

Understanding the Impact of Water Accessibility and Sanitation-Related Diseases on Livelihoods in Tanzania

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ABSTRACT

Water is an important resource for improved sanitation and livelihood due to its multiple uses and impacts on household income. Despite its significance, most households in developing countries, including Tanzania, have been facing difficulty accessing this resource, whose effects are seen in health and general household welfare. In bringing that into light, the current study investigates the interplay of water accessibility, sanitation-related diseases, and livelihood among households in Tanzania by employing the probit regression and the Ordinary least squares models using Household Budget Survey data of 2017/18. Findings showed that urban households (0.111, $p < 0.01$), age (-0.305, $p < 0.05$), household size (0.159, $p < 0.01$), education level, water cost (-0.249, $p < 0.01$), and employment (0.166, $p < 0.01$) influence water accessibility. Moreover, variables like secondary education, college education and water costs were also found to influence household sanitation status. Conversely, the study found that water accessibility and sanitation-related disease influence household livelihood significantly at 0.167 ($p < 0.01$) and -0.649 ($p < 0.1$). Conclusively, neglecting the urban gap would continually worsen the welfare of the people living in rural areas. Furthermore, the study recommends that programs to enhance water accessibility should go hand in hand with health promotion programs, especially in rural areas where water accessibility is poor, and most people are characterised as having low income.

Keywords: Livelihood, Poverty, Sanitation, Water Accessibility

I. INTRODUCTION

One of the Sustainable Development Goals targets maintaining the equality of water and hygiene (Adegoke et al., 2023). As stated by SDG through goal number 6, accessibility to basic water and sanitation are aimed to improve by the year 2030, thus reducing the gaps in service delivery (Okumu et al., 2022; Dickin & Gabrielsson, 2023). The Joint Monitoring Programme was developed by the World Health Organization (WHO) and the United Nations Children's Fund (UNICEF) to monitor progress toward the goals. They developed a Joint Monitoring Programme ladder for water, sanitation, and hygiene services. An essential human right and the cornerstone of public health is access to proper sanitation and water and hygiene services. Low access to safe WASH (water, sanitation and hygiene) services is responsible for a large percentage of infectious disease transmission in developing countries (Kitole, 2023; Girmay et al., 2023). Unsafe water and poor sanitation are strongly related to disease transmission such as cholera, hepatitis, malaria, typhoid, dysentery, diarrhoea and polio (Rawlings & Seghosime, 2022; Dimoso & Andrew, 2021). Lack of access to water may impede hand-washing practices, thus increasing the chance of diarrhoea and other related diseases.

Water can be considered a major food constituent whose essentiality is determining a community's quality of life and holds a society's sociological, biological, physical and mental wellbeing (Asoba et al., 2021; Kitole et al. 2024b). It has been noted that the availability and accessibility of water and the related issues of sanitation have been a great challenge in civilised societies for an extended time. Sub-Saharan African countries face challenges in ensuring adequate sanitation and hygiene behaviours for the rapidly growing populations (Malima et al., 2022; Adugna, 2023). As per recent data, the need is even more acute in Africa, with 73%, 61%, and 63% of people lacking access to safely managed sanitation, drinking water, and basic hygiene services. Many African issues related to water and sanitation in Africa still hold a political perspective related to colonisation, which are largely segregatory and does little for rural and native communities (Asoba et al., 2021). The UNICEF report on water and sanitation show that more than 57.40% of population in Sudan do not have access to clean water, with only 46.87% have access to improved sanitation (UNICEF, 2021). Moreover, according to World Bank (2023), less than 52.6% of entire population in Congo (DRC) have access to clean and safe water sources, while only 29.10% to the improved sanitation. The problem is also the same for Kenya where only 59.0% (UNICEF, 2023) of population have access to clean water, contrary in Uganda the problem seems to

be more severe as 6 out of 10 people consider water problem being severe (Observer, 2023). Additionally, Tanzania is also not exempted from the problem whereby most of its citizens suffer from access to water, and the situation is even worse among the people living in rural areas (Zeeshan et al., 2019).

In collaboration with various stakeholders, the Tanzanian government has continued to implement water-related projects in urban and rural areas. As reported in the FYDP II, between 2015 and 2020, 1,423 water supply projects were constructed with 131,370 water points benefiting 25,359,290 people. This is equivalent to 70.1 percent of the rural population. However, basing on water points functionality, out of 131,370 constructed only 86,780 were functioning (Kitole et al., 2023c). There is still a need for more focus on sustainability to ensure the little resources available are utilised effectively to achieve high impact.

Despite the intervention reported to address water and sanitation situations, it has still been reported in the literature that the challenges to accessibility of water and sanitation remain a notable problem in many countries (Rawlings & Seghosime, 2022; Fumbwe et al. 2021). The same applies in Tanzania, where even though some water points are constructed, some no longer function, thus leaving the majority of Tanzanians with low access to safe and clean water and leading to poor sanitation practices. Sanitation dramatically impacts health outcomes (Kitole et al., 2023b; Zeeshan et al., 2019). From this ground, this study aims to study the nexus between water accessibility, sanitation-related disease and livelihood in Tanzania.

II. LITERATURE REVIEW

2.1 Empirical Literature Review

Researchers and policymakers have paid much attention to the impact of accessibility of water and sanitation due to the role of investment in water and sanitation to generate sectorial and intersectoral economic benefits, which include benefits for agricultural development and food production, industrial production, and cross-cutting benefits such as ecosystem services and protection against floods and drought. However, sanitation has always been discussed from a general perspective, thus giving little attention to sanitation-related diseases. This section looks at a few empirical studies on the subject matter of this study.

Zeeshan et al. (2019) conducted a study on whether accessibility to water and sanitation improves household wellbeing in India; the study used data from Indian Human Development Surveys (IHDSs) collected by the University of Maryland and the National Council of Applied Economic Research in 2004-05 and 2011-12. The study utilised the Pareto theory of economic welfare policy to study the relationship. The results from the ordered Logit Regression Approach found no significant improvement in access to water sources in India from 2004-05 to 2011-12. However, it was found that there is a positive relationship between improvements in households' sources of water and sanitation and improvements in households' overall welfare.

Issn et al. (2019) examined the impacts of water accessibility and sanitation on household disease prevalences in India by the use of the National Sample Survey data. The study employed logit regression and T-test to model and test the relationship between water accessibility, sanitation status, and household disease prevalences. Moreover, the results reveal that there is a high significant association between the uses of water from improved sources and stomach problems. From the study, it was concluded that improvement in water and sanitation conditions can substantially reduce the prevalence of diseases and can be expected to affect other aspects of human hygiene and health.

Aminu and Udeze (2023) assessed the relationship between water, sanitation, hygiene practices, and the incidence of water-borne disease among urban slum households in Lagos. The study used multistage sampling to select the 120 household heads from four local government areas in the states for data collection. The findings from Logit Regression Model indicated that age, education, household size, occupation, water treatment, type of toilet facility, toilet sharing, refuse disposal method, environmental sanitation exercise, and using the same container for bathing and cooking were significant factors influencing the incidence of water-borne diseases in the study area. It was then recommended that people be properly trained about the consequences of utilising contaminated water, poor sanitation, and poor personal hygiene practices on their health in the study area.

Gyasi et al. (2022) carried out a study on water, sanitation, and the risk of chronic disease in old age in Ghana using data from the WHO-SAGE Wave 2 involving adults above 50 years old. Univariate descriptive analysis was firstly employed to describe the features of the sample, and next, bivariate analysis by sex and location to estimate the relationships. Generalised logistic regression was also done to establish the causality of presence of chronic diseases and estimate the effects of water and sanitation indicators on chronic diseases. It was found that the use of unimproved sanitation and sharing of sanitation facilities were associated with higher odds of chronic diseases. However, the use of water did not reach significance. The study concluded that the use of poorly improved sanitation facilities and the sharing

of toilet facilities are associated with the occurrence of chronic diseases among older people. Policy and public health interventions targeted at improving the health and wellbeing of older people should conspicuously include better access and improved sanitation services.

Empirical evidence from Fielmua et al. (2019) found a complex linkage between water and sanitation intervention, and livelihood in the context of Ghana. The authors found that reduction in related diseases was not guarantee with provision of water and sanitation infrastructure. Hence, limits the improvement in the livelihood. Based on the aforementioned piece of literature, it can be concluded that there is a complex relationship between water and sanitation and livelihoods and welfare in rural communities of developing countries (Fielmua et al., 2019; Zeeshan et al., 2019). Also, Aminu and Udeze (2023) and Gyasi et al. (2020) have shed light on the relationship between sanitation and water quality, as well as the prevalence of waterborne illnesses and the population's risk of chronic diseases. Likewise, Fielmua et al. (2019) have emphasized the importance of comprehending socioeconomic issues in order to improve the effectiveness of interventions addressing the complexity connection between water accessibility, sanitation, diseases, and livelihood for wellbeing improvement especial in the communities of developing countries like Tanzania. Based on the supposition that socioeconomic factors affect the accessibility of water and Sanitation related diseases (Figure 1), the study investigates the relationship between safe water access, enhanced sanitation, and rural livelihoods with the aim of fostering healthy and prosperous communities especially in the developing countries like Tanzania.

III. METHODOLOGY

This study uses nonexperimental research design because it helps to provide a realistic depiction of the water accessibility, sanitation related diseases and the livelihood of the household in society. The non-experimental research design provides analysis of the existing condition and variable to gain a deeper understanding the interplay between water accessibility, sanitation related diseases and the livelihood of the household (Kitole & Sesabo, 2024). Tanzania Household Budget Survey data (2017/2018) in this paper are used. It was implemented by the National Bureau Statistics (NBS) in collaboration with the Poverty Eradication Division in the Ministry of Finance and Planning (MoFP). The funding for the 2017-2018 HBS was provided by the Government of Tanzania and Development Partners including World Bank, UN Women, Irish Embassy, United Nations Children's Fund (UNICEF) and Global Affairs Canada (GAC). Technical assistance was provided by the World Bank, UN Women and United Nations Children's Fund (UNICEF).

3.1 Modelling Household Food Security

This study uses both probit model to determinants for water accessibility, and effects of water accessibility on sanitation related diseases among households. The choice on the model is based on the ability of the model to provide the likelihood estimates or the chances to which each factor can contribute to the outcome variable (Kitole et al. 2023c; Dimoso and Andrew, 2021). Therefore, the demographics and socioeconomic characteristics related to the households under the study are therefore regressed against outcome variables.

Thus, general probit equation for the determinants of household water accessibility is therefore given as;

$$Y_{1i} = \alpha_0 + \alpha_1 X_i + \alpha_2 D_i + \mu_i \quad (1)$$

Under the conditions that, when

$$\begin{aligned} y_i^* &> 0, y_i = 1 \text{ if household access water} \\ y_i^* &\leq 0, y_i = 0 \text{ if household don't access water} \end{aligned}$$

On the other hand, for the effects of the effects of water accessibility on sanitation related diseases which were captured by binary variable which indicate presence of diarrhea in a household, the probit model was also used with the estimated equation presented as

$$Y_{2i} = \alpha_0 + \alpha_1 X_i + \alpha_2 D_i + \varepsilon_i \quad (2)$$

Given that for such factor to influence effects on the household the condition that should be satisfied should follow that:

$$\begin{aligned} y_i^* &> 0, y_i = 1 \text{ if household has diarrhea victims} \\ y_i^* &\leq 0, y_i = 0 \text{ if household don't have diarrhea victims} \end{aligned}$$

All these equations were estimated based on marginal effects estimator which presents the degree of change of the factors as shown in equation (3)

$$\frac{\Delta y}{\Delta x_i} = \alpha_i \vartheta(\alpha_1 + \alpha_n) \quad (3)$$

Additionally, for the effects on the household livelihood, the robust ordinary least square model was used to estimate the relationship and extent to which water accessibility and sanitation related diseases affect household livelihood. Therefore, a multiple linear regression model which is an extended model with multiple parameters (see Table 1) under the study is given as;

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \dots + \beta_n X_n + \varepsilon \quad (4)$$

Whereby Y stands as the household livelihood (income), while β_0 is the intercept term, and $\beta_1, \dots, \beta_n$ are the coefficients for the variables affecting household livelihood (income), on the other hand, $X_1, \dots, X_n$ are set of the independent variables (see Table 1) or factors affecting livelihood, and ε is the error term.

Table 1

Description of Variables

Variable name	Operational definition	Expected relationship
Water accessibility	Household report having access to water (gets water less than 500meters of walk) (have access to water=1, have no access to water=0)	
Sex	Dummy, 1=female, 0 otherwise	+/-
Household size	Number of people with a household	+
Residence	Dummy, 1= rural, 0 otherwise	+
Time	Time spent looking for water in minutes	-
Household income	Total amount of expenditure per month in Tanzanian shillings (proxy variable for income)	+
Sex	Dummy, 1=female, 0 otherwise	+/-
Household size	Number of people with a household	+
Residence	Dummy, 1= rural, 0 otherwise	+
Time	Time spent looking for water in minutes	+
Household income	Total amount of expenditure per month in Tanzanian shillings (proxy variable for income)	-
Water Cost	Amount of Tanzanian shillings paid for 20 liters of water	+
Livelihood	Total household consumption per month in Tanzania shillings	
Sanitation related disease	Household report of diarrhea sickness (dummy, presence of sanitation-related disease(diarrhea)=1, 0 otherwise)	+

IV. FINDINGS & DISCUSSIONS

4.1 Findings

Results in Table 2 show that 6675 households, equivalent to 70.54% are residing in rural areas while 2788 (29.46%) are residing in urban areas. These results are similar to those of Kitole and Sesabo (2024). On the other hand, results show that majority of population are females who forms 62.73% of entire population while males are just 37.27%. Moreover, findings show that large population (79.68%) are having primary education, while those with no formal education background are just 12.83%, secondary education (4.87%). Moreover, those with college and university education were just 1.98% and 0.65% respectively.

Moreover, results based on the marital status in Table 2 show that 4.46% of households are divorced, 4.36% of households are just living together without formal or traditional marriages, 56.60% are living in the monogamous marriage, 5.36% have never married, 11.20% are in polygamous marriage, 5.05% are separated, and 12.99% are widowed. On the other hand, on the sanitation status across households result have shown that 7487 equivalent to 84.76% are living under un-improved sanitation status while only 15.24% are living under the improved sanitation status indicating that most households in Tanzania are in poor sanitation statuses, and these results are supported with the findings of Kitole and Sesabo (2022) who showed that most households are living in poor sanitation in Tanzania.

Table 2
Household Characteristics

Variables	Attributes	Frequency	Percent	Cum.
Residence	Rural	6675	70.54	70.54
	Urban	2788	29.46	100.00
Total		9463	100.00	
Sex	Female	5936	62.73	72.73
	Male	3527	37.27	100.00
Total		9463	100.00	Total
Education level	Primary education	5924	79.68	79.68
	No formal education	954	12.83	92.51
	Secondary education	362	4.87	97.38
	Tertiary/college education	147	1.98	99.35
	University education	48	0.65	100.00
Total		7435	100.00	
Marital status	Divorced	422	4.46	4.46
	Living Together	410	4.34	8.80
	Monogamous Married	5352	56.60	65.40
	Never Married	507	5.36	70.76
	Polygamous Married	1059	11.20	81.96
	Separated	478	5.05	87.01
	Widowed	1228	12.99	100.00
Total		9456	100.00	
Sanitation status	Un-improved sanitation	7487	84.76	84.76
	Improved sanitation	1346	15.24	100.00
Total		8833	100.00	
Age	Mean		47.06	
	Std. dev.		15.74	
Time to fetch water (hours)	Mean		38.93	
	Std. dev.		27.94	
Household size	Mean		5.24	
	Std. dev.		3.52	
Household income	Mean		789,700	
	Std. dev.		109,452	

Additionally, results in Table 2 show that the average age of households in Tanzania is 47 years old with the standard deviations of 15.74, moreover, average time spent by household to fetch water is 38.98 hours indicating the problem of water availability across most households and communities in Tanzania, also the standard deviation on the same variable is 27.94. On the other hand, the average household size is 5 indicating that each household at least have five members with the standard deviation of 3.52. Furthermore, results in Table 2 show that the average household income is Tanzania shillings 789,700 with the standard deviation of 109,452.

4.1.1 Determinants of Water Accessibility among Households

Results in Table 3 show that household being in urban areas increase the likelihood of accessing water compared to the rural counterpart significantly (0.149, $p < 0.01$). This implies that urban household have more chances of having reliable water sources compared to those in rural areas. Moreover, results indicate larger household size are more likely to have access to water compared to household with lower number of family members (250, $p < 0.01$). Additionally, other variables that were found to influence water accessibility positively includes university education (0.109, $p < 0.05$), employment status whereas household whose head of households are employed they were found to increases chances for their household to have access to water by 0.275 ($p < 0.01$), also, having improved sanitations was also found to influence water accessibility significantly (0.187, $p < 0.05$). Furthermore, results Table 3 show that household with higher income are more likely to have access to water compared to those with lower income significantly (0.257, $p < 0.01$).

Table 3*Determinants of water accessibility*

Variable	Simple probit			Marginal coefficients		
	Coefficient	Standard error	P-value	dy/dx	Standard error	P-value
Residence (Urban)	0.111	0.105	0.040	0.149	0.012	0.000***
Age	-0.305	0.113	0.053	-0.221	0.036	0.011**
Sex (Female)	-0.094	0.052	0.153	-0.129	0.185	0.129
Household size	0.159	0.023	0.044	0.250	0.050	0.000***
Primary education	-0.250	0.042	0.017	-0.109	0.006	0.001***
Secondary education	0.096	0.152	0.172	0.162	0.125	0.155
College education	0.264	0.259	0.162	0.148	0.150	0.217
University	0.123	0.043	0.030	0.109	0.017	0.020**
Water Cost	-0.249	0.020	0.00	-0.399	0.008	0.000***
Time spent on water	-0.253	0.317	0.274	-0.194	0.021	0.044**
Employment status	0.166	0.013	0.000	0.275	0.034	0.000***
Sanitation (Improved)	0.217	0.032	0.000	0.187	0.073	0.024**
Household income	0.143	0.029	0.000	0.257	0.012	0.000***
Constant	0.692	0.380	0.069			
Number of observations	5,149					
Pseudo R squared	0.1283					
Chi squared	915.63					

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

On the other hand, several variables in Table 3 were found to influence decline in the household likelihood of accessing water services, for instance, the amount of money used by the household to pay for water services was found to reduce water accessibility among households as results showed that an increase in the water costs reduce the likelihood of household to access water by 0.399 ($p < 0.05$). Also, similar variable with negative influence on the water accessibility were time spent to fetch water (0.101, $p < 0.05$), and age of the head of household (0.221, $p < 0.05$). Additionally, for variable that were found to be insignificant includes sex of the head of household, college education and secondary education.

4.1.2 Effects of Water Accessibility on Household Sanitation Status

Results in Table 4 show that household being in rural areas reduces the likelihood of experiencing good sanitation status compared to the urban counterpart significantly (-0.135, $p < 0.01$). Furthermore, variable showing negative relationship with the household sanitation statuses are primary education level (-0.224, $p < 0.05$), and water costs (0.407, $p < 0.01$). Therefore, an increase in the costs of the water reduces the likelihood of household to have good sanitation statuses. On the other hand, variable that have been found to have positive influence to the sanitation statuses were college education (0.146, $p < 0.05$), and employment status (0.147, $p < 0.01$).

Table 4*Impact of Water Accessibility on Household Sanitation Status*

Variable	Simple probit			Marginal coefficients		
	Coefficient	Standard error	P-value	dy/dx	Standard error	P-value
Residence (Urban)	-0.135	0.292	0.644	-0.204	0.011	0.000***
Age	0.024	0.266	0.928	0.231	0.097	0.017**
Sex (Female)	0.182	0.107	0.257	0.170	0.319	0.679
Household size	0.129	0.316	0.104	0.217	0.421	0.163
Primary education	-0.224	0.303	0.012	-0.119	0.020	0.010**
Secondary education	0.142	0.011	0.015	0.265	0.015	0.041**
College education	0.320	0.103	0.002	0.011	0.004	0.008***
University	0.146	0.052	0.076	0.301	0.101	0.016**
Water Cost	-0.407	0.044	0.017	-0.241	0.025	0.016**
Time spent on water	0.072	0.081	0.373	0.002	0.002	0.372

Employment status	0.147	0.029	0.064	0.218	0.092	0.000***
Household income	0.193	0.139	0.167	0.005	0.003	0.116
Constant	-0.239	0.035	0.042			
Number of observations	5,149					
Pseudo R squared	0.3075					
Chi squared	0.0000					

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

4.1.3 Effects of Water Accessibility and Sanitation Related Diseases on Household Livelihood (Income)

Results in Table 5 show that as household access water their livelihood is likely to improve by 0.167 ($p < 0.01$), this implies that water is an important resource for the improvement of the household livelihood. Moreover, sanitation related diseases have been found to reduce the household welfare (livelihood) by 0.649 ($p < 0.01$). Other variables that were found to influence household livelihood significantly includes household size (0.172, $p < 0.05$), secondary education (0.127, $p < 0.01$), college education (0.267, $p < 0.05$), and university education (0.329, $p < 0.01$).

Table 5

Effects of Water Accessibility, and Sanitation Related Disease on Livelihood

Total consumption	Coefficient	Standard error	t-value	P-value	[95% Confidence Interval]	
Water accessibility	0.167	0.003	7.20	0.000***	0.335	1.073
Sanitation related disease	-0.649	0.125	-6.88	0.000***	0.266	1.573
Age	0.124	0.266	0.928	0.301	0.117	0.927
Sex (Female)	0.324	0.107	0.257	0.176	0.110	0.979
Household size	0.172	0.016	2.104	0.016**	0.421	0.163
Primary education	-0.016	0.303	0.162	0.319	0.020	0.832
Secondary education	0.217	0.081	5.710	0.000***	0.015	0.748
College education	0.267	0.103	0.002	0.011**	0.204	0.975
University	0.329	0.052	6.376	0.001***	0.001	0.375
Constant	0.218	0.094	91.16	0.000	0.367	24.952
Mean dependent var		0.539	SD dependent variable			0.403
R-squared		0.749	Number of observations			9461
F-test		59.006	Prob > F			0.000
Akaike crit. (AIC)		4769	Bayesian crit. (BIC)			5431

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

4.2 Discussions

As per findings, when adult women and female children (aged below 15 years old) look for water for the household, they are more likely to access it than other family members. The study still reveals the role of women in fetching water as previously found by other researchers in the matter (Nyanza et al. 2018; Asoba et al. 2021). In society, access to water has been gender-based, where women and female children play a significant role in the family's search for water. In this study, water cost was captured in terms of Tanzanian shillings paid per 20 liters of water. It was found that increased water costs decrease the probability for the household's access to water. The same result was found by Kitole et al. (2022), whereby household income is usually spent for many households daily needs, including treatments for emerging diseases (communicable and non-communicable diseases). Therefore, it is not surprising that access to water is lower as water costs increase, and households also spend money on other goods and services.

The findings found that the more time spent fetching water, the less likely the household accesses water. This is due to long travel searching for water as the result of sources for water being far away from people's residence, which consumes a lot of time and thus hardly access water. Similar findings were found by Cassivi et al. (2018), the study found that the time spent fetching water can significantly impact access to water for households, especially for women and girls. It was also found that when the collection time exceeds 30 minutes, it can substantially waste time and effort, affecting many people.

The study found that an increase in a number of household members, the less likely the household to access water. As already described according to age in this study, this was because a reasonable number of people were above 47 years old, and a reasonable number of male adults normally don't fetch water under normal circumstances. Similar finding was found by Gaffan et al. (2022), a study found a negative association between an increase in the number of

members in a household and access to basic drinking water, implying that as the number of household members increases, the likelihood of the household accessing water decreases.

It was found from this study that for every additional increase in household income per month, the more likely the household accesses water. These results are in line with the study of Gaffan et al. (2022) who found that odds of having access to basic drinking water services increased significantly with the wealth index of the household. Moreover, results indicate that there was a positive and significant relationship between household water accessibility and wealth indexes, implying that wealth was a significant determinant of water accessibility; hence poor households had more burden for both water accessibility and poor sanitation, which are key factors causing the prevalence for the sanitation-related diseases such as cholera and diarrhoea.

On the spatial differences, the study found that households living in rural areas are less likely to access water compared to their urban counterparts. Moreover, these households were also found to have less access to improved sanitation, hence indicating that rural households are prone to low livelihood as the result of these burdens. Therefore, the rural to urban differences imply that there is a need to increase socioeconomic services delivery in rural areas in order to meet the demands of rural residents and enhance their welfare. Similarly, Asoba et al. (2021), Kitole and Utouh (2023), and Ashraf and Kumar (2022) argued that increasing investment in rural areas helps to improve the welfare of rural residents and enhance equal development opportunities and growth and hence reduce deprivation among rural residents.

On top of that, this study has established the fact that water helps to enhance household sanitation statuses, and later influence livelihood improvements through the reduction in the disease's prevalence. This contribution is important for the knowledge and policy development particularly in developing countries where households have water accessibility challenges and poor sanitation at the same time, which increases chances for the disease prevalences. Therefore, this study has benchmarked that to improve welfare of the people there should be deliberate investment in water services by making the service closer to households' residents. Similar observations were found in the study of Zeeshan et al. (2019) which suggested that improvement in sanitation had a positive relationship with overall household welfare and reduction in the household burden as the result of diseases outbreak due to both poor sanitation and water accessibility.

V. CONCLUSIONS & RECOMMENDATIONS

5.1 Conclusion

The study has shown that one who collects water and total households' income per month had a positive significant effect on water accessibility, on the other hand sex, cost for water, time spent in fetching water, household size and place of residence were found to have a negative impact on water accessibility. From this study it was also found that sex had a significant impact on sanitation-related diseases. The findings also found that water accessibility and sanitation-related diseases had a negative impact on households' livelihood.

5.2 Recommendations

Practically, this study informs public and policy makers as an intervention to empower women in the community, access to water should be considered because it has also been found that women are the very concerned group when it comes to the issue of looking after water in the family. Reducing distance for women in searching for water would allow them to participate fully in other development activities, thus raising their income. On the other hand, increasing access to water would improve women welfare by reducing their vulnerability to sanitation-related diseases as they are vulnerable to the diseases as compared to men.

Moreover, the government should also improve the living conditions of people living in rural areas regarding access to water to reduce the existing urban gap. This is because people living in rural areas are less likely to have access to water as found in this study. To achieve this, the government should construct and repair the water sources in rural areas and charge a reasonable price for water to cover some maintenance costs and still be affordable to low-income earners. The cost charged will benefit the maintenance of water sources, thus leading to their sustainability.

Although the study has managed to provide the Nexus between Water Accessibility, Sanitation Related Disease and Livelihood in Tanzania, it is not exempted from common methodological and data limitations so long as the study has used the Tanzania Household Budget Survey (HBS) data (2017/2018). The data provides information on access to water and sanitation and does not provide detailed information on the quality of water and sanitation facilities, which are important for assessing the impact on health and livelihoods (Benjamin et al., 2022). Additionally, the HBS is designed mainly to evaluate households' financial and living conditions rather than specifically to assess the nexus

between water accessibility, sanitation-related disease, and livelihood. Future studies need to assess data sources and evaluate their quality and biases; doing this will assist in improving the reliability and validity of research outcomes.

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