EFFECT OF SOCIOECONOMIC DETERMINANTS ON ACCESS TO CLEAN AND SAFE WATER IN URBAN KENYA

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DECLARATION

Declaration by the Candidate

I declare that this research report is my original work and has not been presented for examination in this University or any other institution of higher learning.

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Declaration by the Supervisors

The research report has been submitted for examination with my approval as university supervisor.

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DR. WANDEDA DICKSON

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ABSTRACT

The provision of safe drinking water is a significant global social policy challenge due to its fundamental importance in sustaining human life. In urban areas of Kenya, the rate of population increase frequently exceeds the pace at which infrastructure and services can be constructed or enhanced. Consequently, individuals residing in urban areas frequently turn to other water sources, which may be potentially hazardous, thereby exacerbating risks to their overall health and welfare. Hence, it is imperative to analyze the impact of various demographic characteristics on individuals' access to clean drinking water inside the metropolitan areas of Kenya. The objective of this study was to examine the influence of socioeconomic factors on water accessibility in urban regions of Kenya. Specifically, the study sought to examine the impact of household head characteristics on the availability of clean and safe water in urban regions of Kenya. Additionally, the study aimed to assess the influence of household characteristics on access to clean and safe water in urban areas of Kenya. The 2015/2016 Kenya Integrated Household Budget Survey was utilized as the main source of secondary data. By employing the probit model, the study's results indicate that persons who reside with partners see a notable increase in the likelihood of accessing clean water. Furthermore, the significance of education has become evident as a crucial factor, specifically in relation to the correlation between achieving secondary school education and the likelihood of gaining access to clean water. Based on the research outcomes, it is strongly recommended that the government should give precedence to policies pertaining to investments in educational infrastructure, curricula, and awareness campaigns. Additionally, it is suggested that programs targeting the improvement of individuals in lower socioeconomic brackets should be introduced, offering financial aid for the development and upkeep of water infrastructure.

CHAPTER ONE

INTRODUCTION

1.1 Background

Ensuring the availability of safe drinking water is a significant concern in global social policies, being indispensable for sustaining life. International entities, including the United Nations, consistently engage in discussions addressing various aspects of water accessibility. The Sustainable Development Goals (SDGs) of the United Nations General Assembly recognize clean water as a fundamental requirement for human well-being. Its accessibility is vital due to the diverse benefits it directly and indirectly provides to humanity (World Health Organization, 2017). Access to clean water plays a crucial role in achieving all 17 SDGs, contributing to improved health and socio-economic development.

Despite notable achievements, millions of people, especially the marginalized and poor, still lack access to improved safe water (Abubakar, 2019). While favorable advances have been made in various global sectors, the basic need for clean water continues to be elusive for many. According to Sultana (2018), safe drinking water is not merely essential to human health but also vital for survival, growth, and development. However, these necessities remain a luxury for a significant portion of the world's population. Access to clean and safe water is particularly challenging for urban areas.

Several regions are off track in achieving the SDG 6 related to water access, despite progress in some countries (Herrera, 2019). For instance, regions like Sub-Saharan Africa and Oceania face considerable challenges in ensuring that people obtain enhanced sources of drinking water. With reference to the Sub-Saharan Africa context, where Kenya is situated, the challenge of water accessibility in urban areas is exacerbated by multiple

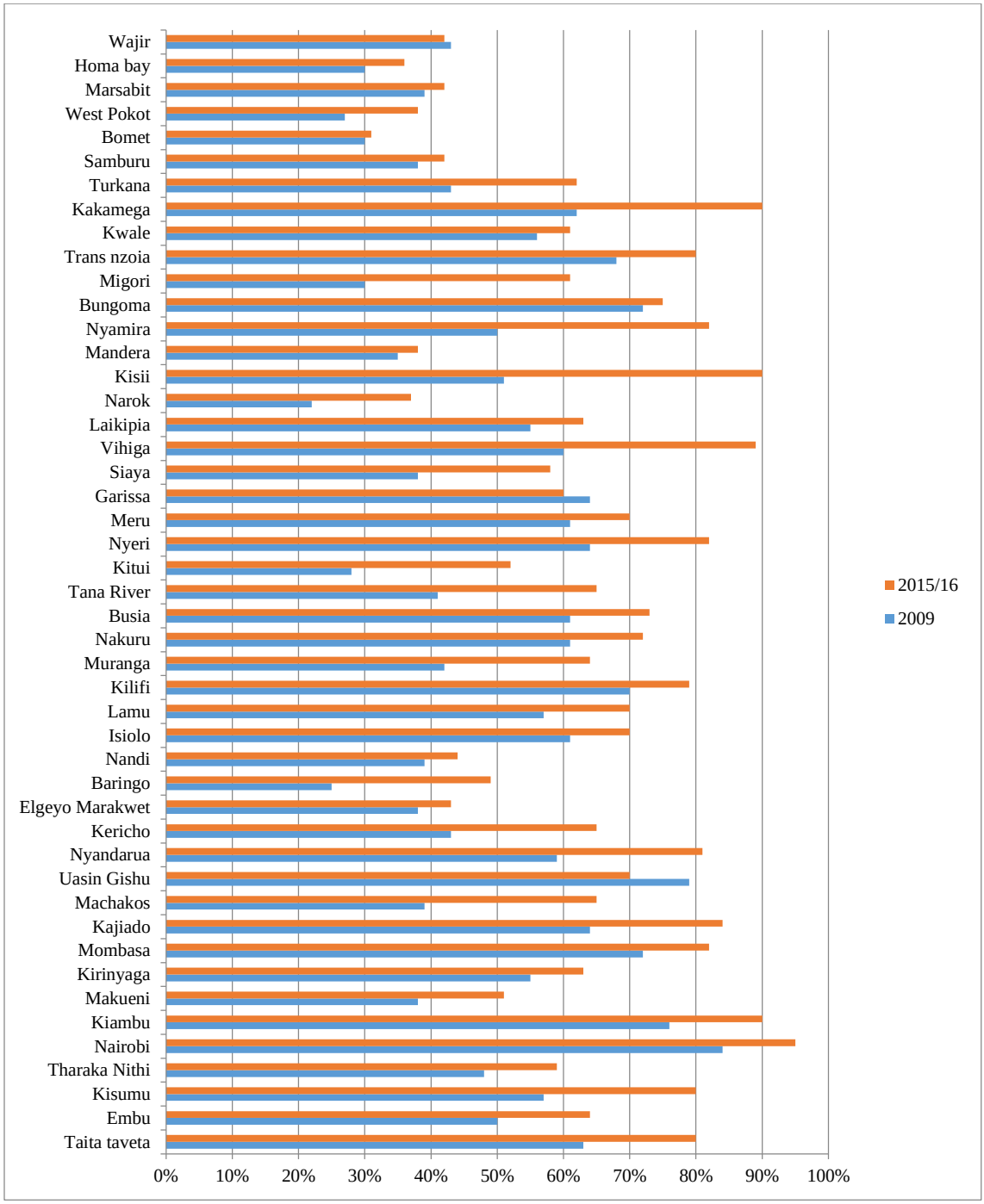
factors (Olago, 2019). Rapid urbanization, often unplanned, has led to the emergence of sprawling informal settlements or slums. These areas often lack adequate infrastructure, making the delivery of basic services, including water, an uphill task. The water systems in such places are frequently under-resourced and overstretched, leading to inadequate supply and poor water quality (Abrams, Carden, Teta & Wågsæther, 2021).

Moreover, in Kenya's urban centers, the population's growth rate often surpasses the rate at which infrastructure and services can be developed or upgraded. According to Odongo and Donghui, (2021) this mismatch results in increased pressure on existing water resources, further diminishing the quality and quantity available to residents. Studies have also indicated that the variability in rainfall and the effects of climate change have been a great cause for scarcity of drinking water in urban areas (Amanullah, Imran, Arif, Altawaha & Parmar, 2020). Recurring droughts and changing rain patterns have put a strain on available water sources, affecting both the quantity and reliability of supplies. As a result, urban dwellers often resort to alternative, and at times, unsafe sources of water, further endangering their health and well-being (Odongo & Donghui, 2021).

In Kenya, water resources underpin key economic sectors, such as agriculture, tourism, and manufacturing, emphasizing the significance of water for the country's development. As per the findings of the African Development Initiative Report (2018), Kenya encounters several obstacles that impede its ability to ensure availability of sanitation and secure water at full capacity by the year 2030. The limitations encompass a shortcoming of over one trillion Kenyan shillings, an excessive dependence on contributions from donors, poverty, broken policy models, water pollution, insufficient data for planning and budgeting, a growing population that increases water demand, and climate change (Omondi & Jackson,

2022). Furthermore, substantial disparities in water access from an enhanced source are documented throughout the nation and must be rectified so that every county is on an equal footing. For example, national water access from enhanced sources increased from 2009 to 2015/2016, but urban areas continue to lag behind. An upward trend in national figures was observed, with figures rising from about 56 percent in 2009 to 73 percent in 2015/16 (Africa Development Initiative Report, 2018). The report indicates that approximately 87 percent of urban households have access to information, while 62 percent of rural households do. In excess of ten rural counties, fifty percent could not access water from an enhanced source from 2009 to 2015/2016, exposing them, among other obstacles, to water-borne diseases. Figure 1.1 shows the comparison of the segment of households accessing water from an enhanced source by county in 2009 and 2015/16.

Figure 1: Percentage of households accessing water from an improved source 2009 and 2015/2016



Source: Africa Development Initiative Report (2018)

Figure 1 shows that there is a considerable improvement in segment of households accessing water from an enhanced source between 2009 and 2015/16 in most counties in Kenya. However, substantial disparities persist in terms of access to water sourced from enhanced sources. For example, Embu, Kisumu, and Taita Taveta are thriving at over 80 percent, whereas other counties in Kenya including Marsabit, Wajir, West Pokot, etc. have access to less than 30 percent (Africa Development Initiative Report, 2018).

Despite efforts to improve water access, disparities persist, particularly between urban and rural areas. While affluent neighborhoods in cities like Nairobi or Mombasa may have relatively better access to clean water through boreholes or purchased water (Nzengya, 018), majority of those living in impoverished areas might have to rely on vendors selling water at exorbitant prices, or even on contaminated sources (Omondi & Jackson, 2022). The social stratification, evident in many Kenyan urban centers compared to rural areas, directly reflects disparities in water accessibility. Further, literature suggest that traditional water sources or community-shared resources at times, come under threat due to urban development or privatization. Moreover, corruption, lack of transparency, and inefficiencies in local governance can hinder the effective implementation of water-related policies, further deepening the crisis.

1.2 Problem statement

Access to clean drinking water remains a daily struggle for many in developing countries (Abubakar, 2019), with a significant portion of urban water supplies in sub-Saharan Africa being non-functional (Armah, Ekumah, Yawson, Odoi, Afitiri & Nyieku, 2018). In this context, Kenya's efforts to meet the SDG related to water access has faced challenges (Mulwa, Li & Fangninou, 2021). Although significant proportions of households in Kenya

rely on improved water sources, Chepyegon and Kamiya (2018) argued that disparities persist between urban and rural areas, highlighting the urgency of addressing water access issues especially in urban settings.

Kenya has undertaken numerous initiatives to ensure universal access to water, housing, and energy in every household by 2030. However, challenges in achieving this goal by the specified deadline stem from implementation hurdles, including inadequate data on essential indicators for more informed policy formulation (Chepyegon & Kamiya, 2018; Mulwa, Li & Fangninou, 2021). Notwithstanding the ongoing growth of the population, there remains a significant lack of access to potable and hygienic water (KNBS, 2019). Consequently, this necessitates the exploration of alternative methods to guarantee access to potable water in Kenya by the year 2030. This research endeavors to establish the manner in which determinants pertaining to socioeconomic aspects of household access to clean and safe water in urban Kenya can contribute to this line of reasoning. The study specifically examines which socioeconomic characteristics ought to be prioritized in order to enhance the availability of pure and safe water.

Multiple studies have been conducted on the topic of expanding the availability of clean water on a global, regional, and municipal scale. The factors impacting urban-rural disparities on secure water access in Nigeria were studied by Abdu et al. (2016), while Armah et al. (2018) looked at obtaining better sanitation and water in sub-Saharan Africa. Another Ghanaian study (Asibey, Dosu, & Yeboah, 2019) looked at how city dwellers see their own part in the problem of inadequate water supply in urban areas. Numerous studies have been conducted in Kenya, including Chepyegon and Kamiya (2018), Mulwa, Li, and Fangninou (2021), and most recently Omondi (2022), who examined the impact of

household characteristics on the availability of clean water, housing, and energy in rural areas. There are a number of other studies that address this issue, but none of them have determined the role that socioeconomic factors play in determining who in Kenya's urban regions has access to clean and safe water. As a result, it is crucial to examine how different socioeconomic factors affect people's ability to obtain potable water in Kenya's metropolitan centers.

1.3 Research Questions

The study sought to answer the following questions.

1. How do socioeconomic determinants affect access to clean and safe water in urban areas in Kenya?
2. What policy suggestions are needed to improve access to clean and safe water in urban areas in Kenya?

1.4 Objectives of the study

I. Determine the effects of household characteristic on access to clean and safe water in urban areas in Kenya.

II. Suggest policy recommendations to improve access to clean and safe water in urban areas in Kenya.

1.5 Justification of the study

It is evident that Kenya has taken significant measures to strive for universal access to water by 2030. Despite these efforts, there are substantial challenges hindering the achievement of this crucial goal. These obstacles primarily stem from difficulties in implementing the set objectives, exacerbated by a lack of adequate data for improved

policy formulation. This shortfall in data significantly impedes the country's ability to address the escalating demand for clean and safe water, a challenge that persists even as the population continues to grow (KNBS, 2022).

In this context, the research aimed to offer an in-depth analysis of the socioeconomic characteristics that foster availability of clean and safe water in Kenya, particularly considering the nation's evolving landscape due to the advent of devolution. By comprehending the socioeconomic factors that influence the access of clean and safe water sources in Kenya, this study seeks to empower policymakers with the critical insights required to prioritize specific characteristics within government-led development initiatives, encompassing education, employment, and community networks. Furthermore, the research endeavor contributes significantly to academic discourse by advancing our understanding of the socioeconomic determinants that promote access to clean water, especially in rapidly urbanizing areas. This investigation not only aligns with Kenya's ambitions for universal water access but also serves as a crucial step in addressing the challenges identified within the context of evolving demographics and governance structures.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

The second chapter of this research explores the current corpus of information and academic work about the availability of uncontaminated and secure water, specifically within the framework of socio-economic factors and the distinct dynamics of urban Kenya. This literature review serves as the foundation for understanding the intricacies surrounding water accessibility, offering insights from past research and academic endeavors. By synthesizing and critically examining prior studies, this chapter not only provides a comprehensive overview but also identifies gaps in the current literature, setting the stage for the original contributions this research aims to make.

2.2 Theoretical literature

This section of the literature review focus into theoretical perspectives and models that underpin the understanding of the present topic under study. The theoretical foundation is essential in providing a structured focus through which socio-economic determinants can be examined in the context of water access in urban landscape.

2.2.1 The Human Capital Theory (Becker, 1964)

The Human Capital Theory (HCT), a framework initially applied in labor economics, posits that investments in human capabilities, such as education and health, yield economic benefits in the form of increased productivity and income (Schultz, 1961). The HCT was primarily developed and popularized by the American economist Gary Becker in 1960. Becker's research in the 1960s and 1970s laid the foundation for this theory, which focuses on the notion that individuals' knowledge, skills, and education are valuable investments

that significantly impact their productivity and well-being (Becker, 1960; 1964; 1976). In this context, HCT can be effectively applied to explore how investments in human capital can influence an individual's capacity to secure clean and safe water.

Education is a core component of the human capital hypothesis. A person's education level becomes a significant determinant of their economic prospects and well-being (Becker, 1967). In the context of water access, education plays a critical role in several ways. According to O'Reilly and Louis (2014), education enhances awareness regarding the importance of clean and safe water for overall welfare and health. Educated individuals are more likely to understand the significance of water quality and hygiene, which can drive demand for improved water access. Also, Broderick (2018) asserts that education equips individuals with problem-solving skills and the ability to advocate for their rights. In urban Kenya, where water access disparities exist, educated individuals are better positioned to engage with authorities and community organizations to address water-related challenges. They can participate in water governance and contribute to policy discussions aimed at improving access for all.

Health, another dimension of human capital, is closely linked to water access. Individuals with good health are more productive and resilient, enabling them to engage in activities that may improve their water access (Ameis, Lai, Mulsant & Szatmari, 2020). Moreover, they are less likely to suffer from waterborne diseases, which can result from contaminated water sources. Improved health, in turn, contributes to increased labor force participation, economic productivity, and overall well-being (Krueger, 2017). Health also affects the individual's capacity to engage in activities related to water access, such as collecting water from distant sources. According to Cosgrove and Loucks (2015), healthy individuals are

better equipped to manage the physical demands associated with water retrieval, a common practice in regions facing water scarcity.

The theory emphasizes the importance of investment in human capabilities to enhance economic prospects (Schultz, 1961; Becker, 1976). In the context of water access, the hypothesis underscores the noteworthiness of investments in education and health to improve an individual's and community's ability to secure clean and safe water. By increasing access to education and healthcare services, communities can better equip themselves to address water-related challenges, advocate for improved water infrastructure, and make informed choices regarding water usage and hygiene.

The theory has however encountered several criticisms over the years. Critics including Stewart, Ranis and Samman (2018) argue that the theory's narrow focus on economic outcomes, such as increased earnings and productivity, often neglects other dimensions of human development like social well-being and happiness. It has been accused of ignoring the ascendancy of social and cultural elements on education and human capital development, assuming that individuals make purely rational, economically driven decisions (Tan, 2014). Moreover, the theory may reinforce existing inequalities, particularly when it comes to issues of equity. Tan, 2014) further argues that the theory often assumes perfect information and fails to consider alternative forms of learning and skill acquisition. Additionally, critics contend that the theory is reductionist, reducing complex human development to quantifiable variables as outlined by Wu (2013), and it may not adapt well to changing economic and technological landscapes as emphasized by Rip and Kemp (1998).

Despite the criticisms outlined above, the theory aided this study by providing a valuable framework to comprehend the function of education and knowledge in modelling individuals' as well as communities' capacity to secure access to clean and safe water in urban Kenya. It calls attention to the relevance of investments in human capital, particularly education, as a means to empower individuals to make informed decisions about water access. Moreover, the theory's emphasis on knowledge acquisition and rational decision-making aligns with the study's focus on socio-economic determinants and the function of education in addressing water access disparities. The theory enabled the researcher to gain deeper insights into how education and knowledge impact water access and offer a valuable perspective for addressing this crucial issue.

2.2.2 Andersen's Behavioral Model (1968)

Andersen's behavioral model is a highly esteemed framework in the realm of health services and the consumption of healthcare. Ronald M. Andersen developed this concept in 1968. Although primarily centered around healthcare, aspects of this framework could be modified and utilized in examining the issue of accessibility to uncontaminated and secure water. The model highlights that the availability of healthcare services is impacted by three primary kinds of factors: need factors, enabling factors, and predisposing factors (Andersen, 1968).

With reference to the current research, "predisposing factors" could be related to individual characteristics and social factors that influence a person's likelihood to seek and obtain clean water access. These might include demographics, beliefs, and knowledge about water quality and safety (Hurwitz, 1969). The "enabling factors" could represent the resources and opportunities available to individuals that facilitate their access to clean water. This

might encompass economic resources, availability of water infrastructure, and social support networks (Proença, Proença & Costa, 2018). The "need factors" could relate to the perceived need for clean and safe water, influenced by health concerns, environmental conditions, or other determinants (Von Lengerke, Gohl & Babitsch, 2013).

Detractors argue that the model oversimplifies the multifaceted factors influencing healthcare utilization, potentially neglecting the complex interplay of social, economic, and cultural determinants (Natera, Rojas, Dutrénit & Vera-Cruz, 2020). Furthermore, it may not seamlessly extend to various research contexts, and its adaptability to fields such as access to clean water might lead to crucial determinants being overlooked (Parker, Wall & Cordery, 2001). Some critics claim the model insufficiently addresses structural barriers to access, lacks a dynamic element to account for evolving behavior, and lacks cultural sensitivity, thus potentially neglecting the cultural variations influencing healthcare or resource utilization patterns (Garney, Wilson, Ajayi, Panjwani, Love, Flores & Esquivel, 2021). However, it's worth noting that the model has evolved over time, with researchers often integrating additional elements or theories to address these limitations and offer a more comprehensive understanding of resource access. By adapting the model to the context of clean water access, the researcher can explore how these three categories of factors interact and impact the ability of urban residents in Kenya to obtain safe and clean water.

2.3 Empirical literature

The studies discussed in this section shed light on various components touching on access to clean water, encompassing elements such as socio-economic determinants, gender dynamics, and the impact of education. By examining these empirical findings, we can

gain insights into the complexities of water access in different settings, both rural and urban, and further inform the current study's exploration of socio-economic characteristics that determine access to clean and safe water in urban set up.

Water services are acknowledged by Resolution 300 outlined by the African Commission on Human and Peoples' Rights as a legal entitlement, as opposed to commodities donated for charitable purposes. A study entitled "Socioeconomic determinants of water distribution satisfaction in a medium Sub-Saharan African city: a case study of Kisumu, Kenya" was conducted by Ocholla, Letema, and Mireri in 2022. The fact that only 60% of the urban populace in Kenya possesses access to adequately managed drinking water suggests that socioeconomic inequalities among urban residents may be a contributing factor. This study examines the influence of socioeconomic components on household satisfaction with water delivery in Kisumu city, Kenya. Descriptive research design was utilized to obtain data from 384 households. The results indicate that water distribution in Kisumu city is bifurcated, with formal city areas receiving standard delivery and informal settlements benefiting from a model that prioritizes the needs of the impoverished. The study's findings, derived from ordinal logistic regression, highlight the substantial influence of socioeconomic factors: household income correlates with water affordability; tenancy and household income affect water accessibility; and household income determines water reliability. Also influencing water quality is educational attainment. It is crucial to note that the study did not identify any significant impact of gender on water distribution satisfaction. This underscores the importance of socioeconomic factors as crucial forecasters of water service delivery in the city of Kisumu. The study underscores

the importance of considering socioeconomic factors in water service delivery planning by relevant agencies.

Although a universal population of 91 percent can now access safe drinking water, low-income urban neighborhoods nevertheless confront persistent problems with water quality, quantity, and cost. Tshililo et al., (2022) examined the factors that influence gaining of water and paying for it among the urban poor in Diepsloot Township. The goal of this research was to study factors affecting the availability, quality, and cost of household water in these areas. The researchers conducted a structured questionnaire survey involving 500 households and made several noteworthy observations. High unemployment rates and low incomes, with many individuals earning monthly income of less than R3000 ($198), were prevalent among the population. Approximately Sixty-six percent of homes have access to running water, albeit with irregular supply, and most of them were not paying for water services. Key determinants of obtaining water by a household and payment included water source, household size, and house size, while variables like employment, education, and income did not significantly predict household water access. Furthermore, factors like income, education, gender, and water quality had no significant association with household water payment. The study underscores the pivotal role of policy interventions in piloting successful water service provision and achieving Sustainable Development Goal 6.1 in urban low-income communities.

Albulescu, Luminosu and Pater (2023), conducted a study to examine the regulatory framework for treating wastewater and the cooperation between the European Union (EU) and the Organization for Economic Cooperation and Development (OECD) as part of the European Union Water Initiative. In addition, they conducted a practical examination of

the factors influencing wastewater treatment in 28 OECD nations, using yearly data from 2000 to 2017. The panel data analysis demonstrated that the availability of wastewater treatment services is directly impacted by both per capita income and research and development (R&D) expenditure. In contrast, elevated energy prices are discovered to detrimentally affect the availability of wastewater treatment services, whereas being a member of the European Union does not notably influence the rates of service accessibility.

The study conducted by Gómez and Fernandez (2016), investigated the correlation between different socioeconomic factors and the availability of enhanced water sources in emerging nations, specifically emphasizing rural regions. The study employed regression models and panel data analysis to examine the relationship between water access and many parameters, including Gross National Income (GNI), female primary completion rates, agricultural activities, rural population growth, political stability, and corruption control. The results indicated that Gross National Income (GNI), control of corruption, political stability, and female education were usually associated with the accessibility of water. However, the nature of these associations varied depending on the origin of water and the income bracket being evaluated. Significantly, it was discovered that official development assistance exhibited a favorable correlation with water access in low-income nations. Furthermore, there was a clear positive correlation between female education and water availability in all countries and types of water sources. Conversely, agricultural activities showed a negative association. Moreover, the study disclosed that the absence of corruption control had a greater effect on piped on premises water sources in comparison to other improved sources.

In a similar vein, Abdu, Buba, Jibir, Adamu, and Hassan (2016) studied socioeconomic drivers of access to potable water for households and factors impacting urban-rural differences in Nigerian household's ease of obtaining drinking water. This research was motivated by the recognition of the fundamental role that improved water access plays in various socio-economic and environmental aspects, including health and urbanization. Analyzing 2013 Nigerian Demographic and Health Survey data, the research employed OLS and probit regressions to uncover several determinants of safe drinking water access, such as age, household size, awareness, gender, marital status, and access to electricity. Furthermore, the study revealed that education level, age, household size, awareness, and electricity access contributed to urban-rural disparities in safe drinking water access. These findings are highly relevant to the current study, as both research endeavors share a common goal of examining determinants of access to clean water in pursuit of SDG 6. While the previous study focused solely on safe drinking water, the current study expands its scope to consider additional variants, such as age, household size, gender, education and marital status, in the context of access to clean water, clean energy, and decent housing. Furthermore, the study underscores the importance of targeting these determinants in interventions aimed at enhancing access to safe water and narrowing the urban-rural gap in clean water access.

In their study, Asibey, Dosu, and Yeboah (2019) examined the perspectives and attitudes of urban residents in the New Juaben Municipality, Ghana, regarding urban water insecurity. They also evaluated the efficacy of coping mechanisms and perceived obligations of urban inhabitants in addressing water stress. Their research was motivated by the recognition that access to portable water is pivotal for achieving SDG 6 and that

access to clean water is regarded as a fundamental human right (WHO, 2015). The study utilized a mix of quantitative and qualitative methods to investigate how variables such as age, gender, employment status, consistency in water supply, and income affect the involvement of city dwellers in addressing water scarcity. It was revealed that although a significant proportion of household heads were male (72%), the responsibility of ensuring access to domestic water sources fell primarily on women and children due to socio-cultural norms. This responsibility increased during water shortages, affecting women and children by extending the time spent searching for water. In addition, the research revealed that preferable coping mechanisms during water shortages were significantly influenced by individual income, with lower-income households opting for less expensive water sources that were nonetheless less safe. This study offers valuable insights for the current research, emphasizing the need to examine specific household contributions to achieving equitable, safe, and affordable drinking water access while considering the socio-cultural context and income disparities.

Bisung, Elliott, Schuster, Karanja, and Abudho (2014) did a study in rural Kenya, examining the correlation between social capital, collective action, and water accessibility. Their research addressed the pressing issue of global populations lacking access to enhanced water sources and the adverse impact of inadequate access to safe water on health and development. Through logistic regression analysis of household data, the study found that investments in building social capital, gender dynamics, social cohesion, and collective action could contribute to addressing local water and sanitation challenges. However, it's essential to note that this study concentrated on rural settings, leaving a gap that the current

study seeks to fill by examining accessibility to water in urban areas in Kenya, thus expanding the understanding of this critical issue.

2.4 Overview of the literature

Different theories such as, the human capital hypothesis and the behavior model theory reviewed in the current study are closely interconnected. A rational individual goes for alternatives that maximizes their utility when presented with alternative choices and limited income. The current study is grounded in the theories, which consider the individual as a rational decision-making unit capable of selecting water sources that optimize their utility. The economic climate and an individual's capacity also influence the decisions of households and individuals regarding secure and clean water. The ability of the household is determined by a combination of social and economic elements, including household size and employment status, as well as age, education level, sex, and place of residence.

Most of the studies reviewed are for associated with individual access to water. A number of the reviewed studies have acknowledged the interconnectedness of the access to water as well as their importance in attainment of sustainable development goals. Empirical literature such as; Mensah & Adu (2015); Abdu et al (2016), and Asibey, Dosu, & Yeboah (2019) have highlighted the household characteristics including income, age, gender, household status, employment status, education level and area of residence as determinant factors to choices of water sources. The impact of household head and/or household characteristics on access to pure and safe water was not established in any of the aforementioned studies. Most are focused in developed economies with few being done in developing countries. In addition, none of those studies combined the attainment of clean and safe water at household level in the urban set up.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Introduction

Research methodology serves as the blueprint for conducting the study, guiding the research process, data collection, and analysis. It is imperative to define the methods and techniques that are employed to achieve the research objectives systematically. This chapter provides a comprehensive overview of the theoretical framework, and empirical model. The section also presents the variable definition table, data source as well as the fundamental diagnostic tests and data analysis approach.

3.2 Theoretical framework

The study is anchored on random utility framework developed by McFadden in 1974 and later received numerous developments including by Horowitz, Keane, Bolduc, Hajivassiliou, Koppelman, Rossi and Ruud (2014). The theoretical approach is grounded in the principle of utility maximization, positing that individual decision-making is driven by selecting the alternative that offers the most utility. The satisfaction obtained from a particular option is contingent upon the characteristics of the option itself, as well as the known and unknown characteristics of the decision-maker. The underlying assumption of the model posits that individuals exhibit a tendency towards excessive rationality, coupled with an illogical inclination towards dispassionate rationality. According to the model, individuals opts for alternatives when the utility they gain from those options surpasses the utility derived from any other alternatives. Moreover, individuals may opt for alternative options when the utility obtained from these alternatives is either equal to or lower than the utility received from other choices.

The objective of the random utility model is to create a framework for analyzing the decision-making process of rational consumers when faced with a selection of n alternatives. The available options are denoted as $1, \dots, n$. The underlying assumption of the model posits that the consumer's choice for the available alternatives may be effectively captured by a utility function, denoted as a vector $U_1, U_2, \dots U_n$ which is connected with the n potential options. The utility for item i is denoted as U_i

Precisely, if U_1 is the utility for choosing alternative 1, U_2 for preferring 2 and U_n for selecting alternative n, then person's choice y over n options is given by;

$$y_i = \begin{cases} 1 & if\ U_1 > U_2 > U_3 > \dots > U_n \\ \vdots & \vdots \\ n & if\ U_n > U_1 > U_2 > \dots > U_{n-1} \end{cases} \quad \text{……………………………..3.1}$$

Based on the aforementioned, individuals would opt for an alternative i if the utility obtained from this choice surpasses that derived from all other alternatives. Conversely, they would select other alternatives if the benefit generated from these options is either equivalent to or lower than the utility obtained from other options. The set of potential possibilities n resulting from option y can be denoted as follows:

$$y = 1,2, \dots, n \text{………………………………………………………3.2}$$

Drawing inspiration from the framework proposed by Horowitz et al. (2014), the random utility function can be expressed as follows:

$$\begin{aligned} U_1 &= W'\beta_1 + Z_1'\alpha_1 + \epsilon_1 \\ &\vdots \\ U_n &= W'\beta_n + Z_n'\alpha_n + \epsilon_n \end{aligned} \quad \text{…………………………………………………..3.3}$$

The vector W' represents the qualities of the specific consumer, whereas the vector Z' represents the features of the possibilities available to the consumer. The random utility model provides the probability associated with each choice when undergoing selection.

3.3 Empirical model

Probit model was employed to investigate the extent to which urban residents in Kenya can access clean water. This type of regression employs both the likelihood and a response factor with a binary value of one to one. The premise, upon which these types of models are founded, according to the literature, is that individuals are required to choose between two alternatives, with their decision being influenced by a variety of factors. The error term in this particular case adheres to the normal distribution. The determination of whether an individual has access to pure and safe water is based on an underlying response variable. Thus:

$$Y^* = \beta X_i + \varepsilon \quad \text{.....3.4}$$

Where Y* is the response variable of access to clean and safe water or no access, X_i are the dependent variables predicting accessibility to water. They include variables such as the age of the respondents, their education level, health care quality among other variables. β represents the respective coefficients, ε is the error term. The dependent variable Y is binary in nature, taking the value of 1 if the respondents accessed water and zero otherwise. This is represented as follows:

$$Yi = \begin{cases} 1, \text{ if access} \\ 0, \text{ No access} \end{cases} \quad \text{.....3.5}$$

Hence, the likelihood of Y being equal to 1 given the evaluation of X may be determined using the ordinary normal cumulative function, denoted by the subsequent equation:

$$P\,(Y = 1/X = \Phi(X'\beta) \quad \ldots\ldots 3.6$$

In this context, the symbol P represents the concept of probability, whereas Φ represents the cumulative standard normal distribution function. Additionally, ß denotes the number of factors or variables that possess estimable parameters. The equation presented above can be interpreted as the conditional probability of an urban inhabitant accessing clean and safe water, given a certain set of recognized variables X_i. The likelihood function was used to estimate the same model, from which we derive the estimate $\beta\hat{}$ that maximizes the log likelihood function. The objective of this study is to obtain the average marginal effects in order to assess both the direction and magnitude, as proposed by Muriithi (2013) and Orayo (2014). The marginal effects demonstrate the change in the probability of y = 1 in response to a one-unit change in the predictor variable X. The calculation of the marginal impact is performed either by taking the sample average or by determining the mean of separate marginal values.

3.4 Model Specification

The study operates under the assumption that the likelihood of an urban resident lacking access to clean and safe water is determined by a set of predetermined variables (explanatory factors). These predictor factors comprise a variety of enabling and predisposing elements, such as socio-demographic characteristics of the population, healthcare infrastructure attributes, and environmental factors.

Therefore, estimable model is:

$$Y = \beta_0 + \beta 1X1 + \beta 2X2 + \beta 3X3 + \beta 4X4 + \beta 5X5 + \beta 6X6 + \beta 7X7 + \beta 8X8 + \beta 9X9 + \beta 10X10 + \varepsilon \ldots . 3.7$$

Where Y is the response variable access to clean and safe water, X_1=Age, X_2 = Sex, X_3 = marital status, X_4= level of education, X_5 = religion, X_6 = size of the household, X_7 = wealth Index, X_8 = distance to health facility, X_9 = employment, X_{10} = access to information and X_{11} = household income.

3.5 Variable definitions and Measurements

Table 1 presents the variable definition and measurement. Also, the probable signs are presented.

Table 1: Variable definitions and corresponding predicted expectation

Variable	Measurement	Expected sign
Dependent Variable		
Access to clean and safe water	This is a binary variable, with value of 1 if an urban resident indicates that they collect water from piped water source, 0 otherwise	
Independent Variables		
Age	This is measured as a continuous variable expressed in years.	Positive
Sex	This is measured as 1 if the respondent is female and 0 otherwise.	Positive
Marital Status	This is measured as 1 if married and zero otherwise.	Indeterminate
Level of Education	This is a categorical variable, measured as 1 if no education, 2 if primary level, 3 if secondary school level and 4 if tertiary level of education.	Positive

Wealth Index	This is categorical in nature, measured as 1 if poorest, 2 if poorer, 3 middle, 4 implies rich and 5 if richest.	Positive
Status of Employment	This is binary in nature, measured as 1 if respondent is employed and zero otherwise.	Positive
Religion	This is categorical in nature, measured as 1 if no religion, 2 if Christian and 3 if Muslim.	Indeterminate
Household size	This is a discrete variable measured as the complete number of individuals per household	Positive
Distance to Health Facility	This is represented in categories, measured as 1 if less than 5km, and zero if above.	Positive
Access to Information	This is measured as a binary variable, represented as 1 if the respondent listens to radio or has access to TV or newspaper, and zero otherwise.	Positive
Household Income	This is the average total amount in Kshs that a household earns from an economic activity per day	Positive

3.6 Data Type and Source

In order to accomplish the study's objectives, secondary data was sourced from the 2015/2016 Kenya Integrated Household Budget Survey. This collection of cross-sectional data in Kenya, which constituted the household budget survey, spanned a duration of twelve months. The data was subsequently disaggregated both at the county and national levels. The survey gathered information on various indicators, such as household characteristics, water source, education, and general health attributes. The results of the survey were disseminated at various levels of government, including national, county, rural, and urban. 2,568 clusters in urban areas and 2,792 clusters in rural areas out of the

total 5,360 clusters surveyed were required to meet the sample size requirements. Stratified sampling was done in two stages by separating each county into rural and urban areas. However, this criterion was not applicable to Nairobi and Mombasa counties since they were composed of urban setups only. The clusters served as primary sampling units for picking of households in stage two and a static number of ten households were selected from each cluster.

3.7 Data Analysis

The probit regression model was used as modeled in equations 3.6 and 3.7 since dependent variable contains two responses. The survey determined probit indices of the independent variables and the marginal effects of those variables. The coefficients that result were not interpreted, however, the marginal effects was. Since the variables promote and discourage some of the alternatives simultaneously, the marginal effects must sum to zero.

CHAPTER FOUR

ANALYSIS AND RESULTS

4.1 Introduction

This chapter presents the descriptive statistics, including measures such as the average, standard deviation, the minimum values and the maximum values. Equally, inferential statistics for the probability distribution estimates and marginal effects are reported for probit model.

4.2 Descriptive statistics

The focus of this investigation is on exploring the impact of various socioeconomic factors on the accessibility of clean and safe water in urban areas of Kenya. The descriptive statistics presented in Table 2 provide insights into various socio-demographic variables within the sampled population

Table 2: Descriptive statistics

Variable		Obs	Mean	Std.	dev.	Min	Max
	Access to clean Water	21,208	0.595	0.491	0	1	
	age	23,889	35.035	7.546	15	49	
Marital Status	Never Married	23,889	0.052	0.221	0	1	
	Married	23,889	0.686	0.464	0	1	
	Living with Partner	23,889	0.070	0.256	0	1	
	Widowed	23,889	0.045	0.208	0	1	
	Divorced	23,889	0.038	0.190	0	1	
	Separated	23,889	0.109	0.312	0	1	
Education Status	No Education	23,889	0.190	0.392	0	1	
	Primary	23,889	0.370	0.483	0	1	
	Secondary	23,889	0.273	0.446	0	1	
	Higher	23,889	0.168	0.374	0	1	

	Poor	23,889	0.144	0.351	0	1
Wealth Index	Middle	23,889	0.155	0.362	0	1
	Rich	23,889	0.701	0.458	0	1
	Christians	23,197	0.720	0.449	0	1
Religion	Muslins	23,197	0.280	0.449	0	1
	Other religion	10,015	0.065	0.246	0	1
	Household Size	23,889	5.592	2.850	1	24
	Distance to health Facility	12,358	0.781	0.414	0	1

The mean for access to clean water is approximately 0.595, indicating that, on average, 59.5% of Kenyan households have access to clean water. The standard deviation is 0.491, suggesting a moderate level of variability in the access to clean water across the sample. The average age in the Kenyan urban sample is 35.04 years, with a standard deviation of 7.55. This indicates a relatively narrow age distribution, ranging from 15 to 49 years.

The descriptive statistics for marital status reveal that the majority of the urban households are married (mean = 68.6%, SD = 0.464), followed by individuals who are never married (mean = 5.2%, SD = 0.221). The standard deviations suggest varying degrees of dispersion within each marital status category. In terms of education, the sample exhibits a diverse distribution. The mean values indicate that the highest proportion has primary education (mean = 0.370, SD = 0.483), followed by those with secondary education (mean = 0.273, SD = 0.446). The standard deviations imply a considerable spread in education levels.

Wealth distribution, as measured by the wealth index, indicates that a significant portion of the Kenyan urban sample is classified as rich (mean = 0.701, SD = 0.458), with lower proportions falling into the poor (mean = 0.144, SD = 0.351) and middle (mean = 0.155, SD = 0.362) categories. The standard deviations reflect notable variability in wealth distribution. The majority of the Kenyan urban sample follows the Christian faith (mean =

0.720, SD = 0.449), while a smaller proportion identifies as Muslim (mean = 0.280, SD = 0.449). A minority in the sample adheres to other religions (mean = 0.065, SD = 0.246).

The average household size for Kenyan urban is 5.59, with a standard deviation of 2.85, indicating some variability in household composition. Majority (78.1%) of the Kenya Urbans travel less than 5 kilometers to health facilities, with a standard deviation of 0.414.

4.3 Regression output

In examining the effect of various socioeconomic determinants on access to clean and safe water in urban Kenya using a probit model, both the coefficients and marginal effects to gain insights into the relationships are presented in Table 2. The focus is on understanding how the probability of access to clean water having is influenced by different socioeconomic factors.

Table 3: Probit Model Results

VARIABLES	(probit) coefficient	(probit) marginal effects
Age	-0.00384	-0.0015
	(0.00282)	(0.00112)
Married	-0.0385	-0.0152
	(0.116)	(0.04572)
Living with partner	0.312**	.1198**
	(0.138)	(.0507)
Widowed	0.225	.0872
	(0.173)	(.0652)
Divorced	-0.121	-.0479
	(0.164)	(.065)
Separated	0.0267	.0105
	(0.144)	(.0565)
Primary	0.000970	.00038
	(0.0636)	(.02517)

Secondary	0.201***	.0798***
	(0.0752)	(.0298)
Higher	0.261***	.1039***
	(0.0910)	(.0360)
Middle	0.817***	.29611***
	(0.0679)	(.0214)
Rich	0.972***	.3729***
	(0.0628)	(.0222)
Muslims	-0.0337	-.0133
	(0.0570)	(.0225)
Employment Status	0.428***	.16161***
	(0.0868)	(.0304)
Household size	-0.0491***	-.0194***
	(0.00787)	(.0031)
Distance to health facility	0.0265	.0105
	(0.0474)	(.0188)
Constant	-0.147	
	(0.162)	
Observations	4,306	

Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

The marginal effect results show that individual marital status is statistically significant inn influencing access to clean and safe water in urban Kenya. For instance, individuals who are living with their partners are 31.2% more likely to have access to clean and safe water than those who were never married. This effect is statistically significant at 5% significance level. This could be attributed to living with a partner often entails the sharing of economic resources, including household income. This economic pooling may provide individuals in such partnerships with greater financial capacity to invest in water infrastructure or services. The combined resources might contribute to a more secure and reliable access to clean water, as households are better equipped to meet the costs associated with water provision and maintenance.

The coefficient for secondary school attainment is 0.201, indicating positive impacts on the probability of access to clean and safe water. The marginal effects are 0.0798 and statistically significant. This finding implies that likelihood of access to clean and safe water is higher among individuals with secondary school than those without formal education. This finding can be attributed to several factors. Firstly, secondary education often equips individuals with improved knowledge and awareness of hygiene practices, fostering a greater understanding of the importance of clean water. Secondly, individuals with secondary education may have enhanced socio-economic opportunities, affording them the means to invest in water infrastructure or access more reliable water sources. Additionally, secondary education may empower individuals to engage with community initiatives and government programs aimed at improving water accessibility. of education in shaping health outcomes and infrastructure access in urban settings.

The wealth index categories of middle and rich have positive coefficients (0.817 and 0.972, respectively) and large positive marginal effects (0.29611 and 0.3729, respectively). This implies that higher wealth index categories are associated with a significant increase in the probability of having access to clean water than lower wealth index. In particular, individuals in rich and middle wealth index categories are 10.39% and 37.29% more likely to have access to clean and safe water than individuals in poor wealth index category. The effect is statistically significant at 1% level of significance.

Employment status has a positive and statistically significant coefficient of 0.428, suggesting a positive impact on the probability of access to clean water. The marginal effect is 0.16161 implying that employed individuals are 16.16% more likely to have access to clean and safe water than individuals who are not employed. This finding can be attributed

to several interconnected factors. Employed individuals typically have a more stable financial foundation, enabling them to invest in water infrastructure or services. Moreover, being employed may afford individuals a higher socio-economic status, providing greater access to reliable water sources. Additionally, employed individuals may benefit from workplace and community initiatives that prioritize water accessibility.

Finally, household size has a negative and a statistically significant association with the probability of access to clean and safe water in urban Kenya. For example, the probability of access to clean and safe water among urban residence in Kenya decrease by 1.94% with an increase household size. The negative and statistically significant association between household size and the probability of access to clean and safe water in urban Kenya suggests that larger households face challenges in securing reliable water access. The observed 1.94% decrease in the probability of access with each increase in household size points to potential economic and logistical constraints. Larger households may experience higher water demand, placing stress on available resources. This, coupled with limited infrastructure, could result in reduced access for each member. Furthermore, the allocation of resources and investments in water infrastructure may be more challenging in larger households, impacting the overall probability of access.

CHAPTER FIVE

SUMMARY CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction

This chapter provided an overview of the empirical findings and offered conclusions. The areas for future research and the policy implications of the findings were also provided

5.2 Summary of empirical findings

The empirical findings from the probit model investigating the effect of socioeconomic determinants on access to clean and safe water in urban Kenya yield valuable insights into the multifaceted dynamics shaping water accessibility in this context. The analysis reveals that certain demographic and economic factors play crucial roles in determining the likelihood of individuals having access to clean water.

Firstly, the influence of marital status is noteworthy, with individuals living with partners exhibiting a significant positive impact on the probability of access to clean water. This underscores the importance of household dynamics and economic pooling within partnerships, suggesting that shared resources and collaborative decision-making contribute to improved water access. Moreover, the findings highlight the complexity of household structures and the need for tailored interventions that account for the diverse marital situations prevalent in urban Kenya.

Secondly, education emerges as a pivotal determinant, particularly with a positive association between secondary school attainment and the probability of having access to clean water. This implies that education not only enhances individual knowledge of hygiene practices but also facilitates socio-economic opportunities that contribute to

improved water infrastructure. The findings underscore the broader societal benefits of investing in education as a means to address water accessibility challenges in urban areas.

Lastly, the positive and statistically significant association between employment status and access to clean water emphasizes the pivotal role of economic stability. Employed individuals are shown to be more likely to have access to clean water, suggesting that financial resources and stable employment contribute to better water infrastructure and service availability. This underscores the interconnectedness of economic factors and water accessibility, calling for holistic approaches that address employment opportunities and income disparities to ensure equitable access to clean and safe water in urban Kenya.

5.3 Conclusions

In conclusion, the comprehensive analysis of the marginal effects in the context of marital status, education, wealth index, employment status, and household size provides a nuanced understanding of the intricate relationships between these socioeconomic determinants and access to clean and safe water in urban Kenya. The statistically significant findings shed light on the disparities in water accessibility among different demographic groups, offering valuable insights for policymakers and practitioners striving to design targeted interventions.

The positive association between living with a partner and increased access to clean water emphasizes the role of economic pooling within households. This suggests that fostering economic stability and shared resources through partnerships can contribute significantly to overcoming barriers to water access. Similarly, the positive impact of secondary school attainment underscores the pivotal role of education in enhancing awareness, socio-

economic opportunities, and community engagement, all of which collectively contribute to improved water infrastructure and services. Furthermore, the pronounced positive effects associated with higher wealth index categories and employment status highlight the crucial role of economic factors in ensuring equitable access to clean water. Conversely, the negative association with household size suggests that larger households face unique challenges, necessitating tailored interventions to address their increased demand for water resources.

5.4 Recommendations

To address the identified disparities in access to clean and safe water in urban Kenya, a multifaceted policy approach is recommended. First and foremost, targeted interventions should be developed to support and empower individuals in different marital status categories. Recognizing the positive impact of partnership dynamics on water access, programs that promote economic collaboration within households, such as joint financial planning and resource-sharing initiatives, can enhance the financial capacity of couples to invest in water infrastructure. Moreover, educational campaigns focusing on the benefits of stable partnerships in securing reliable access to clean water can be instrumental in fostering a community-wide understanding of the importance of collaborative decision-making within households.

Education emerges as a key lever for improving water accessibility, as evidenced by the positive association with secondary school attainment. Therefore, policies should prioritize investments in educational infrastructure, curricula, and awareness campaigns. Ensuring broader access to quality secondary education not only equips individuals with the knowledge and hygiene practices necessary for water preservation but also fosters a

population with enhanced socio-economic opportunities. Additionally, community engagement programs, linked to secondary schools, can play a pivotal role in raising awareness about sustainable water practices and encouraging active participation in government and community initiatives aimed at improving water accessibility.

Given the substantial impact of wealth index on water access, policies should prioritize targeted interventions to address economic disparities. Programs aimed at uplifting individuals in lower wealth index categories should be implemented, providing financial assistance for water infrastructure development and maintenance. Public-private partnerships can be explored to attract investments in water projects and to ensure sustainable funding mechanisms. Moreover, employment creation initiatives and skill development programs can contribute to enhanced socio-economic opportunities, ultimately improving the overall wealth index and, consequently, access to clean water.

Lastly, addressing the challenges associated with household size requires a tailored approach. Policies should explore innovative solutions such as community-based water management strategies that can efficiently cater to the increased demand from larger households. Furthermore, targeted infrastructure development in areas with larger households can alleviate the strain on existing resources. Promoting water conservation practices and efficient water use within these households through education campaigns can also contribute to sustainable water access.

5.5 Areas for further study

While this study provides valuable insights into the socioeconomic determinants influencing access to clean and safe water in urban Kenya, there are several areas that warrant further investigation. First, a more in-depth exploration into the specific

mechanisms through which marital status impacts water access could provide a nuanced understanding of household dynamics. Understanding the decision-making processes within different types of households and the role of gender dynamics within partnerships could shed light on additional factors influencing water access. Second, further research could delve into the intersectionality of education and other demographic factors, such as gender and age, to uncover how these factors collectively shape water accessibility. Additionally, exploring regional variations within urban areas and the impact of local governance structures on water infrastructure could provide context-specific insights for targeted interventions. Lastly, longitudinal studies tracking changes in socioeconomic factors and their subsequent impact on water access over time could contribute to a dynamic understanding of urban water challenges and guide adaptive policy strategies.

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