Practical Paper

Water, sanitation and hygiene coverage and practices of a semi-arid county in the Eastern Region of Kenya

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ABSTRACT

Despite substantial progress in sanitation and hygiene in Kenya, its semi-arid regions still experience poor environmental conditions. Kitui County, a semi-arid region, is characterized by water supply shortages, poor sanitation and poor hygiene coverage. This study covers water, sanitation and hygiene coverage and practices in two subcounties of Kitui County. A cross-sectional survey using mixed methods of data collection was adopted. Seven hundred and fifty-seven households were included and household heads were interviewed. Quantitative data were analyzed using descriptive statistics. Five focused group discussions and key informant interviews were conducted and data analyzed thematically. These revealed that a majority of people obtain their water from rivers (39.9%), with 57.4% walking more than 2 km to water sources. Only 11.9% of all water sources were available throughout the year. A total of 47.4% of people use 13.3 liters/capita/day with an average cost of Ksh. 35 per 20 liter jerry can, which was reported as costly. A total of 43.6% of people felt that the water they collected was not enough to meet their requirements. Filtering was the most common form of water purification, with a majority of people perceiving clear water as safe for drinking. Latrine coverage stood at 56.4% and open defecation at 8.5%. Access to safe and adequate water supply, hygiene and sanitation services to the community continues to be poor and hence WASH interventions need to be scaled up for meeting recommended national standards.

Key words | hygiene, sanitation, semi-arid, water

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HIGHLIGHTS

- The manuscript highlights water hygiene and sanitation issues of a semi-arid area.
- Key search terms: Water, hygiene, sanitation, semi-arid.

INTRODUCTION

In recent years, water and sanitation in Sub-Saharan Africa (SSA) has become a major problem and is turning precarious with each passing day (Wanczeck *et al.* 2017). A large number of people in SSA lack access to clean water compared with those anywhere in the world (Rodriguez 2019). The current sustainable development goal 6 aims to improve sanitation and access to clean drinking water through increased investment in the management of fresh water ecosystem and sanitation facilities in developing countries and in SSA among others (United Nations 2015). Access to improved sanitation infrastructure has seen slow growth; for example, access increased from 27% in 1990 to only 31% in 2008, with worse outcomes in arid and semi-arid lands (ASALs; United Nations Organization 2008). This

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slow progress is a serious cause for concern. In a sample of 21 sub-Saharan countries, only 16% of the poorest quintile was found to have access to improved sanitation, compared with 80% in the richest quintile. This divide is set to widen (United Nations Organization 2008). Scarcity of financial resources, a lack of political commitment, socio-cultural inadequacy and adverse environmental events in ASALs are just a few barriers that threaten progress in the field of sanitation and hygiene (World Health Organization; UN-Water 2014).

Kitui County, located in Eastern Kenya, is semi-arid and is adversely affected by recurring droughts that have diminished water supply and rendered many rivers seasonal. These have resulted in inadequate and unclean water (County Government of Kitui 2014). The main source of water in this county is the rivers that flow during the short-lived rainy season and dry up during the dry season, making access to drinking water extremely difficult as well as providing inadequate supply of water for both agricultural and domestic use (Munyui 2015). According to the 2019 Census, the majority of the population in Kitui County access their water from streams/river waters (42.3%), boreholes (13.2%), public taps (9.3%), protected wells (6.3%), unprotected wells (6.2%), water vendors (5.9%) and dams (5.5%) (KNBS 2019). Treated water supply is available only to the residents of Kitui town and Mwingi town and to those who receive water through the Masinga pipeline. Distances to water sources are long, ranging between 4 and 7 km (County Government of Kitui 2018). Latrine coverage in the county is about 55% (County Government of Kitui 2018). Waste disposal is a major problem, with the majority (64.4%) disposing their household waste in farm gardens (County Government of Kitui 2014). The Kitui County Integrated Development Plan 2018–2022 lists diarrhea as one of the major causes of morbidity (County Government of Kitui 2018). This paper highlights the results of a baseline survey that sought to: (1) determine the water, sanitation and hygiene coverage density among household heads in two selected subcounties within Kitui County and (2) assess water accessibility using different parameters including sources, distances, quality, quantity and the potential for increased water production among household heads in two selected subcounties within the county.

METHODOLOGY

Site

The survey was carried out in August 2018 in Kitui West and Mutitu subcounties of Kitui County. The choice of the study areas was purposively guided by the fact that the two subcounties were targeted for the implementation of a water sanitation and hygiene program by Amref Health Africa. The county and specifically the selected subcounties face serious water scarcity challenges. Recurring droughts have diminished water supply, rendering many rivers seasonal and drying them up completely. Large-scale deforestation has made the problem worse by severely reducing water catchment capacity.

Design and sample size

The survey employed a cross-sectional survey targeting household heads within households in the two selected subcounties as respondents. With the understanding of the total beneficiaries and geographical activity coverage points for the project, a *z*-statistic of 1.96 was used (the 95% level of confidence), a sample design effect was set at 2.0 with an attrition rate of 10%; the proportion of the total population accounted for by the target population was derived from a rule of thumb of 0.03 for each year of age that the target population represents (over 18); the average household size (number of persons per household) was set at 5.0 from the Kenya National Census (2009), while 0.03 was used as the margin of error giving the total number of households required as approximately 757. The survey's primary sampling units (PSUs) were communities from the target subcounties, while the households were the secondary sampling units (SSUs). The sampling frame consisted of a list of all villages and households within the identified project area. From the constructed sampling frame, simple random sampling procedures were used to select the study sample.

A multistage sampling methodology was adopted in the evaluation. The first stage was the selection of PSUs which were actually the villages. Out of these PSUs, SSUs (the households) were selected. The general principle that was to be applied in the probability sampling was to show the greatest diversity. To accomplish this, teams were advised

to have many clusters but sample the same number of households in each of the selected clusters/villages.

Data collection methods

Both qualitative and quantitative data were collected. Quantitative data collection utilized household questionnaire administered to household heads of the sampled household at the time of the survey. The household questionnaire covered issues related to the following: household identification and consent; respondent demographics; and household information water access as well as sanitation and hygiene coverage and practices. Data were collected electronically using smart phones in order to facilitate efficient and clean data entry and linking of data from each survey tool to the households' demographics. The programming was done using the Open-Data Kit (ODK) software. Data from smart phones were uploaded to a secure server based at Amref Health Africa regularly and monitored for quality assurance on a real-time basis. The designated data manager (in liaison with the team supervisors) provided technical backstopping to the survey teams throughout the data collection process in case of tablet malfunction or programming errors.

Qualitative data were collected through key informant interviews and focus group discussions. Key informants included representatives from line ministries, WASH project staff and opinion leaders such as community-based resource persons. Purposive sampling was used to identify key informants. Focus group discussions with community members including women who had the responsibility of fetching water, head of households and youth were conducted. A total of five key informant interviews and five focus group discussions, each between 8 and 12 people, were conducted. Data were collected using the key informant guides and FGD guides that examined the opinions of the respondents of KIIs and FGDs on water accessibility parameters as well as hygiene practices and interventions in the selected counties. FGD respondents were identified and mobilized through community water management committees.

Data analysis

Quantitative data were analyzed using the statistical package for social sciences (SPSS) software version 21. Data were cleaned and descriptive statistics used to determine frequencies and percentages for different variables under study. Qualitative interviews for the FGDs and KIIs were conducted in the local language, translated into English and transcribed verbatim. The transcribed texts were transferred to NVIVO 10 qualitative analysis software and analyzed. Following coding of the transcripts, a full list of themes was developed and the themes were categorized within a hierarchical framework of main and sub-themes. The thematic framework was systematically applied to all of the interview transcripts. Patterns and associations of the themes were identified and compared and contrasted within and between the different groups of respondents to enhance triangulation of data.

Ethical approval

Ethical and scientific approval was obtained from the Amref Health Africa Ethics and Scientific Review Committee in Kenya.

RESULTS

Participant sociodemographic characteristics

Almost half (47.3%) of the households were headed by women. One third of the respondents (34.3%) were aged between 41 and 50 years. The least age category was 18–24 years, with the percentage being 5.8. The average number of household members was 10. Sale of livestock products (eggs and milk) was reported as the main source of household income at 44.8%, followed by small-scale trading (16.2%). It was found that a total of 35.7% of people had completed their education up to the primary level, but only 4.3% of them had completed their tertiary education.

Main sources of drinking water

Most respondents obtain their water from seasonal rivers (39.9%), followed by boreholes (13.9%), private piped connections (11.9%), water kiosks (10.9%), community protected wells (10.4%) and rainfall/own sources (10.1%). According to the majority of the respondents who were

household heads (44.5%), the water sources were accessible to women, and this is noteworthy. A woman discussant from Zombe location explains, '…… everyone here can access water from the different sources, but the problem is the distance, especially for those of us in this village who have to go to the river early in the morning. Most of the times we don't feel safe as we have to wake up early in the morning, but we have no choice'.

Quantity of water consumption for households

A total of 47.4% of people use 4 jerry cans of 20 liters of water each (80 liters) per day, which is equivalent to 13.3 liters/capita/day. A total of 43.6% of the respondents stated that the water collected was not enough to meet their daily requirements for drinking and other household chores such as washing, bathing and cooking.

Time and distance to water sources

The study estimated the distance covered to water sources and found that about 57.4% of people walk more than 2 km to the water sources, while only 24.2% access water sources less than 2 km from their homes. Regarding the time taken to access water sources, 30.1% of people reported 30 min or less, 27.2% took between 31 and 60 min, while 42.7% reported taking more than 60 min to fetch water. Women and girls (67.4%) in the target community bear the burden of fetching water.

Cost of water consumed in households

Among those who access piped water and water from vendors, about 46.5% paid between KES 10 and 50 for a 20 liter jerry can of water. Water from rivers came free of cost, obviously. When asked for their opinion on the cost of water, 42.6% of respondents said that it was expensive, while 39.4% thought it was fair. Only 12% thought it was cheap.

Water quality and water treatment methods

Filtering was the most popular method of water purification, with the percentage being 48.1, boiling percentage stood at 25, treating water with chemicals 17.2%. A total of 4.1% let the water to settle, while 5.6% took no action. Approximately 9.7% of participants perceived the quality of water based on its color. Colorless water is assumed to be clean and safe, and this may explain to a large extent the lack of any action on the part of some.

Seasonality of water sources

Most water sources were seasonal in nature and dried between 1 and 6 months. Only 11.9% of the water sources were reported to be available throughout the year. Seasonal water sources were available during the rainy season and when they dried up, residents ended up accessing piped water – usually paid for – and water from rivers.

Management of water sources

A number of water sources are communal (42.2%), especially water from rivers and boreholes with pipelines being managed by communities through water management committees with support from non-governmental organizations and the county government. Private water companies manage very few water points. Almost all (92.7%) committees managing water points had elected members, while 7.3% were managed by volunteers. The process of selection and the roles played by water management committees were corroborated by discussions with water management committee members. 'Our committee is made up of elected members. And we have rules that govern our duties as a committee. We meet once per month to deliberate on community and water management issues', explains a male FGD participant from Kyamatu.

As part of their responsibilities, he explains: 'Sensitizing the community on various aspects of WASH project in the area as well as communicating emerging issues to the supporting organizations as well as the local authority through the office of the area chief. We also champion for increased support from the county government and sometimes take part in health promotion activities with the support of different organizations'.

Access to sanitation infrastructure (latrine coverage)

Slightly more than half of the people covered in the sample (56.4%) had access to latrines, with households headed by

men showing a higher percentage (52.5) than those headed by women (38.3%). In parts of Zombe location, qualitative data indicated that some villages used undesignated open defecation areas. Some respondents cited this as an option for persons with disabilities in areas where latrines were not accessible to the elderly and the physically challenged. A male FGD discussant from Malatani sub-location of Zombe location explains '……..in some villages within this sub-county accessing latrines for the elderly or persons with disability is a big challenge since the existing facilities are not designed to suit their special needs. And that's why in some villages they have designated places where these people can relieve themselves. But in other villages there are no designated spaces. It (defecation) is done anywhere'. The effects of these practices within the community were evident around the bushes as the sight of feces acted as an eyesore to those taking transect walks across the villages.

Type of latrines available

A majority of people (73.5%) used pit latrines, but 52% of these latrines were found to be without slabs. Those still using composting latrines constituted 9.6%. The study revealed that only 39.5% of people had access to flush toilets, a piped sewer system, septic tanks, flush or pour flush latrines (to pits), ventilated improved pit latrines, pit latrines with slabs or composting toilets, and these facilities existed in peri-urban settings.

Faecal disposal and solid waste management

An average of 33.4% of the surveyed households reported proper disposal of child feces by either burying or disposing them of in latrines. A total of 43.5% of the respondents reported that they burned solid waste, 33.0% used the household waste pit, 16.5% threw waste in bushes, while 6.8% used the community waste pit. Qualitative interviews highlighted that the general sanitation awareness and practices among the residents in some of the villages was better. '… In some of the villages, disposal of solid waste is done in waste disposal pits dug by the households and burned when filled…', said **a woman FGD discussant from Zombe location.**

Hygiene practices

A total of 37.5% of people used papers for anal cleansing, while 25.2% used other undisclosed materials. Leaves were commonly used by 23.1% of the respondents. While 53.3% reported that they washed their hands at critical times, 46.7% reported that they washed their hands with soap and water. A total of 22.3% used water alone, while 31% used water and ash to clean their hands, as indicated in Table 1.

Hygiene and health education

In the 1 month preceding the survey, 36% of people had heard or read messages on sanitation and hygiene. Asked what messages they had received, they replied that 46% of the messages were on safe water handling, 24% were on personal hygiene, 11% on excreta handling and 6% on hand washing, while 10% of people reported receiving information on general health including disease prevention. A total of 13% reported that they had received some form of health and sanitation messages but could not recall the

Table 1 | Hygiene practices at the household level

Characteristics	Proportion of respondents
Materials for anal cleansing	% of respondents using these materials:
Toilet papers	12.7
Leaves	23.2
Papers	37.5
Water	1.4
Others	25.2
Washing hands	
Using only water for cleaning hands	22.3
Using soap and water	46.7
Using water and ash	31
Disposal of children's fecal matter	
Doing nothing	21.3
Throwing in the latrine/toilet	32.2
Burying in the soil	1.1
Throwing in the garden	35.9
Placing in the waste bin/heap	0.4
Others	9.1

specifics of the content. The main sources of hygiene promotion messages included radio (32.5%), posters (23.2%), billboards (20.3%), community health volunteers (17.6%) and campaign T-shirts (6.4%). A small percentage of respondents (22.3) reported knowing at least three ways of preventing diarrhea.

DISCUSSION

Most respondents obtain their water from seasonal rivers. This constitutes a real threat to water-related diseases and predisposes the vulnerable age groups to malnutrition and overall health morbidity. This percentage is significantly high compared with a KNBS report which estimated the average percentage of Kenyans who obtain their water from rivers in the rural areas to be 24 (KNBS 2018). As defined by the UNICEF/WHO guideline, safe water sources included any of the following sources: piped water in dwellings and piped water in yards/plots; public taps or standpipes; tube wells or boreholes; protected dug wells; protected springs (WHO 2018). Most of the surveyed households reported that the water sources were accessible to women, possibly because of the fact that fetching water is one of their main gender roles in society.

A majority of them (42.7%) reported taking more than 60 min to fetch water against the national average of 11.6% (KNBS 2018). This long time taken to fetch water was attributed to long queues at the rivers/boreholes, leading to negative impacts on the welfare of women, children and other vulnerable groups and the physically challenged in the community under study. The UN affirms that access to water within the vicinity of a household is a fundamental human right. Studies have demonstrated that the shorter time taken to collect water from a source had a direct association with the average reduction in diarrhea, improved anthropometric indicators of child nutritional status and a relative reduction in under five child mortality (Gerber *et al.* 2019). Survey findings indicate that women and girls (67.4%) in the target community bear the burden of fetching water and as a result miss out on opportunities for education, productive activities or leisure time.

The basic human right to water entitles everyone to have sufficient, safe, physically accessible and affordable water for personal and domestic use (United Nations 2014). A sizable proportion of the population incurs a significantly high cost in purchasing water. It is evident from the survey findings that the population under study is largely water constrained. The cost of water at the time of the survey was found to be about 40 times more than the average cost of water in most rural areas in Kenya (Cook *et al.* 2016).

Access to affordable water treatment technologies is an essential prerequisite for ushering in significant socio-economic development (Organización Mundial de la Salud 2018). The study demonstrated that filtering and boiling were the most popular methods of water purification among the surveyed households, but further study is required to assess the efficacy of these methods.

This almost mirrors the national average which shows that less than half of the population treats its drinking water. Most water sources were seasonal and dried between 1 and 6 months. It is important to note that the area under study is geographically classified as ASALs with highly variable rainfall patterns across seasons, a challenge likely to be further exacerbated by climate change. In this regard, consideration for improved water infrastructure such as the construction of new water sources and the rehabilitation of existing ones will be crucial in mitigating unforeseen climatic effects. Half of the water sources are communal, mostly managed by water management committees, and NGOs, government and private water companies manage very few water points in the county.

The overall access to sanitation in the county is still low (56%) compared with the national average of 65.3% (KNBS 2018). The majority of households rely on unimproved toilet facilities that are hazardous to the environment and health. Communities in Kitui County are at a higher risk of spreading diseases through the fecal–oral route since more than 60% of the population still comes under the low category in the sanitation ladder. In the matter of toilet design, no consideration is given to vulnerable groups such as persons with disabilities, including features such as rump for wheel chair users and hand rails for support. As such, the requirements of physically challenged people are hardly met.

Proper fecal disposal is a crucial factor in the control and prevention of diseases at the community level. The issues that need to be addressed at this level include solid waste disposal, animal waste disposal, and flies that affect

a majority of the households. In regard to latrines, the issues that need to be addressed include smell, flies and the presence of human feces. Leaves and papers appear to be the most popular materials for anal cleansing. Although these could be acceptable in rural areas, the use of such materials in urban areas is undesirable as they would predispose the users to fecal contamination and the spread of disease since most of them have no hand washing kits.

As mentioned earlier, filtering was the most popular method of water purification. This mirrors the national average; less than half of the population treats its drinking water. In Kitui County, colorless water was assumed to be clean and safe, and this may explain to a large extent why most people do not treat water before consuming it. Therefore, health promotion messages ought to focus on this aspect.

Given the documented correlation between water-borne diseases and sanitation behavior, it is imperative that a comprehensive approach to improving sanitation practices and reducing disease must consider increasing access to sanitation and safe water services and addressing the related hygiene behavioral changes.

Lessons learnt and recommendations

Both county and national governments need to leverage existing gains by previous interventions within the county in order to capitalize on the positive gains yielded so far. Key among these would be the construction of new facilities and/or the rehabilitation of existing water, sanitation and hygiene infrastructure so that more households could be covered. More robust community engagement approaches need to be adopted, which will not only promote the much-needed goodwill among communities but also stem reported cases of vandalism of infrastructure items like water pipes and pump parts, especially in Zombe location. This community goodwill is crucial for maximizing the impact of intervention as well as promoting the prospects of sustainability. The survey strongly recommends that communities that come within the project implementation areas be more empowered through the transfer of skills to enable them to take greater charge of their own health and sanitation. To achieve an open defecation free society, there is a need to scale up sanitation and hygiene promotion approaches through the adoption of community-led total sanitation. Given the poor environmental and sanitation indicators in the county as evidenced by low water treatment practices at the household level and poor fecal disposal methods, the adoption of targeted hygiene/sanitation promotion activities (outreach and behavioral change initiatives) will lead to improved hygiene and sanitation standards which are crucial for reducing the reported incidences of communicable diseases such as diarrhea and typhoid in the community.

Study limitations

The study presents findings from two subcounties in Kitui County which may not be generalizable for all arid and semi-arid regions in Kenya. The sites were selected for the baseline survey to inform interventions on water sanitation and hygiene to be implemented in the two subcounties.

DATA AVAILABILITY STATEMENT

All relevant data are included in the paper or in its Supplementary Information.

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