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Influence of Rural Community Water Supply Schemes on Health in Rachuonyo North Sub-County, Homa Bay County, Kenya

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Abstract:
Clean water is a necessity for all humans. However, there are more than 1 billion people in the developing world that are unable to access, on a daily basis, a reliable source of clean, freshwater. This problem is particularly acute in rural areas and small communities, where water collection may require hours of physical effort, water sources may be contaminated, or must be purchased at rates that are too expensive to allow for proper health and hygiene. The impact of inadequate water and sanitation services falls primarily on the poor. Owing to dearth of studies in Kenya on how to tackle this, the purpose of the study is to establish the influence of rural community water supply schemes on health services in Rachuonyo North Sub-County. The study was guided by descriptive survey research design on a target population of 64045beneficiaries of rural water supply schemes within Rachuonyo North District.A smple of 400 was used for the study. Owners or leaders of such supply schemes, and community leaders (chiefs) were also targeted as key informants. Questionnaires, focused group discussion and key informant interviews were the data collection tools. The data was analyzed using descriptive statistics (frequency, percentages, mean and standard deviation), content analysis on qualitative data to establish the influence of rural water supply schemes on health.. The findings established that on health, water supply schemes have improved hygiene, reduced water related illnesses, and improved quality and quantity of water access.

Keywords: Rural community water supply schemes, health, rachunyo north sub-county

1. Introduction

Lack of safe drinking water is still a challenge that needs to be addressed in the twenty first century. Unless this is addressed, the desire to realize the millennium target of universal access to safe water will remain an elusive dream. The amount of fresh water on the continent is constant and yet the demand for this water is continuously growing leading to the inevitably increasing scarcity of clean drinking water worldwide (Barizlay,1999). An estimated world population of 884 million still do not have access to safe water, and almost all of them are from developing countries (UNICEF/WHO, 2010). The most affected out of this proportion, are people living in rural areas which has in recent time shown rapid population growth due to urbanization (United Nation Population Division, 2000). The problem of safe water access does not exclude the industrialized world, competing interests of agriculture, industries and households together with the growing human population continues to place increasing demands on water resources and are having various consequences on water quality.

Inadequate accesses to a safe water supply and a lack of water infrastructure have been shown to exacerbate nutritional deficiencies (Cairncross and Cliff, 1987) and dramatically affect human health. Water supply coverage in Africa stands at 60% while that of sanitation is at 31% (WHO/UNICEF, 2010). In spite of decade of government and donor supported investments in water supply and sanitation, public utilities in many African countries have been unable to fully meet the demand for water and sanitation services (Asingo, 2005). While most countries are committed to increasing access to safe water, there is little consensus on how to actually achieve this goal (Birdsal and Nellis, 2002). In general, international consensus exists that private sector has a role to play in the provision of urban water and sanitation services (Njiru, 2004). By estimating the proportion of the general population accessible to piped water at home, the estimates also provide estimates of the number of people without such access potentially exposed to water related health risks.

Access to water in Kenya still remains a bigger challenge. Kenyan Census Report of 2009 estimated that 38.4% access to piped water is realized in urban population while in the rural setup only 13.4% have access to piped water which is considered the safest. Access to water in Kenya is hindered by chronic cycles of drought increasing in severity and frequency, rapid population growth, climate change, upland water destruction, and inequitable distribution of water resources.

In 2003, driven by need to introduce comprehensive reform in water sector, the Government established Water Services Regulatory Board (WASREB), a non-commercial state corporation. WASREB was mandated with overseeing the implementation of strategies and policies concerning and incidental to the provision of water and sewerage services. Of essence is ensuring that consumers access adequate, efficient, affordable and sustainable water services. Under the regulatory patronage of WASREB are eight (8) Water Services Boards (WSBs): Rift Valley Water Services Board, Athi Water Services Board, Tana Water Services Board, Tanathi Water Services Board, Coastal Water Services Board, Lake Victoria South Water Services Board, Lake Victoria North Water Services Board and Northern Water Services Board (WASREB, 2012). These WSBs are mandated to ensure efficient and economic provision of Water and Sanitation Services in their areas of jurisdiction.

Lake Victoria South Water Services Board (LVSWSB) jurisdiction covers Rachuonyo North sub-County and other 47 Counties within the Counties of Bomet, Kisumu, Homa Bay, Migori, Siaya, Kisii, Nyamira, Kericho, Narok and Nandi. LVSWSB contracts agents or WSPs to provide water and sanitation on its behalf. By 2012, LVSWSB had contracted 9 and 54 urban and rural service providers respectively. Safe water coverage stood at 53% in urban and 28% in rural areas whereas sanitation access is 47% in urban and 13% in rural areas (LVSWSB Strategic Plan, 2013-17).

From the foregoing, this low level of access exposes residents to other alternative sources whose quality may be questionable. Rachuonyo North Sub-County has been suffering serious water shortages since 1980s (JICA, 1998). There has been a steady increase in population since then with no expansion in water supply capacity. As a result, the water deficit has continued to grow. The government, NGOs and other relevant stakeholders have responded to this by initiating water supply schemes such as boreholes, water kiosks, protected springs, individual household connections within the Sub-County. Even though this has been done, much is yet to be achieved in terms of economic transformation of the local residents. Poverty is still rampant in most parts of the region especially in remote areas. This is what has informed the researcher to anchor this study in Rachuonyo North Sub-County to establish the influence of water supply schemes on health and education.

1.2. Statement of the Problem
Despite significant investments made in the water sector during recent decades by governments, non-governmental organizations, bilateral and multilateral agencies and the private sector, the outlook on access to safe and adequate supplies of water and environmentally sustainable sanitation remains grim. Coverage varies substantially by Sub-Counties, but well over a third of rural populations in Rachuonyo North lack access to safe water or sanitation. This is despite water being consistently identified as a basic need and a top priority by those who lack convenient or affordable access to it. This is what motivated the researcher to initiate this study in Rachuonyo North Sub-County.

1.3. Objective of the Study
In view of the above stated problems, the objective of this study was to examine the influence of rural community water supply schemes on health in Rachuonyo North Sub-County

1.4. Research Question and Hypothesis
The study sought to test the following research question and hypothesis:
What is the influence of rural water supply schemes on health.
→ H_0: There is no significant influence of the rural water supply schemes on household health in Rachuonyo North Sub-County;

2. Literature Review

2.1. Rural Water Supply Schemes
Rural Water Supply Schemes (RWSS) are commonly defined as those water supply systems that operate independently of other formal services (Schouten and Moriarty 2003,). These systems may be rural or otherwise independent of a municipal supply network or, simply, a RWSS may be a water system established where the regional water management agency does not have authority or the ability to extend infrastructure (Deverill et al. 2004; Swartz and Ralo 2004).

Some of the infrastructure features of a RWSS include boreholes, hand pumps, raw water mains, elevated tanks, roof rain-water catch tanks, small diversion dams, and gravity powered pumps (e.g., hydraulic rams) (Wagner and Lanoix 1959; Jordan 1980; Younger 2007). RWSS are also defined by a type of management and governance, which is often community based and derived from social rules and socially agreed upon modes of operation (Brooks, 2002).

Rural water supply projects differ from municipal water development, large-scale irrigation works, or hydropower development in that a RWSS project is focused primarily on the management of land and water resources for human consumption in rural areas, through the utilization of local institutions (Cairncross, 1992; Narayan 1995; Swartz and Ralo, 2004).

2.2. Rural Community Water Supply Schemes and Health
Good health is a key to poverty reduction, directly affecting the quality of life of poor people and an essential pre-requisite for sustainable increases in income. Ill health is a double burden: it reduces productive capabilities and means limited resources (time and money) have to be spent on caring for the sick. It is the most vulnerable, women and children, the extreme poor, the elderly, the malnourished, who bear the burden of ill-health the most and are the least able to cope with it. Sustainable improvements to health conditions are a key to poverty reduction, and in turn improvements to water management are a key to improving health conditions.

Each year witnesses millions of preventable deaths, and hundreds of millions of people ill from preventable diseases. Their impact on the economics of countries and the livelihoods of poor households is even more insidious. Water-associated diseases hit the poor in a disproportionate way and this burden of ill health maintains the vicious cycle where poverty leads to more ill health, and more ill health implies further impoverishment.

Water and health are intricately linked. A workable public health perspective of all water issues requires a clear definition of the nature and magnitude of the links between water and health. There are basically two types of links between water management and the incidence of ill health: water as the conveyance medium of pathogens and water providing the habitat for vectors and intermediate hosts of pathogens. To these can be added the significance of water availability in rural areas in determining food security and nutritional status (itself a key determinant of health) and, in some parts of the world, the growing significance of water-related disasters such as floods, storms and major pollution incidents resulting in injuries, deaths and the incidence of many diseases (Soussan *et al.,* 2000).

The right to safe water and adequate sanitation remains a promise unfulfilled for the world's poorest citizens. The lack of access to safe drinking water and to basic sanitation impedes economic development, thwarts progress towards gender equality and puts the health in danger. The unsustainable exploitation of natural resources is often due to insufficient or inadequate water supply and sanitation. The arguments in support of expanding the access to water supply and sanitation services and promote environmental sustainability can be expressed in terms of human values, human rights as well Socio-Economic Impacts of Water Supply and Sanitation. Providing access to safe and sufficient water and improved sanitation is the most effective way to improve health. It is also a good economic bet: investments in water and sanitation provide rates of return in excess of those found in many productive activities and are positive throughout the developing world (WHO, 2004).

Water management will play a critical role in achieving the three health-related MDGs and their associated targets. Water-borne diseases are the biggest killer of young children and improved quantities and quality of domestic water and sanitation will directly reduce child   deaths. Improved nutrition and food security, for which access to water is critical, will reduce susceptibility to a wide range of diseases and will lower both child and maternal mortality rates. Malaria is a scourge that will only be sustainably addressed through water management that removes the breeding habitats of its vectors. Similarly, water management will reduce vulnerability to a range of other diseases transmitted by aquatic vectors (www.lboro.ac.uk/well).

3. Research Method
In this study, a descriptive survey research design was used to find out the current state of the water access within the defunct Rachuonyo North Sub-County, rural community water supply schemes in existence, and their consequent effect on household livelihood.

3.1. Target Population
This study was conducted in Rachuonyo North Sub-County. The Sub-County had two divisions: West and East Karachuonyo Divisions. West Karachuonyo Division had 14 locations, while East Karachuonyo had 9 locations making a total of 23 locations. The study targeted all the 164,045 community members living and working around the water supply schemes located within Rachuonyo North Sub-County (KNBS, 2009).

3.2. Sample Size
The sample size for this study was 400 respondents selected from the total population of 164,045 community members living and working around the water supply schemes located within Rachuonyo North Sub-County. To determine the sample size from each location, proportionate stratified sampling method was used. Yamane model was used to arrive at the sample size for household participants at 0.95 confidence level.

3.3. Sampling Procedure
The study adopted stratified random sampling technique to identify the water supply schemes where research was conducted. This is based on the target population being heterogeneous (consisting of different administrative locations, all of which must be represented in the sample). Stratified random sampling technique ensured that RWSS within all the locations are represented.

The sample size from each administrative location was determined by proportionate stratified sampling method at a ratio of 400/164045 (00244). Within each identified household, one member particularly involved in fending for others was included for requisite information.

Rachuonyo North Sub-County has a total of 23 locations in the 2 Divisions, East and West Karachuonyo Divisions. The targeted population was grouped or stratified into the 23 locations. From each stratum, proportionate sample was selected from the location consisting of three officials (The Chairperson, the Secretary and the Treasurer) of the RWSS and the beneficiaries of the water supply schemes. Simple random sampling technique was used to achieve this.

3.4. Research Instruments
The study used primary data sources: questionnaires, key informant interviews and focused group discussions. These instruments aided in the collection of both qualitative and quantitative data. Qualitative data was obtained through open-ended questions contained in the instruments. This provided the researcher with necessary background and in-depth information about community water supply

schemes and how they affect poverty alleviation among the populace. Quantitative data was obtained through close-ended questions contained in the questionnaires.

3.4.1. Questionnaire
Semi-structured questionnaires were administered on community members working and benefitting from the water supply schemes. The items on the questionnaire were developed on the basis of the objective of the study. Section A of the questionnaire captured questions concerning personal data of the respondent; this section provided elaborate information on demographic characteristics of respondents. Section B contained information on community water supply schemes and health.

3.4.2. Key Informant Interview
Key informant interviews were administered on community leaders, location chiefs and leaders of the water supply schemes. Key informant interviews are qualitative in-depth interviews with people who know what is going on in the community (Holliday, 2007). Its purpose was to collect information from a wide range of people like including community leaders, professionals and informed residents who had first hand knowledge about the community and the phenomenon under study. It was used by the study as it provided the researcher with detailed, qualitative information about leaders' impressions, experiences and opinions on the subject matter.

3.4.3. Focus Group Discussions (FDGs)
Qualitative data was collected from the FDGs. Two focus groups composed of 20 individuals consisting of beneficiaries of RWSS were conducted based on the results from the questionnaires so as to get more clarification of the findings obtained. This is a form of qualitative research whereby a group of individuals are probed about their beliefs, opinions, perceptions, and attitudes towards an idea or phenomenon (Nachmais and Nachmais, 2008). It was a good way to gather information from group of similar experiences or background (beneficiaries of community water supply schemes) as they engaged in a lively and natural discussion guided by a moderator. By allowing participants to agree or disagree amongst themselves, it gives insight into how they perceive an issue, concept, phenomenon, a relationship among variables, thus, fostering an in-depth finding on research objects (Stewart, Shamdasani and Rook, 2007).

3.5. Data Collection Procedure
Due to the huge coverage area for the research, the researcher recruited four research assistants who assisted in data collection. The researcher trained these four research assistants on how to administer the instruments. The researcher and the four research assistants then administered the questionnaires. Questionnaires were collected immediately after being filled by respondents. To ensure a high response rate, the researcher explained the purpose of the study to the respondents, made the questions precise and concise, clarified difficult questions and assured participants of total confidentiality. Before data entry, questionnaires were checked for completeness and data cleaning done to enhance data quality

3.6. Data Analysis Techniques
The research employed qualitative and quantitative techniques of data analysis. The data analysis technique involved the use of descriptive statistics which included frequency tables and cross tabulation. Statistical Package for Social Scientists (SPSS version 17) aided in the analysis of quantitative data.
Upon successful data collection, the research sorted and coded the data for entry into SPSS. Quantitative analysis was carried out on close-ended questions. This involved the use of descriptive statistics: frequencies, percentages and measures of central tendency and dispersion, mean and standard deviation respectively. Thematic content analysis was used in the analysis of open-ended questions.
A Null Hypothesis was used to consider the objective. (H_0): There is no significant influence of the rural water supply schemes on household health in Rachuonyo North Sub-County.

4. Results and Analysis

4.1. Response Rate
The study targeted 400 respondents within Rachuonyo North Sub-County. By the end of instrument administration process, 352 respondents out of the 400 responded, adding up to a cumulative response rate of 88%. The responses were thus adequate as they conformed to the prescribed level. Mugenda and Mugenda (2003) states that for representative generalization, a response rate of 50% is adequate for analysis and reporting, 60% is good and a response rate of 70% and over is excellent.

4.2. Rural Community Water Supply Schemes and Health
Water and its accessibility have a direct influence on household livelihood. Based on this premise, the objective of this study sought to analyze the influence of rural water supply schemes on household health among beneficiaries of Rachuonyo North Sub-County. The various indicators used to measure this objective included source of water, protection of the source from contamination, reason for using water from the source, treatment of water, distance from water point, whether the water source is good for health, mode of transporting water, water storage, amount of water fetched per day, rural water supply scheme and sanitation among.

4.3. Source of Water
The study sought to establish the residents' predominant water sources to determine extent of their exposures to possible aquatic pathogens. Divergent responses were obtained as summarized as presented in Table 1.

Source	Frequency	Percentage
Water points/Kiosks	56	15.9
Boreholes/Shallow Wells	127	36.1
Water Pans	41	11.6
Spring	5	1.4
River/Streams	81	23.0
Dams	0	0.0
Roof Catchment/Rain Water	21	6.0
Tap Water	21	6.0
Total	**352**	**100.0**

Table 1: Source of Water
Source: Rachuonyo North Sub-County (2016)

Table 1 illustrates that 127 (36.1%) of the respondents collected water for domestic use from boreholes or shallow wells, 81 (23.0%) from river/streams, 56 (15.9%) from water points/kiosks, 41 (11.6%) from water pans, 21 (6.0%) from roof catchment or rainwater and a similar percentage from tap water sources. Further, it was found that only water from some boreholes and kiosks was under formal surveillance and treatment. This implied that majority of the residents consumed non-treated water, hence a possibly higher level of exposure to water-borne diseases. According to Curtis, Cairncross and Yonli (2000), different sources of water are prone to various contamination possibilities. Water sources which are unprotected have a higher propensity to contamination than those protected and regularly put under surveillance.

4.3.1. Source Contamination
The extent to which water sources at Rachuonyo North Sub-County were contaminated was analyzed and findings were as presented in Table 2.

Water Contamination	Number of Responses	Percentage (%)
Water Contaminated	196	56
Water Not Contaminated	156	44
Total	**352**	**100**

Table 2: Water Source Contamination
Source: Rachuonyo North Sub-County (2016)

Table 2 shows that 196 (56%) of the water sources were contaminated to extent that users were overtly alarmed. Based on the users' judgment, the other 156 (44%) water sources were free from contamination. Further to this, the study found out that despite the riskiness poised from contaminated sources the inhabitants did not relent fetching water due to limited alternative sources. According to Bauman (2005), the presence of contaminants in water could lead to adverse health effects, including gastrointestinal illness, reproductive problems, and neurological disorders. Infants, young children, pregnant women, the elderly, and people whose immune systems are compromised because of AIDS, chemotherapy, or transplant medications, may be especially susceptible to illness from some contaminants. Therefore, majority of Rachuonyo residents were prone to poor health and dejected livelihood as a result of undeterred consumption of contaminated water.

4.3.2. Water Treatment Methods
Treating raw water is meant to improve its quality and hence protect households from disease-causing pathogenic exposures. The various methods Rachuonyo North Sub-County residents applied to treat water from available schemes were identified and analyzed as presented in Table 3.

Treatment Method	Frequency	Percentage
Boiling	176	50.0
Use of Chemical	82	23.3
Filtering	53	15.1
Solar Disinfection	41	11.6
Total	**352**	**100.0**

Table 3: Treatment of Water
Source: Rachuonyo North Sub-County (2016)

As illustrated in Table 3, 176 (50.0%) of the respondents indicated that they treated water by boiling, 82 (23.3%) indicated that they used water treatment chemicals, 53 (15.1%) indicated preference for filtration while a paltry 41 (11.6%) used solar disinfection. According to WHO (2009), household water treatment interventions may play an important role in protecting public health where existing water sources including those delivered via a piped network or other improved sources are untreated. However, this loads an extra cost on households. Based on this, therefore, water fetched from existing sources at Rachuonyo was not fully in usable form and needed additional household inputs to meet expected standards.

4.3.3. Distance from Water Points
The DFID (2002) report acknowledges that availability of a good quality water sources close to homes has numerous benefits especially in terms of human health. Based on this, respondents were asked to indicate how far their preferred water sources were from their houses. The findings are presented in Table 4.

Distance	Frequency	Percentage
Less than 100 meters	41	11.6
100m - 1km	191	54.3
1 - 5km	79	22.4
Over 5 Km	41	11.6
Total	**352**	**100.0**

Table 4: Distance from the Water Point
Source: Rachuonyo North Sub-County (2016)

Table 4 indicates that 191 (54.3%) of the respondents' houses were between 100 meters and 1 km away from the water points which they regularly used, while the same were 1 – 5km apart for 79 (22.4%) of homes. In addition, 41 (11.6%) of the residents had water sources within a distance of 100 meters while a similar proportion had nearest water sources over 5kms away. Therefore, about a half of the population at Rachuonyo North Sub-County spent several hours a day collecting water from distant sources which would again expose them to more health compromises. According to UN-Water (2007), distant sources of water increase the likelihood of water contamination.

4.3.4. Mode of Transporting Water
Study respondents were asked on how they transported water from their respective sources to their homes. The results were as presented in Table 5.

Mode	Frequency	Percentage
Physically Carrying Water	205	58.2
Use of Donkey	46	13.1
Use of Bicycles/Motorcycles	69	19.6
Within Homestead or Pipe Connection	32	9.1
Total	**352**	**100.0**

Table 5: Mode of Transporting Water
Source: Rachuonyo North Sub-County (2016)

Table 5 shows that majority of the residents 205 (58.2%) physically carried water on their backs or heads to their homesteads, 46 (13.1%) used donkeys, 69 (19.6%) used bicycles, while 32 (9.1%) had pipe connections to the water sources. According to the UNDP (2006) report, mode of water transport is easily one of the leading contaminators despite protection of the sources. Moreover, Peterson and Gould (1999) attest that water pumping is the safest mode of water transport as it is subjected to less contamination. In view of this, therefore, majority of Rachuonyo North residents faced the heightened possibility of contaminating water during transportation.

4.3.5. Water Storage
Other than transportation of water, its storage is another possible avenue for contamination. In this respect, respondents were asked to state how they stored water they got from the sources. The realized responses were as presented in Table 6.

Storage	Frequency	Percentage
Plastic Jericans	177	50.3
Metallic Tanks	79	22.4
Plastic Tanks	91	25.9
Cemented underground/Surface Tank	5	1.4
Total	**352**	**100.0**

Table 6: Water Storage
Source: Rachuonyo North Sub-County (2016)

Table 6 shows that 177 (50.3%) of the study participants stored water in plastic jerricans, 91 (25.9%) in plastic tanks, 79 (22.4%) in metallic tanks, and only 5 (1.4%) stored water in cemented underground/surface tank. This depicted that majority of the residents stored water for future use in plastic jerricans and metallic or plastic tanks. Metallic reservoirs are health risks as metallic elements (heavy metals like lead) could easily get into water over time and consumed together. In a study by Unicef/Who (2010) on impact of water accessibility on household welfare, health challenges were noticeable thanks to poor storage systems which undeterred further contamination.

4.3.6. Volume of Water
While water quality is an important indicator to household livelihood, its quantity is equally significant. Through this study, the amounts of water accessed per household in a day at Rachuonyo North Sub-County were obtained and analyzed as shown in Table 7.

	Frequency	Percentage
Below 40 Litres	20	5.7
41-100 Litres	200	57.5
100-200 Litres	100	28.7
Above 200 Litres	28	8.0
Total	**348**	**100.0**

Table 7: Water Residents Fetched per Day
Source: Rachuonyo North Sub-County (2016)

Table 7 shows that 200 (57.5%) of the respondents fetched between 41 to 100 litres of water per day, 100 (28.7%) fetched 100-200 litres per day, 28 (8%) fetched above 200 litres per day and 20 (5.7%) fetched below 40 litres per day. With an average household size of six persons and recommended 20 litres of water per person per day (UN-Water, 2007), the findings implied that majority of households received water less than anticipated quantities.

4.3.7. Treating Health-Related Illnesses
Still under health, the study sought to find out how much residents of the Sub-County spent annually in treating water related illness. Findings were ascertained as shown in Table 8.

Amount	Frequency	Percentage
Less than Ksh1000	69	19.6
Ksh1000-2000	163	46.3
Ksh2001-3000	103	29.3
Ksh3001-4000	17	4.8
Ksh4001-5000	0	0.0
Total	**352**	**100.0**

Table 8: Annual Expenditure on Water Related Illnesses
Source: Rachuonyo North Sub-County (2016)

Table 8 shows that 163 (46.3%) of the households spent Ksh1000-2000 while 103 (29.3%) spent Ksh2001-3000. At the lower levels, 69 (19.6%) spent less than Ksh1000, and 17 (4.8%) spent Ksh3001-4000. Based on these, therefore, households lost substantial amounts of money treating ailments resulting from water-borne conditions thus diminishing their economic stability. These findings matched the WHO (2009) report which indicated that majority of the poor households in the Sub-Saharan African spent over 35% of their meagre income on treating water related illnesses, which would have been mitigated if proper water management practices were embraced.

4.3.8. Testing Hypothesis
Using relevant indicators on a 5-point Likert Scale, respondents were asked to rank extent to which rural water supply schemes in the Sub-County were significant to the community with regard to health. The observations were used to test null hypothesis (H_0) as stated hereunder and presented in Table 9:

H_0: Rural water supply schemes have no significant influence on the health status of beneficiaries in Rachuonyo North Sub-County.

Test Indicators	Mean Score	Std Dev	Sample Test t-values	p-Values
Better hygiene (hand washing, etc.)	3.93	0.710	3.697	0.000
Reduced ingestion of pathogens in drinking water and food	4.11	0.689	2.259	0.025
Reduced number of pathogens in the environment	3.94	0.781	2.943	0.017
Improved the quality and quantity of water	4.28	0.653	3.876	0.023
Provided means of safe excreta/waste disposal	3.04	0.791	3.120	0.008
Reduced morbidity and mortality	3.93	0.702	2.337	0.010
Increased water intake/usage to optimal levels	3.82	0.752	3.697	0.006

Table 9: Rural Water Supply Schemes and Health
Source: Rachuonyo North Sub-County (2016)

Table 9 shows that at a higher level, rural water supply schemes improved the quality and quantity of water (mean score of 4.28) and reduced ingestion of pathogens in drinking water and food (mean mean of 4.11). Moreover, the schemes contributed in reducing number of pathogens in the environment (mean score of 3.94), reducing reduced morbidity and mortality (mean score of 3.93), led to better hygiene through hand washing (mean score of 3.93), and increased residents' water intake/usage to optimal levels (mean score of 3.82). At the moderate level, the existing rural water supply schemes provided means for safe waste disposal (mean score of 3.04). Further to these above average scores, all the indicators had associated t-values greater than 2 and p-values less that 0.05 and this led to rejection of the null hypothesis that "rural water supply schemes have no significant influence on health". This implies that development of rural water supply schemes significantly influences household livelihood of the beneficiary communities.

4.4. Summary of Findings
The study established that majority (nearly three quartiles) of the households sampled that earned below Ksh10,000; get water from borehole/shallow well and rivers/streams, most of the water sources are protected from contamination though significant portion are not protected from such contamination. Cost and distance of the water point was the main decision factor in residents' water consumption pattern. Water treatment of households involved boiling water or using chemicals, and distance to water source was 100m to 5km for most households and they transported water to the homestead by physically carrying the same.
On rural community water supply schemes and health, the findings show that majority of the residents stored water in plastic jerrycan and metallic or plastic tanks which was a health risk. Improved access to water within the Sub-County had led to improved sanitation to great extent. Majority of the residents used clean and chlorinated water. Majority of households in Rachuonyo North Sub-County spent between Ksh1000-3000 on water related illness which had reduced considerably owing to water supply schemes. Additionally, rural water supply schemes within the sub-county greatly led to improvement of the quality and quantity of water, reduced ingestion of pathogens in drinking water and food, reduced number of pathogens in the environment, better personal hygiene such as hand and cloth washing, and reduced morbidity and mortality. Regression analysis shows that rural water supply schemes had significantly ($p = 0.002$) improved health within the Sub-County.

5. Conclusions
Based on the summarized findings above, the study concludes that RWSS have improved health within Rachuonyo North Sub-County thus leading to improved household livelihood. Unlike other sources, rural water supply schemes have proper management and good sanitary standards are kept and water purified hence water is clean and safe for use and drinking. The supply schemes ensured adequate supply of water within the Sub-County and in effect promoting personal hygiene. Reduced expenditure on health increased household disposable income. Good health also enabled economic productivity of households, thus, enhanced income generation.
Owing to water-health relationship, it is recommended that responsible Government agencies and other partners in health seek to strengthen their advocacy campaigns and sensitizations on water resource management and consumption of safe water to mitigate incidences of water-borne diseases. This is highly recommended especially in vulnerable areas such as the lower Counties of Nyanza and the arid and semi-arid North Eastern parts of Kenya where water access is a problem. Further than disease management, the water schemes will have an associated positive effect on poverty alleviation and hence enhancement of household livelihood.

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