kenya. It was found that households' in Obunga have poor water-user preference, and household water-user preference in the slums is dependent on the sustainable supply.

The reviewed studies have dwelt at large on the status of water availability to households' in informal settlements as well rural areas. It is clear that households' living in these two areas classified as low-income areas do face water stress. However, most of the studies have not assessed the water-user preferences of the households': this could be a critical factor determining availability of water for domestic use. Moreover, information with regard to whether households' water-user preferences in Obunga informal settlement are dependent on availability of water has not been documented.

METHODOLOGY AND MATERIALS

The study was conducted in Obunga informal settlement in Kisumu Municipality between the months of March and July, 2012. Administratively the informal settlement is in Kanyakwar Sub-location, in East Kisumu Location, in Winam Division of Kisumu Central Constituency, Kisumu West sub-county, in Kisumu County. The informal settlement can be located by GPS on coordinates listed on Table 1.

Table 1: Obunga informal settlement Gps Co-ordinates.

Area	Gps co-ordinate	Co-ordinates	Co-ordinates	Co-ordinates	Co-ordinates
Obunga Central	Longitude	34.759 E	34.764 E	34.7662 E	34.7667 E
	Latitude	-0.079 S	-0.08 S	-0.0781 S	-0.0799 S
Obunga Kamakowa	Longitude	34.765 E	34.759 E	34.772 E	34.771 E
	Latitude	-0.078 S	-0.077 S	-0.076 S	-0.075 S
Obunga Sega sega	Longitude	34.7662 E	34.7667 E	34.775 E	34.775 E
	Latitude	-0.0781 S	-0.0799 S	-0.071 S	-0.072 S
Obunga Kasarani	Longitude	34.759 E	34.765 E	34.775 E	34.775 E
	Latitude	-0.077 S	-0.0738 S	-0.069 S	-0.072 S

Note: E = Easting, S= Southing.

The population of Kisumu city by Kenya national population and Household census of 2009 was 573,649. This is when Obunga informal settlement had population of 8211.

Figure 1: A cross-sectional view of types of housing in Obunga informal settlement.

The housings in Obunga informal settlement are characterized by congested dwellings like those shown on Figure 1 above. These houses lack connections to piped water. They depend on stand pipes which are a few meters away or in the same compounds, for water. The residents buy water from sellers at the standpipes or from water vendors who bring water in 20 litres jerricans to the house for drinking and cooking, but use water from shallow wells for washing, toilet and gardening. The shallow wells in the informal settlement are within reach and the residents get much water as they need without buying.

Research Design

This study was conducted through an Ex post facto research design; a kind of "experiment" in which a researcher, rather than administering a treatment, examines the results of a naturalistically occurring treatment after that treatment has occurred. Ex post facto are pseudo (or false) experimental research designs where a researcher, rather than conducting an experiment, substitutes the experiment with a naturally occurring condition after the condition has already occurred, and then relate this after-the-fact-

treatment to an outcome (Oso & Onen, 2008). Ex post facto design was deemed suitable because the elements of household water-user preference which the study investigated had already occurred and were only being studied as an after the fact.

Target Population

The target population consisted of 2,507 households' in the 4 administrative units, being: Obunga Central, Obunga Kamakowa, Obunga Sega Sega, and Obunga Kasarani, distributed as indicated in Table 2

Table 2: Population description of Obunga informal settlement by administrative units.

Administrative areas	Households'	Male	Female	Total
Obunga Central	766	1324	1248	2572
Obunga Kamakowa	645	1070	952	2022
Obunga Kasarani	573	1044	978	2022
Obunga Sega sega	523	837	758	1595
Total	2507	4275	3936	8211

Sample Size and Sampling Procedure

The study obtained the sample size through the following sampling procedure.

Sample Size

The sample size comprised 331 households' in Obunga informal settlement. The sample was determined according to Amin's (2005) table of samples, as shown below, and was distributed among the 4 administrative units in the informal settlement as shown in Table 3.

Table 3: Distribution of households' in the four administrative units in Obunga informal settlement

Population	Obunga Central	Obunga Kamakowa	Obunga Kasarani	Obunga Segasega	Total
Households'	766	645	573	523	2,507
Sample	101	85	76	69	331

Amin (2005) recommends a sample of 331 for a population of 2,507, at 0.05 level of confidence and 5.0% margin of error. These were the same conditions which the researcher used on the study. Guided by the Table, this study selected 331 households' from the 2,507 households' in the 4 administrative units in the informal settlement.

3.5.2 Sampling Procedure

This study employed stratified and purposive sampling techniques to select the individual members of the sample. Stratified sampling was used to determine the sizes of households' in each administrative unit to be included in the sample. Stratified sampling ensured that each administrative unit is represented in the sample, and that the administrative units' differences are accounted for. For each administrative unit, the sub-sample size was determined as:

Sub-sample size = (sub-population size/total population) required sample size.

ss = (sp/tp) Sample Size;

Where ss denotes sub sample size; sp is sub population size; tp is total population.

Therefore, the sample size of households' in each administrative unit was determined as follows:

Table 4: Determination of Sample size

Administrative unit	Determinant	Sample size
Obunga Central	(766/2507) x 331	101
Obunga Kamakowa	(645/2507) x 331	85
Obunga Kasarani	(573/2507) x 331	76
Obunga Sega Sega	(523/2507) x 331	69

Simple random sampling was thereafter used to select the 331 households' to be included in the sample for the purpose of questionnaire administration. According to Oso and Onen (2008), simple random is a selection technique that selects a sample without bias from the target or accessible population.

Instruments for Data Collection

Questionnaires were used to collect data from the sampled 331 respondents of the study because the sample size was quite large, and given the time constraints, questionnaires were the ideal tool for

collecting data. They (questionnaires) are deemed suitable in that they have the benefit of being self-administered, anonymity and standardization of questions for the purpose of easing the data analysis procedure (Orodho, 2005). The questionnaires used had sections on the biographic information, access to water, availability of water, quality of water, sustainable supply of water, and the household water-user preference. This section particularly sought information on the water used by households' on gardens, laundry, toilets, car washing, direct heating system, drinking, cooking, and personal washing.

Reliability of the Study Instruments

Reliability is a measure of the degree to which a research instrument yields consistent results after a repeated trial (Amin, 2005). Test – Retest method was used to measure reliability of the questionnaires and a correlation of 0.1 was obtained, by testing the same examinees/subjects twice (through a pilot study) with the same test/scale and then correlating the results, signifying that the instrument coefficient was stable. This means that the study instruments were capable of yielding consistent responses from the selected respondents.

Validity of the Study Instruments

According to Mugenda and Mugenda (2003), instrument validity represents the extent to which the instrument measures what it purports to measure; it is the degree to which the analysed data actually represents the phenomenon under study. To ensure instrument validity, the data collection questionnaire, research questions were reviewed by experts from the department of environmental science of Kenyatta University and their inputs included in the final instrument.

Data Analysis Methods

Quantitative data was analysed by the help of statistical packages for social sciences (SPSS). SPSS package is able to handle a large amount of data and given its wide spectrum in the array of statistical procedure which are purposefully designed for social sciences; it was deemed efficient for the task. Chi-square was used to compare the differences between water quality supplied to households' and household water-user preferences. In this study, the independent variable (household water-user preference) is categorical. Treatment in this study was household water-user preferences in each household. The study classified household water-user preference for each household as good, moderate and poor, and then compared the differences between the elements of water quality, also categorized as poor, moderate, and good.

RESULTS AND DISCUSSIONS

Household water-user Preference in Obunga informal settlement

The first objective of this study was to assess the overall household water-user preference in the informal

settlement. Household water-user preference was assessed based on the UN- WWAP (2009) ratios on the water that was used on; personal washing, gardens, laundry, toilets, car washing, dishes, cooking, and drinking. The respondents in each household were asked to indicate how much water they use on each of these aspects per 100 litres or five 20 litres jerricans of water. The ratios were then compared to the UN WWAP (2009). The results indicated in Table 5 were obtained.

Table 5: Levels of household water-user preference

Levels of Household water-user Preference	N	Percent – N
Poor	114	44.9
Moderate	66	26.0
Good	74	29.1
Total	254	100.0

Note. N= number of households'

This table shows that 44.9% of the households' have poor household water-user preference while 29.1% have good household water-user preference. It can be seen that most households' do not use water in the good proportions as recommended by the UN-WWAP (2009).

The study thus established that household water-user preference in the informal settlement is generally poor. This means that the UN (2009) ratios on the water that is recommended for use on personal washing, gardens, laundry, toilets, car washing, dishes, cooking and drinking are not followed, because people are not aware, or they cannot follow these ratios.

Household water-user preferences and quality of water

The other objective of this study was to determine the relationship between household water-user preference and quality of water in the informal settlement. Quality of water was gauged by the colour, p^H, taste, and odour; of water supplied to households' in the informal settlement. Respondents were asked to respond to issues intended to measure the quality of water and the responses assessed, scored and rated such that households' that scored between 1 and 2 were rated good and coded 1, those that scored between 3 and 5 were rated moderate and coded 2, while those that scored 4 were rated poor and coded 3, as highlighted in Table 4.1. The quality of water was compared against household water-user preference for each household to determine the actual number of households' in the informal settlement that have poor, moderate and good quality of water, against the poor, moderate and good household water-user preference. The results are summarized in Table 6.

Table 6: Household water-user preference and quality of water supplied in Obunga informal settlement

Levels of Quality of Water and Households' Distribution		Household water-user preference			
		Poor	Moderate	Good	Total
Poor	Frequency	22	21	35	78
	Percent	8.7	8.3	13.8	30.7
Moderate	Frequency	47	18	38	103
	Percent	18.5	7.1	15	40.6
Good	Frequency	40	21	12	73
	Percent	15.7	8.3	4.7	28.7
Total	Frequency	109	60	85	254
	Percent	42.9	23.6	33.5	100.0

It shows that most (40.6%) of households' in the informal settlement perceive that they have moderate quality of water while 28.7% of the households' perceive they have good quality of water; and a significant proportion (30.7%) of the households' perceive they have poor quality of water. Further, the table shows that most (18.5%) of the households' who believe they have moderate quality of water have poor household water-user preference and that only 4.7% of the households' who perceive their water quality to be good have good household water-user preference. But some 8.7% of households' who perceive their water to be of poor quality have poor household water-user preference. This scenario does not suggest any predictable pattern between quality of water and household water-user preference, and it could not be deduced from these frequencies how water quality varies with household water-user preference in Obunga informal settlement.

The data in Table 7 were further tested using a Chi-square test to determine if there were significant differences in the frequencies between the categories indicated in the table; and to test the hypothesis that household water-user preference in the informal settlement is dependent on quality of water supplied. The results of the Chi-square test are summarized in Table 7.

Table 7: Chi-square analysis of household water-user preference based on quality of water

Variable	N	Df	χ^2_c	χ^2_o	A	Decision
Household water-user preference and quality of water	254	4	9.488	6.577	160	Accept Ha

The information in the table indicates that there is insignificant difference in household water-user preference based on the quality of water supplied. From the table, $\chi^2_o = 6.577 < \chi^2_{c\,(4,\ .05)} = 9.488$,

indicating that the differences in the categorical frequencies of household water-user preferences and quality of water are small enough, and could be explained by chance. Hence, the alternative hypothesis Ha_3 that household water-user preference in the informal settlement is dependent on the quality of water was accepted**.** Household water-user preference in the study area is dependent on the quality of water. That the way water is used depends on its quality as perceived by the households' in Obunga informal settlement.

It should be noted that 13.8% of respondents have poor quality of water, yet have good household water-user preference, and 15% of 40.6% who have moderate quality of water have good household water-user preference. This is an indication that the residents of the slum regard quality of water they use as good just because they trust it has already been treated by the provider. Many of the residents use tap water just as gotten from the taps, while some take further measures of adding some chlorine into it before drinking or cooking with it, as the researcher was able to gather from key informant interview. While this may be a measure of taking precautions against water contamination, they may not use appropriate rations as indicated, and treating water which has already been treated runs the danger of over-chlorination (KIWASCO and WARMA offices, 2013)

Discussions

Water-user preferences among households' in Obunga informal settlement are poor. This implies that the way households' use water in this area disregards recommendations by the UN (2009) for wise water-use. The households' under study also seem use water contrary to proportions suggested by Istifanus (2017). This concurs with findings in Ongere, et al (2017) who also established that households' in Obunga informal settlement have poor water-user preferences. This user behaviour revealed in the study perhaps resonates with the households'' perception that water sources in the informal settlement are unsafe hence can be used without following strict procedures as revealed in Cherunya, et al (2015) moreover, Wagner, et al (2018) also found in another study done in Kenya that households', in the their preferences in using water, are not sensitive to other source qualities including taste, color, health risk, or availability. Contrary to expected ions, households' in the area tend to use water in disregard to water pricing. This contradicts findings in Grafton, et al (2011) which showed that the average volumetric price of water is an important predictor of differences in residential consumption. This insensitivity among households' could perhaps be the reason behind unavailability of adequate safe water frequently faced by households' in the informal settlements such as Obunga.

Additionally, the study reveals in Table 4.2 that household water-user preference in the informal settlement is not dependent on the availability of water to households'. Hence, it can be deduced from these results that household water-user preference is one of the factors causing water insecurity in the informal settlement. They (households') tend to use water in undesirable proportions. This tends to contradict a study in Afghanistan by Mohammed and Sanaullah (2017) who found that major components

of water consumption included washing clothes, taking bath, sanitation and kitchen in that order. Water-user preferences established in this study is also contrary to what Olufayokemi (2017) found in a study done in Nigeria that: the largest percentage of total water consumption was used for washing clothes. Findings in Table 4.2 also disagree with Ongere, et al (2017) who found that household water-user preference in Obunga is dependent on the sustainable supply of water. The findings in Table 4.2 may imply that water-user preference depends on other factors such as pricing, distance to the source of water, attitude and size of the family. These were revealed in studies by Grafton et al (2011) and Hanasaki, et al (2019).

CONCLUSIONS

It is concluded that household water-user preference in Obunga informal settlement is poor. In this regard, water stress facing households' in the informal settlement is due to use of water in proportions that are not recommended. The study also concluded that household water-user preference is dependent on the quality of water. The user preference depends on the family size, water pricing and attitude of the users among others.

RECOMMENDATIONS

Quality of water should also be improved in Obunga informal settlement. In this regard, the households' should be sensitized to use water in appropriate proportions geared towards saving the commodity for essential usage such drinking and cooking. This study also recommends water recycling behaviour whereby reusing water for house cleaning and gardening would reduce wasteful behaviour of clean water. More water connections (infrastructure) should also be embarked on in Obunga informal settlement to ensure that water is made available to the residents.

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