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ABSTRACT

Diarrhea was ranked the third prevalent disease in West Pokot County. It can lead to death and nutritional problems like stunted growth and underweight in children if not checked. The aim was to determine various factors contributing to the occurrence of diarrhea in children aged below five years in Chewoyet sub-location, Kapenguria municipality. Chewoyet sub-location, Kapenguria municipality, West Pokot sub-county was the study area where cross-sectional study design adopted. The Study populations were all children aged below 5 years, their mothers and caregivers. Data collection was done through Questionnaires and key informant interviews. SPSS version 18.0 was used to analyze the Data and presented by use of charts, graphs and tables. Majority (n=48, 61%) of the children were male with most (89%) of the mothers being 15-34 years. 61% of the children had suffered from diarrhea within the last six months, mostly in dry season. More male children (63%) had suffered from diarrhea averagely lasting 3-5 days and dependent on gender (p=0.017) with male children suffering more. Most mothers (92%) knew the causes of diarrhea and that it can be prevented but had poor hygiene practices. Majority (54%) did not treat water before drinking. Majority of the households had never received water treatment chemicals from the hospital. This was associated with occurrence of diarrhea in children (p=0.033). In conclusion, most mothers were aware of prevention of diarrhea but had poor hygiene practices. Little supply of water treatment products coupled with the growing population had resulted in reduced water quality hence higher risk of diarrhea. The study recommended monitoring exposure of children in their environments and seeking prompt medication. The Public health departments to conduct a comprehensive urban led total sanitation as well as ensure distribution of subsidized water treatment chemicals and adequate safe water supply.

INTRODUCTION

Diarrhea describes loose watery stools that occur more frequently than usual. It means more frequent trips to the toilet and a greater volume of stool. It is a condition of having three or more loose or liquid stools per day or having more stools than is normal for a person (WHO, 2008).

Most diarrheal infections in children are caused by virus infections e.g. rotavirus which is responsible for more than 40% of all diarrhea-related hospital admissions of children. Many bacteria can cause diarrhea, especially in lowered immunity. The most common bacteria are *Salmonella*, *Shigella*, *Staphylococcus aureus*, *Escherichia coli* and *Vibrio Cholerae*. The most common parasites are *Entamoeba Histolytica*, hookworm and *Giardia lamblia* among others (Hung, 2006).

West Pokot County is an ASAL area, forming part of the 67% of Kenya's ASAL and located in the former Rift Valley Province of Kenya. It borders Uganda to the west, Trans Nzoia and Marakwet counties to the south, Turkana County to the north and east respectively and Baringo county to the south east (ACF, 2012).

It is relatively rugged with an altitude ranging from 900 m in the plains of Turkana in north-east to over 3000 m in Cherangani Hills in the south-eastern parts of the county. The county has a total area of 8,418.2 km² with an estimated population of 512,690; 50% male and 50% female. The population density stands at 61 people per km². Children below five years from 11.3% of the total population (WSP, 2014).

The county comprises of four main sub-counties namely West, Central, South and North Pokot with three major livelihood zones of pastoralism, agro-pastoral and mixed farming for North, Central, West and South Pokot sub-counties respectively (see map in appendix).

Kapenguria is a town lying northeast of Kitale (in Trans Nzoia County), found in West Pokot sub-county and is the headquarters of West Pokot County at latitude 1⁰N and longitude of 35⁰E. It forms a municipality with an urban population of 13,000 people and a total population of 56,000 people. It is also home to the infamous Turkwel Hydro-electric power plant which serves the national grid with approximately 105 MW of power (KNBS, 2009).

Kapenguria town has various locations that form peri-urban residences as well as villages. As a growing town, it attracts several urban dwellers who are majorly employed in the

construction industry in the town. It is where all the administrative offices of the county are situated. It is also a location with three sub-locations namely; Mwotot, Chewoyet and Kamatira. The area is inhabited mainly by the Pokot speaking group (KNBS, 2009) and the study was carried in Chewoyet sub-location.

PROBLEM STATEMENT

Children under five years require adequate care to be free from diseases, especially diarrhea (Hung, 2006). However, diarrhea has remained one of the most prevalent diseases in children under five (PATH, 2007).

Diarrhea is the third leading cause of death among under-fives in Kenya, and it kills dozens of children before their fifth birthday. The most severe form of diarrhea is caused by rotavirus which is responsible for 7500 deaths yearly in Kenya (IRIN-Kenya, 2014).

Still, at worse, diarrhea has been ranked the third prevalent disease in West Pokot County as per the data from the disease surveillance department in the county with under five mortality rate of 206 per 1000. Rapid increase in diarrhea has been recorded in the entire county in the last four years. In West Pokot sub county, this has been the trend, with the year 2014 recording the highest number of cases:

There has been a 130% increase in the cases of diarrhea within the four years since 2011 which is alarming with the year 2014 recording a 77% increase in the cases, up from the previous year.

In the year 2012 alone, there was an increase in the cases of diarrhea in children aged below five years from 22.3% in 2011 to 51.3% in 2012 and this has been on an upward trend (ACF, 2012). Diarrhea leads to nutritional problems like stunted growth and underweight in children (Kopano M *et al*, 2010). In a study on childhood diarrhea, it was found out that children ill with diarrhea 10% of the time during the first 24 months were 1.5 cm shorter than children who never had diarrhea (Hung, 2006). Stunted children suffer a higher mortality due to infectious diseases such as pneumonia and measles as well as being more likely to have poorer cognitive and educational outcomes (WSP, 2014).

Over the years, the infant mortality rates have been shown to be related to poor access to safe water for drinking and sanitation (Porto, 2004). Efforts to provide safe water for drinking and appropriate sanitation have been put in place yet there is still an increase in infant mortality.

Perhaps the approach used to provide the water especially for the children may not be appropriate which this study seeks to establish. This can range from the mode of transport, storage, amount used per capita per day and may be treatment before drinking (Pruss, 2008).

The rate at which diarrhea is increasing in the county endangers the attainment of MDG number four (to reduce by two thirds the mortality rate of children under five) since diarrhea is one of the major causes of child mortality. A lot of resources are usually allocated for treatment and management of diarrhea in children. If diarrhea is not quickly averted, it can quickly spread and affect many children. This can have a detrimental effect on the general image of the county and the nation Kenya as a whole, as well as on the economic sector of the county and country. As a result of these looming perils, a precise and rapid action is required to contain the dominating trend and realize Kenya's vision 2030 in the long run.

This study, therefore, sought to establish the main causes of diarrhea in children in households of Kapenguria municipality and generate solutions to help policymakers institute appropriate and sustainable methods of preventing this menace in children aged below five years.

LITERATURE REVIEW

Types and occurrence of diarrheal diseases

Diarrhea can present as a form of several diseases, most of which are faecal-oral in nature. The category "diarrhea" includes some severe forms of diseases like dysentery, typhoid and cholera. All these are related in that they are transmitted feco-orally (Pruss, 2008).

Dysentery

This can be caused by protozoa or bacteria. *Entamoeba histolytica* (protozoa), the cause of amoebic dysentery, is prevalent worldwide – it is estimated that more than 10% of the world's population is infected with *E. histolytica*, but on average, only 1 in 10 infected people show symptoms, which include stomach pain, bloody stools and fever (UNICEF, 2008). *Entamoeba histolytica* usually causes less than 2% of episodes of bloody diarrhea in children less than 5 years old (Hung, 2006). Another type of dysentery is caused by *Shigella dysenteriae* (bacterium) type 1 which is the pathogen responsible for bacillary dysentery, or bloody diarrhea. *Shigella* has a very low infectious dose and has caused epidemics in Central America, south and southeast Asia, and sub-Saharan Africa since the late 1960s. There are an

estimated 165 million cases of *Shigella* infection each year, resulting in some 1.1 million deaths, mostly of children under 5. *Shigella* causes diarrhea with blood (acute bloody diarrhea) and/or pus, high fever, abdominal or rectal pain, but not vomiting (UNICEF, 2008).

Typhoid

Typhoid is a type of water borne disease. It is commonly known as typhoid fever and should never be confused with typhus fever, caused by body louse. It is caused by ingestion of *Salmonella typhi* bacteria in food or water, and affects about 17 million people each year, causing some 600,000 deaths. Infection causes a sudden high fever, nausea, severe headache, and loss of appetite. It is sometimes accompanied by constipation or diarrhea (UNICEF, 2008). It is normally associated with decline in water quantity and quality and as such is more frequent in dry spells (Kiringe *et al.*, 2009). The appropriate preventive steps are to improve drinking-water quality and prevent casual use of unprotected water sources. Its incidence is highest in children and young adults between 5 and 19 years old. Infants, children, and adolescents in south-central and Southeastern Asia experience the greatest burden of illness. Nonetheless, outbreaks of typhoid fever are frequently reported from sub-Saharan Africa and countries in Southeastern Asia. Historically, in the pre-antibiotic era, the case fatality rate of typhoid fever was 10–20%. Today, with prompt treatment, it is less than 1% (Wikipedia, 2014).

Cholera

Cholera is an infection of the small intestine caused by the bacterium *Vibrio cholerae*. Worldwide, it affects 3-5 million people and causes 100,000-130,000 deaths a year as of 2010 (WHO, Cholera, 2015). Cholera results in severe watery (“rice-water like”) diarrhea and vomiting, but no fever. More than 90% of cases are mild, and most cases respond well to treatment with oral rehydration therapy. However, if untreated, severe dehydration and death can occur within days (UNICEF, 2008). Cholera is considered one of the most severe forms of diarrheal diseases and is highly associated with poor hygiene, unsafe water and poor sanitation. Children are more susceptible to 2-4 year olds having the highest rates of infection as well as people with lowered immunity such as those living with HIV/AIDS (Wikipedia, 2015). Cholera is known to cause devastating epidemics yet most people do not associate it with poor sanitation, which can be so dangerous since this can lead to inadequate sanitary practices being put in place. Among those at risk of contracting cholera are those living in

peri-urban slums where minimum requirements of clean water and sanitation are not met (WHO, Cholera, 2015).

Knowledge and practices on prevention and control of diarrhea.

Diarrheal diseases are preventable and therefore the preventive measures need to be fully understood. The WHO's CDD Programme and other organizations (UNICEF, USAID, etc) have given first priority the prevention of diarrheal deaths, rather than prevention of cases, and focused on promotion of ORT (Hung, 2006).

In recent decades, a consensus developed that the key factors for the prevention of diarrhea are sanitation, personal hygiene, availability of water and good quality drinking water; and that the quantity of water that people have available for hygiene is of equal or greater importance for the prevention of diarrhea as the bacteriological water quality (Hung, 2006). An estimated 82% of urban residents in Sub-Saharan Africa have access to safe water and 55% to sanitation facilities (NEPAD, 2007), as the first step to disease prevention.

Health (strongly influenced by access to safe water) and poverty are inextricably linked. Poor health, especially chronic illness, can force a household below the poverty threshold since more resources would be diverted towards improving the health of the ill persons or stopping the illness altogether. This becomes self-perpetuating as a poverty stricken household is more susceptible to ill health given an on-going lack of resources for sustainable living and appropriate care. Low education levels and lack of knowledge on environmental health and sanitation further sustain this cycle, as the understanding of links between hygiene and waterborne diseases tends to come more easily to households with higher education levels (Corinner *et al.*, 2008).

Challenges encountered in prevention and control of diarrhea

Immunization against childhood illnesses is one of the most effective methods of preventing diarrheal diseases. However, in the integrated survey of 2013, the informal interviews cited lack of adequate facilities offering immunization due to lack of storage capacity, cold chain breakdown and staff shortage as contributing factors to the low coverage (Kipruto *et al.*, 2013). This results in lowered immunity hence a higher risk of contracting diarrheal diseases in children.

Provision of safe drinking water is instrumental in the prevention of diarrheal diseases. However, this, at times may not be achieved for all households especially in peri-urban residences. A good example has been shown by a significant drop in boiling and use of chemicals among residents of Kapenguria as was noted in March 2013. Informal discussions with teams on the ground indicated inconsistency in supplies of water treatment chemicals from government and lack of energy (firewood) to boil water as probable contributing factors (Kipruto *et al.*, 2013). As a result, consumption of unsafe water has been noted, not only in this region but in most parts of the country and Africa. The hardest hit areas are the ASALs where drought is recurrent and has resulted in over 38% of people living in water scarce areas (NEPAD, 2007), predisposing these people to water-washed diseases, some of which are diarrheal in nature.

Kenya has experienced rapid population growth. Increase in population reduces the water volume per capita (MinistryofWater, 2005). Reduced water volume per capita exposes people to contracting water washed diseases, some of which are diarrheal eg bacillary dysentery (UNICEF, 2008).

Despite the benefits, sanitation coverage lags far behind water supply coverage. It is estimated that 40% of people still do not have access to basic sanitation facilities. The most important reason for this is that in many circumstances, there is far less demand for sanitation than there is for water and other services, both among communities and decision makers. Needless to say, this hampers the health improvement efforts since it exposes these people to a great array of causative agents of diarrheal diseases (UNICEF, 2008).

METHODOLOGY

Study design

The study design adopted was cross-sectional study design since this was a one-time study and a sample was drawn to represent the whole study population. Given that it involved a sample survey, the accuracy of data collection was observed to ensure that every important factor was captured in the study.

Study Area

The study was carried out in Chewoyet sub-location of Kapenguria location, West Pokot sub-county covering a total area of 8.1 km². The total population was 3947 people with 920

households while the population density stood at 485 people per km². The area was conveniently chosen due to its proximity, accessibility as well as having most factors under study.

Study Population

Study population included children less than five years of age. Since the children were too young at this age to be interviewed, the mothers or the caregivers of the recruited children were instead interviewed to identify the contributing factors to diarrhea in the children. They were recruited from the households in the sub-location.

Sampling Techniques

Simple random sampling technique was used to obtain the required sample from the population. This was to ensure that every child within the target population had an equal chance of being included in the study. The sample unit was a household, defined as a group of people that have been eating from the same pot within a period of three months.

A starting house was identified at the center of the sub-location and movement done in four directions i.e. north, east, south and west. The data collection was then done by moving to the nearest household in these four directions, starting from the center each time until the sample size was obtained. Only households with a woman of reproductive age (15-49 years) and with a child under the age of 5 years were included. The childhood illnesses were by a six months recall and information was collected from the youngest child aged less than five years.

Sample Size

Using Fisher's Formula (Rothman *et.al* 1974), $n=Z^2 (Pq)/d^2$

Where:

n=the desired sample size (if the target population is more than 10,000)

Target population, N= 920 households in Chewoyet sub-location.

Z=the standard normal deviate at the required confidence level (1.96)

P=the proportion in the target population with the desired characteristics i.e. percentage of households with children under five years was approximately **94.5%**.

$$q=1-p$$

d=the level of statistical significance i.e. absolute precision expressed as a fraction of 100 (0.05).

Substituting in the equation:

$$n = \frac{(1.96)^2 \times (0.945 \times 0.055)}{(0.05)^2}$$
$$n = 79$$

Hence sample size =79 households

Data collection instruments

Questionnaires

These included structured questions, both open and closed ended answered procedurally by the respondents. They were the source of the quantitative data. It was divided into sections as per the specific objectives of the study.

Key informant interview

This included health personnel working at the hospital and county level. Information was obtained by oral interview from the head of disease surveillance department in the county, based in the public health department.

Data analysis

Both qualitative data from the key informants and quantitative data from the questionnaires were collected during the study. The data was checked first in the field for completeness and consistency; any missing and ambiguous data was identified and rectified accordingly. The quantitative data was then coded, entered and verified in Statistical Package for Social Sciences (SPSS), version 18.0 where the bulk of analysis was done. Analysis was also done using Microsoft Excel 2007. Quantitative data was analyzed using measures of central tendency such as mean, mode and median. The data was presented using bar graphs, pie charts and tables.

Inclusion criteria

For one (a woman) to qualify to participate in this study, the following were observed:

- Must have been a resident of that area for at least the last six months.
- Must be within the childbearing age (15-49 years) and have a child less than five years.

Ethical consideration

- The topic was first approved by supervisors from the School of Public Health.
- An introductory letter was written through the public health officer to seek for permission from the area sub-chief.
- The research was explained to the respondent first before starting the interview and verbal consent sought before proceeding.
- Confidentiality was maintained by omitting names on the questionnaire and identifications that would link the response to the respondent.
- The respondents could withdraw from or stop the interview if they so wished.

Study limitation

- Some mothers and caregivers were unwilling to give information in the first instance but with the assistance of a CHV, this was tackled.

RESULTS

Demographic data

The study recruited 79 children below five years from the households. Majority (n=48, 61%) were male and the rest were female. The age distribution was as shown in figure 1.

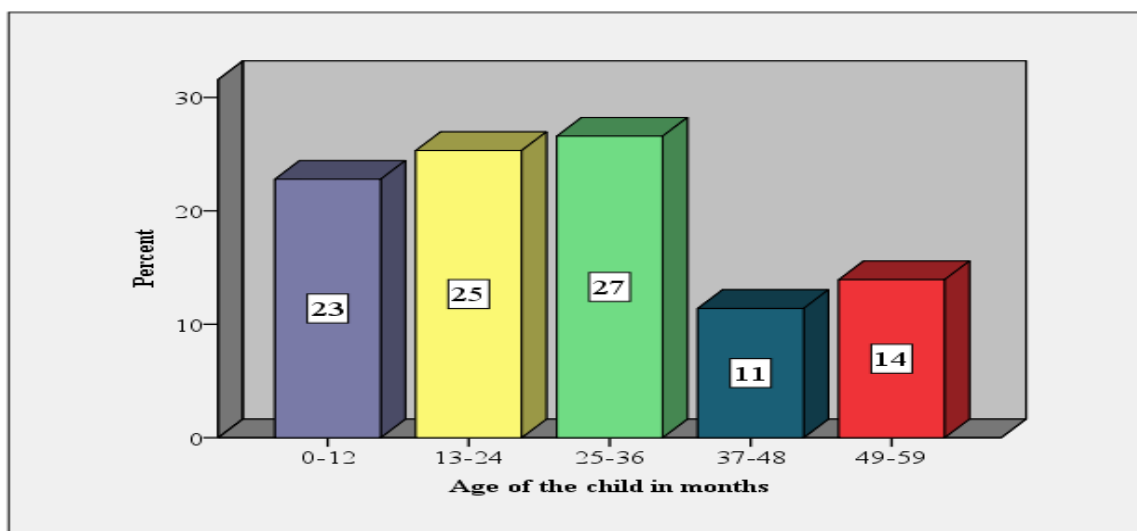


Figure 1: Age distribution of the children (n=79)

Majority (n=21, 27%), were between 2 and 3 years (25-36 months). The education level of the parents or caregivers of the children were as shown in table 1. A great number (n=38, 48%) of the mothers were aged between 25-34 years while those aged 15-24 were 41%. Only 11%, n=9 of the mothers were aged 35 years and above, meaning that most mothers were of youthful age. The mean age of the mothers and caregivers was 26.63 years. All the respondents were Christians.

Table 1: Education level of the mothers or caregivers

Category	Frequency	Percentage	Cumulative percentage
Primary	41	51.9	51.9
Secondary	19	24.1	76
Tertiary	17	21.5	97.5
None	2	2.5	100
Total	79	100	

Occurrence of diarrhea in children below five years

General occurrence of diarrhea

Within the past six months, majority of the children (n=48, 61%) had suffered from diarrhea as was confirmed by the mothers and caregivers at the time of interview (Figure 2).

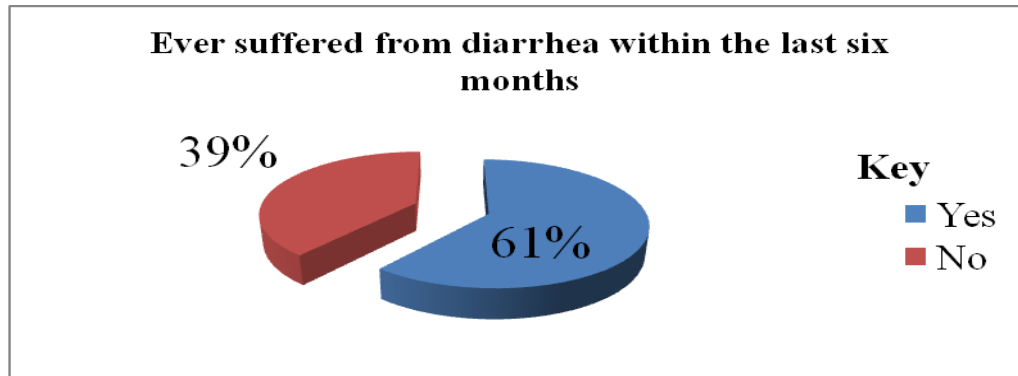


Figure 2: Occurrence of diarrhea within the last six months (n=79)

Information from the disease surveillance department confirmed that typhoid and dysentery have been the most common diseases in the county, recording an overall high prevalence of diarrhea.

Occurrence of diarrhea according to gender

The male children were found out to have suffered more from diarrhea than the females as shown in table 2. They composed 63% (30 out of 48) of the total number of those who had suffered.

Table 2: Occurrence of diarrhea per gender

		Gender of the child		Total
		Male	Female	
Ever suffered from diarrhea	Yes	30	18	48
	No	18	13	31
Total		48	31	79

Occurrence according to seasons

The data from the disease surveillance department indicated that the cases of diarrhea were highest in the month of July and October. These are relatively dry months of the year as published in the season’s calendar of the county by the National Drought Management Authority (NMDA). The findings from the mothers also pointed towards the same, with 14% (n=11), admitting that they were not aware of the seasonal distribution of the cases (Table 3).

Table 3: Seasonal distribution of the cases in the opinion of the mothers

		When cases are high				Total
		Dry season	Rainy season	All year round	Don't know	
Ever suffered from diarrhea	Yes	23	13	7	5	48
	No	9	13	3	6	31
Total		32	26	10	11	79

Duration of the episodes of diarrhea

The study sought to establish the average duration of the episodes of diarrhea among the children when they occurred. Majority of the children who had suffered from diarrhea (n=29, 60%) had the cases lasting 3-5 days. Figure 3 shows how the cases listed:

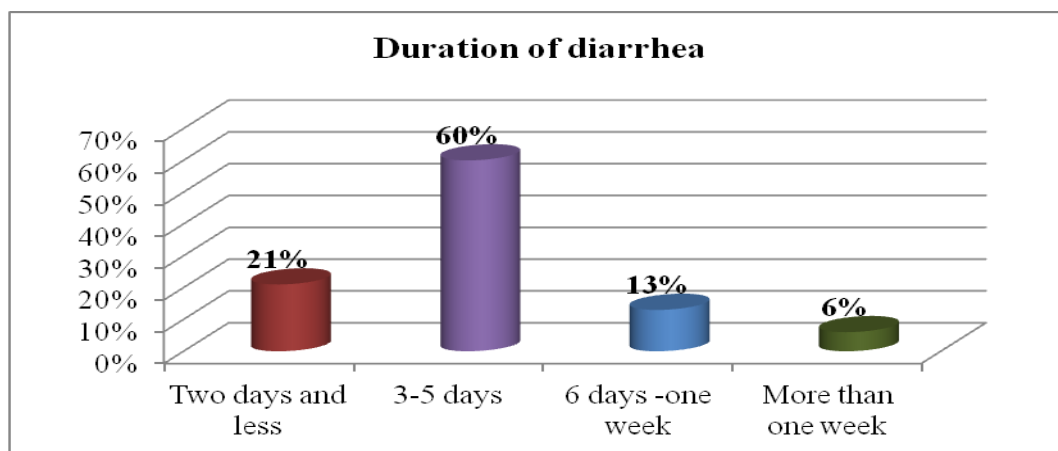


Figure 3: Duration of the episodes of diarrhea (n=48)

The duration of the episodes was found to be dependent on the gender of the child ($p=0.017$). The male children had the longest duration of the occurrence.

Knowledge on diarrhea and its prevention

General knowledge on prevention of diarrhea

A great number of the mothers ($n=73$, 92%) knew the causes of diarrhea and that it can be prevented and outlined various prevention methods like boiling or treating water before drinking, cooking food properly, hand washing among others. However, it was alarming that others (4%) still did not know that diarrhea can be prevented and attributed it to teething (Figure 4).

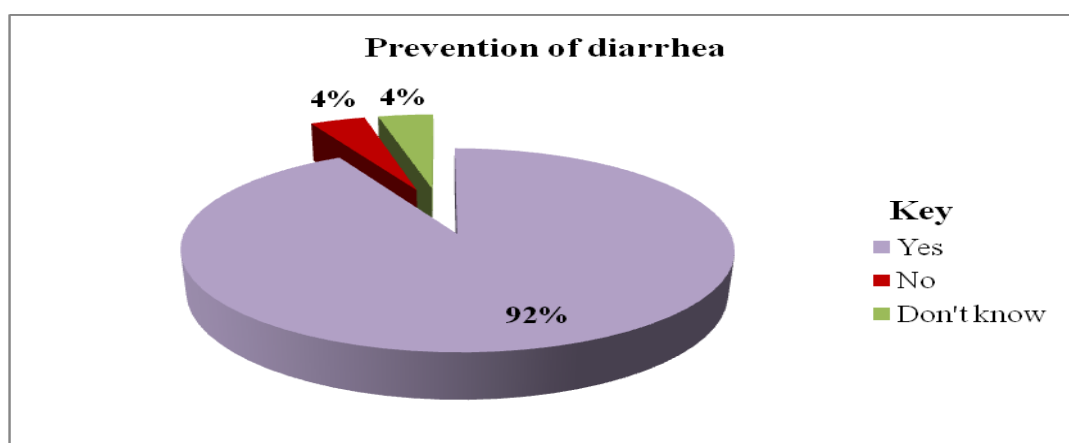


Figure 4: Opinion on whether diarrhea can be prevented ($n=79$)

Opinion on quality of water

Concerning the quality of water used in households, most respondents ($n=48$, 61%) said that it was good, basing their judgment on the color of water, which by most respondents ($n=73$, 92%) was described as clear. The judgment on quality of water by the respondents was found to be dependent on the clarity of water ($p=0.002$).

Age of the child at weaning was also found out. Majority of the mothers ($n=61$, 77%) weaned the children when between 7-12 months, though they could not link this to a great step in prevention of diarrhea in children. However, 13% ($n=10$) still weaned the children when less than 6 months as opposed to the WHO requirement of the same. Nevertheless, age at weaning had no association with occurrence of diarrhea in children under five ($p=0.315$). Other predisposing factors to diarrhea like sharing room with animals and poultry also formed part

of the study. Part of the population (n=17, 22%) was found to be sharing their rooms with the animals and poultry, making them be at a higher risk of suffering from diarrhea especially the children though they did not know.

Management of diarrhea by the mothers

Management of diarrhea as done by the mothers and caregivers was as shown in figure 5 below. Out of the 61% cases, majority (44%) sought help from the hospital where they were given the ORS and other medication as was necessary. Those who resorted to home based care opted for self-medication by obtaining over the counter drugs for the ailing children (Figure 5).

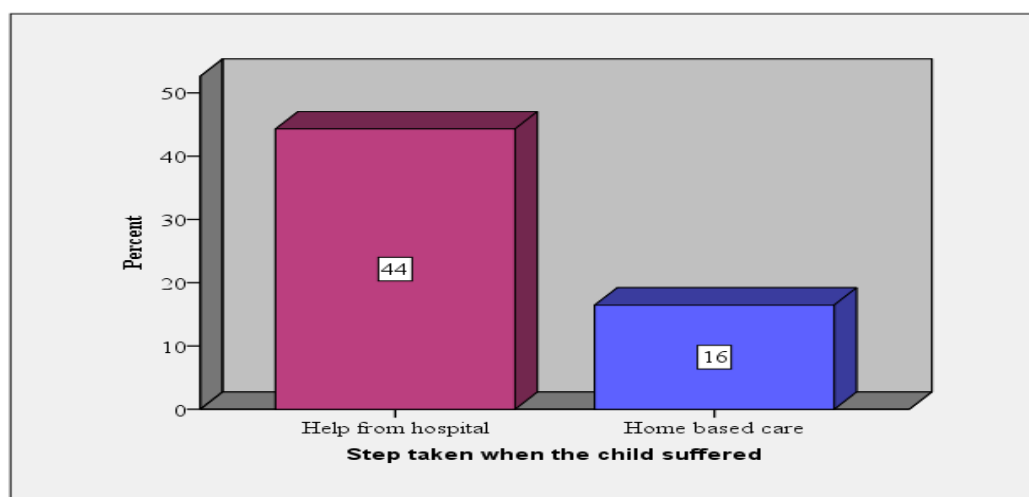


Figure 5: Management of diarrhea by mothers and caregivers (n=79)

Practices by the mothers and caregivers towards prevention of diarrhea

Practices assessed were mainly water treatment using any methods available, maintenance of latrines if available as well as hand washing at critical times.

Water treatment

Only 46% (n=36) of the respondents confirmed to be treating water before drinking. Table 4 shows the various methods used for water treatment.

Table 4: Water treatment methods

Method	Frequency	Percent	Cumulative Percent
Boiling	25	31.6	31.6
Chemical treatment	11	13.9	45.6
Nothing	43	54.4	100.0
Total	79	100.0	

4.4.2 Latrine maintenance

A good number (n=41, 52%) had latrines well maintained and in good condition while 14% (n=11) of the households had latrines in poor state. It was, nevertheless, a matter of concern to find out that 3% of these urban residents did not have access to a latrine or toilet.

Hand washing

All the respondents admitted washing their hands. Of interest was how and when it was done. The pie chart below shows the times when hand washing was practiced by mothers.

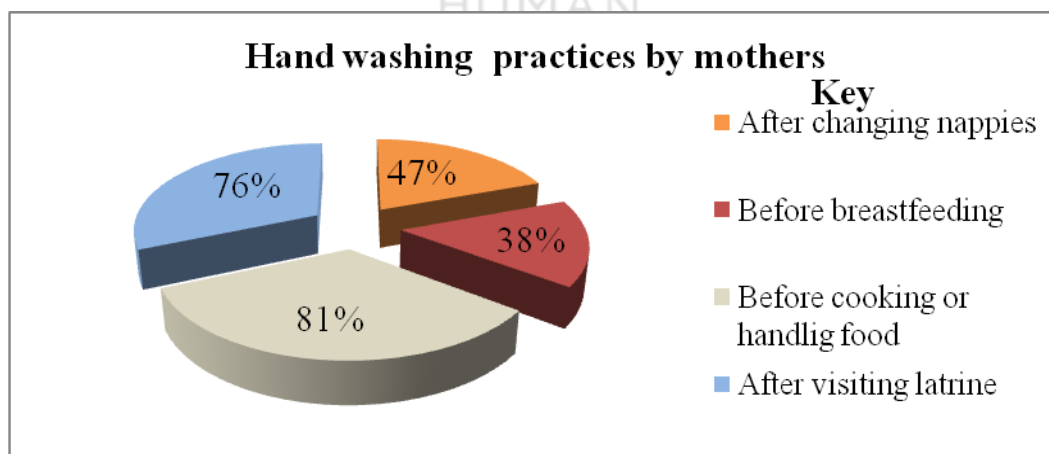


Figure 6: Handwashing at critical times by mothers (n=79).

These were done in most cases using water alone in a basin. Only 38% (n=30) of the respondents remember to wash their hands before breastfeeding their children, putting the health of these children at risk (Figure 6).

Challenges encountered in prevention and control of diarrhea

Amount of water used per day

Amidst all the concerted efforts to prevent and control diarrhea, there were various challenges that were faced by mothers interviewed. In as much as majority (n=52, 66%) of the residents had access to adequate water and used more than 60 liters per day, it is worth noting that others (n=27, 34%) used less than 60 liters per day. With the average household size being five in this municipality, this meant that each person used less than 20 liters per day. Table 5 shows the amount of water used in the households per day for different ranges.

Table 5: Amount of water used in the households per day

	Frequency	Percent	Cumulative Percent
Less than 20 liters	1	1.3	1.3
21-40 litres	12	15.2	16.5
41-60 litres	14	17.7	34.2
More than 60 litres	52	65.8	100.0
Total	79	100.0	

Time taken to water source was found to significantly influence the occurrence of diarrhea (p=0.023).

Water adequacy in households and neighborhood

Some respondents (n=19, 24%) admitted that they did not get enough water in their households for daily use. Still, at worse, 42% (n=33) said that their neighbors had insufficient water for daily use. This depicted that on average, 33% of the residents of this area did not have adequate water for daily use in their households. Inadequacy of water in the households was found to be associated with occurrence of diarrhea in the children under five (p=0.016).

Water treatment chemicals from the hospital

Water treatment components were found to be in inadequate supply from the hospital or any organization that would take that initiative. Only 13% (n=10) of the respondents confirmed to

have received water treatment components from the hospital or any organization at least once. Those who had received the components earlier on turned out to be less likely to have their children suffer from diarrhea. The chi-square cross-tabulation showed that occurrence of diarrhea was dependent on whether a household had received water treatment components from the hospital or any organization or not ($p=0.033$).

Education on water safety

It also came out that majority (86%, $n=68$) had never been taught about water safety especially water handling in households. However, this did not influence the occurrence of diarrhea in the children ($p=0.649$) in as much as it is an important aspect of environmental health and safety.

Non-adherence to hygiene practices

Finally, on the challenges in prevention of diarrhea, 22% ($n=17$) of the respondents confirmed that they never adhered to the hygiene practices that they had outlined when asked about the methods of preventing diarrhea. Some of the reasons given for non-adherence were: forgetfulness, limited water and time, assumption that water is safe among others.

DISCUSSION

Demographic information

Out of the 79 children recruited in the study, (61%, $n=48$) were male, with majority (89%) of their mothers and caregivers being 34 years and below. This indicated that majority of the urban dwellers were of youthful age. These findings are similar to those from a study done on urban and suburban trends by an economist from Harvard University, Jed Kolko, who suggests that majority of the current urban dwellers are aged 18-34 years (Kolko, 2015). This age group is the most productive and as such is involved in various economic activities found in the urban centers. The education level of the mothers and caregivers was found to be low with majority (53%) having only primary education or no education at all. However, this is lower than the projection of UNICEF that puts female literacy rate at 81.6% among the youth in Kenya (UNICEF-Kenya, 2013) and can be attributed to low emphasis on girl child education.

Occurrence of diarrhea in children below five years

Out of the 48 cases of diarrhea that were reported, (63%, n=30) were male children. This indicated that the male children were more prone to diarrhea than their female counterparts. This is slightly higher compared to the findings from a study done on the burden of pediatric diarrhea in Bolivia by Burke *et al.*, 2013 who found out that 56% of the cases under study were male children (Burke *et al.*, 2013). However, these findings concur with those from a study conducted on most common cause and risk factors for diarrhea in children less than five years in Vietnam where the male cases were more than the females in all age groups (Hung, 2006). Most of the cases (n=29, 60% of the cases) lasted 3-5 days, with the male child bearing the burden of the disease (p=0.017). These were all cases of acute diarrhea i.e. diarrhea that lasts less than 2 weeks (Sisson, 2014). According to Hung (2006), sex is one of the factors related nearly to all diseases. This could be attributed to the level of exposure in different sexes. The male children are more adventurers and their frequent movement from one place to another exposes them to a great array of unhygienic environment hence high chances of getting infected by the pathogens.

Many cases (n=23, 48% of the total cases) were witnessed during the dry season of the year. These findings contradicts those by Hung (2006) which showed that diarrheal cases were more prevalent in rainy season when it is hotter compared to dry cold periods. The reason for this is that bacteria thrive well in warmer environments than in cold environments. However, the findings of this study are similar to those from a study by Kiringe *et al.*, 2009, which pointed out that diarrhea; one of the water-borne diseases is higher in dry seasons. This is because, in dry season, the water volume decreases hence lowering the quality of water through the increasing concentration of the contaminants, a factor that suitably describes the climate and water sources in this area.

Knowledge on Diarrhea and its Prevention

Diarrhea is preventable and therefore the preventive measures need to be fully understood and strictly adhered to. A great number of the mothers (n=73, 92%) had a glimpse of knowledge on the causes of diarrhea and its prevention. This is slightly higher than results found by a study done on the maternal knowledge and practices regarding childhood diarrhea and diet by Khalili *et al.*, 2013 in Iran which was 80% (Khalili *et al.*, 2013) and can be attributed to frequent health messages relayed to the public through the media (radio,

television, newspapers etc). It was also good to notice that the mothers were able to identify various methods of prevention. This forms a first step in the effective prevention diarrhea. The knowledge of mothers and caregivers on child proper personal, environmental and food hygiene is very important in alleviating diarrhea and any related complications that may arise thereafter (Kageni, 2011).

Moreover, this study found out that 4% of the mothers had no knowledge on prevention of diarrhea. This is a higher frequency compared to those from a study by Hung (2006), which found that only 0.75% of mothers had no knowledge on prevention of diarrhea. This is a detrimental factor since it can constrain the potential health gains from any available environmental health project like safe and adequate water supply (Corinner *et al.*, 2008).

Most respondents (61%) were generally satisfied with the quality of water they obtained from the sources. The quality of water depended on its clarity as was viewed by the respondents ($p=0.002$). This revealed lack of knowledge on water quality, posing a health risk to the area residents. These findings are consistent with those of a study done on perceptions of safety and household behaviors to improve water quality in peri-urban Cambodia (Turrini, 2013). The study revealed that most respondents (93%) were satisfied with the taste and color of the water used in households, similar to what this study found out. However, quality of water does not depend on clarity alone but other factors also like microbiological and chemical composition of the water (UNICEF, 2008), which could not be understood by the respondents.

Most children (77%) were weaned between the ages of 7-12 months. This concurs with the findings of a study done on morbidity of diarrhea in children whose mothers were hawkers in Nairobi, Kenya. Out of the 350 children recruited in that study, 52.8% were weaned after the sixth month (Kageni, 2011). Some of the respondents (13%) weaned the children when less than 6 months according to this study. The recommended weaning age is after six months. This means that a mother is supposed to exclusively breastfeed the child for the first six months (UNICEF, Infant and Young Child Feeding, 2014). Children less than six months have underdeveloped digestive system hence solid foods can cause irritation of the gut leading to ulceration of the gut and a likelihood of diarrhea (Kageni, 2011). This study, however, revealed that there was no association between the age of weaning and occurrence of diarrhea in children ($p=0.315$), contrary to the findings of Kageni (2011).

Most mothers (73%) whose children suffered from diarrhea sought help from the hospital where they were given the ORS in most cases. This is slightly higher than the findings of the study by Yasmin *et al.*, 2014 (62%). In cases where the condition deteriorates, the mother should visit a physician for further diagnosis and management of the condition (Yasmin *et al.*, 2014).

Practices by mothers and caregivers related to prevention of diarrhea

Majority (54%) of the respondents did not treat water as was revealed by the study. A nutritional survey done by ACF in 2013 in the whole county revealed the same. The reason for this was inadequate water treatment chemicals, lack of fuel (for boiling) and lack of awareness. Kiringe *et al.*, 2009 points out the same reason for lack of treatment of water in households in a study done in Kimana group ranch, Oloitoktok, Kajiado County. In addition, Kiringe *et al.* suggests that the most effective method of water treatment, chemical treatment, may not be achieved by the local residents unless subsidized by the government or health organizations. This will form a big step in prevention of diarrheal diseases which in most cases are water related. Whereas improved water supply reduces diarrhea morbidity by 21%, additional improvements in drinking water quality, such as point-of-use disinfection, would reduce diarrheal episodes by 45% (SwedishWaterHouse, 2007). This explains why households that had never received water treatment chemicals showed a likelihood of their children suffering from diarrhea. Latrines maintenance can play a role in diarrheal disease transmission. In most studies, poor states of latrines have always been linked to high episodes of diarrhea (Kageni, 2011).

Handwashing at critical times was studied i.e. before breastfeeding (for lactating mothers), after visiting the latrine, before cooking or handling food and after changing the nappies. None of these had 100% adherence. These findings, therefore, are consistent with those found by Hung (2006) which revealed irregular hand washing by mothers at these critical times. However, there was no association between these practices and occurrence of diarrhea ($p=0.274$), contradicting the findings of Hung (2006). More importantly, improving sanitation and hygiene reduces diarrhea morbidity by 37.5% while hand washing can reduce the number of diarrheal cases by up to 35% (SwedishWaterHouse, 2007).

Challenges encountered in prevention and control of diarrhea

Majority of the respondents (66%) mentioned that they obtained enough water for daily use. This is lower than the report by NEPAD (2007) revealing that 82% of urban residents in Sub-Saharan Africa have access to safe water. It, therefore, means that some people use little amount of water daily, below the WHO recommended limits of 20 liters per person per day especially for lactating women who engage in moderate physical activity in above-average temperatures. This amount is capable of meeting the per capita needs (WHO, 2015) and non-adherence to this means inadequate sanitation hence a likelihood of outbreak of diarrhea. Water inadequacy was also found to be associated with diarrhea ($p=0.016$). Those who use little water were found to have had their children suffer from diarrhea. This agrees with a report by the Ministry of Water (2005). The reason for this was viewed as the ever increasing population of the country which lowers the per capita water consumption, hence predisposing the people to diarrheal diseases which are water washed in nature (Ministry of Water, 2005). Kapenguria being a growing town, owing to the adoption of devolution, has recently experienced rapid population growth, qualifying the validity of the study findings.

Time taken to water source was found to have an association with diarrhea ($p=0.023$). These findings are similar to those of a study done in Ghana concerning diarrheal likelihood in Ghanaian children (Quinn, 2009). More time required to fetch water have always been linked to higher episodes of diarrhea. Mothers with improved water supply and sanitation services nearer their homes are better able to care for their children, both because they have fewer illnesses and because they devote less time to water-fetching and concentrate on maintaining the hygiene status for their children (SwedishWaterHouse, 2007).

Availability of water treatment chemicals like pur, water guard and other hypochlorites in the health facilities plays a major role in improving water quality when the residents are able to get them. Not having received water treatment chemicals from a health facility or organization and the corresponding education on water safety was found to be related to occurrence of diarrhea ($p=0.033$). These findings are similar to those by Yasmin *et al.*, 2014. The underlying reason is that with continued use of these components and regular education on water safety and quality, there is a positive impact on attitude and practice on water safety (Yasmin *et al.*, 2014).

CONCLUSION

The male children are more prone to diarrhea than the females with most cases occurring in dry seasons of the year. The average duration of the episodes of diarrhea was 3-5 days, still with the male children suffering longer periods than females. Typhoid and dysentery were the main diseases making the prevalence of diarrhea being high in the county.

Most mothers knew the causes of diarrhea and that it can be prevented yet lacked adequate knowledge on water quality. Most children were weaned after six months and most mothers sought help from the hospital when their children suffered from diarrhea.

Most residents did not treat water before drinking and mothers had poor hand washing habits at critical times. However, most households had latrines well maintained with few households lacking a latrine or toilet. Some residents share room with animals and poultry hence posing, increasing chances of unhygienic dwellings.

Most households had never received water treatment chemicals from the hospital or any organization as well as education on water safety and sanitation. Most households mentioned that they had adequate water but pointed out that their neighbors had little water for domestic use, all revealing that there was general shortage of water in this area. Some mothers also admitted that they did not adhere to the hygiene practices they had outlined as preventive measures to diarrhea hence posing a health risk to their children.

Recommendations

To the mothers and caregivers

- Properly monitor the exposure of children, especially the male in their environments to lower probable contacts with unhygienic environments.
- Mothers or caregivers should seek medication as soon as possible to reduce duration of diarrhea hence lower chances of adverse dehydration.
- Put up structures separate for animals and poultry to reduce risk of unhygienic environments.

To the County Public Health Department

- Conduct an Urban led Total Sanitation to sensitize the urban dwellers on the importance of sanitation including latrine construction and maintenance.
- Liaise with the ministry of health to ensure that water treatment chemicals are availed to the residents for water treatment as well as conduct education on water safety.
- Liaise with community health volunteers to sensitize the residents especially the mothers on the importance of adherence to hygiene practices like hand washing at critical times.
- Ensure adequate and safe water supply in collaboration with the ministry of water so as to improve access to water for the residents.

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