Understanding the Effects of Poor Sanitation on Public Health, the Environment and Well-being

Elgeyo Marakwet County - Report of research findings

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Executive Summary

Poor sanitation is linked to diarrhoeal diseases, which are among the leading causes of morbidity and mortality in children under five. It is also associated with a number of infectious and nutritional outcomes which have great bearing on the health and well-being of the child. This study was conducted to gain more insights into the effects of poor sanitation on public health, the environment and well-being in Elgeyo Marakwet County.

The case-control study findings show that the households from which a child with diarrhoea was recruited (case households) were more likely to be poorer than those in the control group: there were slightly more case group respondents in the poor quintile (34%) than in the control group (33%), and more households in the control group (15%) sought treatment in private facilities than those in the case group (11%). In addition, case families appear to be larger than control families, meaning there is a high likelihood of having congested living arrangements: 29.7% of the case families had seven family members or more sleeping in the homestead the night before the interview compared to 22% in the control group.

The results also suggest that more case households were, in general, exposed to higher risk of sanitation-related diseases than in the control group. According to the findings, slightly more households in the cases category had a family member who was treated for sanitation-related illness in the six months before the survey. For instance, 16.5% of the case households had a member treated for typhoid, compared to 13% in control, and similar trends were seen for skin and eye infections (5% compared to 4% in control group) and diarrhoea or stomach ache (four households compared to one household in the control group). This suggests that case households are more at risk of illnesses related to sanitation and that children in these households are at aggravated risk of diarrhoea and related negative health outcomes.

Children in the case group were more affected by **recurrent diarrhoea**

In terms of the observed health status of the child, the results show that children in the case group were more significantly affected by recurrent diarrhoea than those in the control group: 79% had suffered diarrhoea in the past two weeks, compared to only 10% in the control group. In addition, although the case group had older children (73% aged 1-4 years), they had a lower median weight at 10kg, compared to the control group at 11kg, indicating the likelihood of poor nutrition. Although mixed feeding was found to be common in both groups, more children in the control group (34%) were on exclusive breastfeeding than in the cases group (24%), suggesting that they were more exposed to risky feeding practices, which can contribute to increased risk of having diarrhoea.

Overall, more respondents in the control group (58%) had been exposed to messages on sanitation and hygiene than those in the case group (54%). Notably, more respondents in the control group (42%) had heard such messages when visiting a health facility compared to those in the case group (30%), indicating a possible link between exposure to messages and information on sanitation and hygiene and the child having diarrhoea.

In terms of water used by the households in the sample, the results indicate that there may be a link between the source, storage and treatment of water and with the child having diarrhoea. More control households used water from improved, protected sources than case households. Also, more case households (39%) stored water in an open container than in the control group (32%). Significantly, about 71% of the case households reported doing nothing with the water before drinking, compared to 56% of those in the control group, and only about 24% of the households in the case group reported boiling their water before drinking, compared to 38% of the control group.

The situation is aggravated by the finding that the public water points tested in this study were contaminated with a high presence of *Escherichia coli* (*E. coli*) and thus unfit for human consumption if untreated. Geographic information system (GIS) mapping of the locations of the cases and controls in relation to water sources, open defecation sites and pit latrines suggests that there may be a link between the proximity to open defecation sites and the likelihood of a child having diarrhoea.

11% caregivers **did not wash hands** after using the toilet

Caregivers' sanitation and hygiene habits were also found to be more at risk of spreading contamination among the case households than in control households. For instance, more respondents in the case households (11%) did not wash hands after using the toilet than in the control households (9%). In addition, more respondents in the case households used only water (45.6%) compared to control households (38.3%), meaning they were exposed to higher chances of contamination by faeces.

The county government in Elgeyo Marakwet can use these findings to address the issues raised and improve the sanitation situation in the county.

Focus Group Discussion

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List of Abbreviations

ADP	Annual Development Plan
CIDP	County Integrated Development Plan
CLTS	Community Led Total Sanitation
E. coli	Escherichia coli
FGD	focus group discussion
GIS	geographic information system
KSh	Kenyan shilling
MoH	Ministry of Health
ORS	oral rehydration solution
PHO	public health officer
SSH4A	Sustainable Sanitation for All
SNV	SNV Netherlands Development Organisation
URTI	upper respiratory tract infections
VIP	ventilated improved pit
V4CP	Voice for Change Partnership
WASH	water, sanitation and hygiene
WHO	World Health Organisation
WSP	Water and Sanitation Program

Chapter 1: Introduction

Globally, more than 700 million people live without an improved water source, and eight out of ten of these people live in rural areas. An estimated 2.5 billion people – over one third of the world population - lack access to improved sanitation facilities and a billion of these practice open defecation (WHO/UNICEF 2014), most of them in sub-Saharan Africa and Southern and Eastern Asia.

Millions of people suffer worldwide from diseases related to water, sanitation and hygiene (WASH) such as diarrhoea, skin diseases and trachoma. **Unsafe water, inadequate sanitation and poor hygiene are linked to 88% of diarrhoea cases worldwide and result in more than 1.5 million child deaths each year**, mostly among children under the age of five (WHO/UNICEF 2015).

In Kenya, diarrhoeal diseases are among the leading causes of morbidity and mortality in children under five, attributed to inadequate safe water, sanitation and hygiene. **Poor sanitation may be associated with a number of infectious and nutritional outcomes**, and these outcomes also cause a heavy burden of disease. Poor sanitation can adversely impact nutritional status in young children, not only through the impaired absorption of nutrients but through sub-clinical infections with faecal pathogens. Repeated and persistent infection may lead to environmental enteric dysfunction, a sub-clinical condition that can lead to growth faltering.

To gain more insights into the effects of poor sanitation on public health, the environment and well-being, **SNV Netherlands Development Organisation (SNV) commissioned this study in three counties in Kenya (Homa Bay, Kericho and Elgeyo Marakwet)** through its Voice for Change Partnership (V4CP) programme. This programme, implemented in collaboration with the Institute of Economic Affairs (IEA), complements SNV's Sustainable Sanitation & Hygiene for All (SSH4A) project which supports four counties in Kenya to improve access to new and improved sanitation and hygiene facilities: Homa Bay, Kericho, Elgeyo Marakwet and Kilifi. The research was conducted by the Centre for Population Health Research & Management (CPHRM).

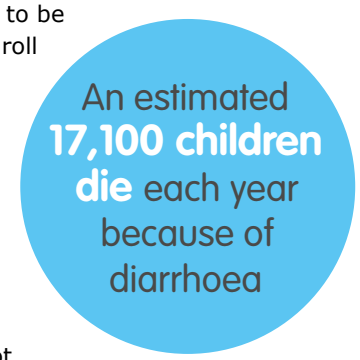
Study Area

According to the 2013-17 County Integrated Development Plan (CIDP), **Elgeyo Marakwet's** population was anticipated to grow by 2.7% annually from the 2009 census total of 370,712 people, with most of this population located in Keiyo North sub-county. An estimated 2.8% of the population live with disability and over half of the population is classified poor (57%), living below the poverty line:[1] this is a larger proportion that the national average of 46%. It is estimated that only 18% of Elgeyo Marakwet County residents have a secondary level of education or above.[2] Formal unemployment is high and only about 21% of those with a secondary level of education or above are working for pay. The county's economy is largely dependent on agriculture – crop farming, livestock production and fish farming - on which 76% of county's rural population depends.

The leading cause of ill health in Elgeyo Marakwet is upper respiratory tract infections (URTI), to which 46% of all cases of ill health per year are attributed.[3] Other causes include skin infections (32%), pneumonia (10.6%) and clinical malaria (2.4%). The HIV and AIDS prevalence in the county is about 2.5% (compared to 6.5% nationally) and tuberculosis (TB) prevalence is about 5.2%. An estimated 30% of all children aged under five are stunted, which has been attributed to the high poverty levels in the county.

1 Data from the 2013-17 Elgeyo Marakwet County Integrated Development Plan
2 Source: 2013 Exploring Kenya's Inequality – Elgeyo Marakwet County. KNBS and SIDS
3 Source: Elgeyo Marakwet County 2014/15-2018/19 HIV and AIDS Strategic Plan

Access to clean water and proper sanitation facilities is important in safeguarding the health of people and communities. Poor sanitation and unsafe drinking water are known to cause illness and death through diarrhoeal diseases. Although the county is currently implementing three new water supply projects[4] to expand coverage and improve sanitation and irrigation, access remains a challenge to a significant proportion of the population. In 2013, the study by KNBS and SID[2] estimated that only 37% of residents used improved sources of water, with the rest relying on unimproved sources. About half the population (51%) were classified as using improved sanitation. However, a different study in 2014 found that only 26% of the county's population had access to improved sanitation services and that 33% and 19% used unimproved sources and open defecation respectively.[5] Commitment to sanitation improvement is evident in the county plans: in the 2014 annual development plan (ADP), the health department was allocated finances for purchase of hand-washing demonstration units (suggesting existence of a sanitation and hygiene campaign) and water sampling kits to be distributed in the county.[6] In addition, the 2014 ADP contained budgeted activities to roll out Community Led Total Sanitation (CLTS) and technologies.



In Kenya, an estimated 19,500 people, including 17,100 children, die every year because of diarrhoea (WSP 2012). The impact of this inadequate sanitation on the well-being of the population in these counties and their ability to contribute to the counties' economic activities is expected to be profound and far-reaching. One study estimated that Elgeyo Marakwet County loses KSh 308 million each year due to poor sanitation-related causes, including losses due to time taken to access facilities, premature death, healthcare costs and hampered productivity.[6] However, the real effects of poor sanitation in the county are only partially understood and there has not been enough research to document the political, social and economic consequences associated with poor sanitation.

This study was conducted to contribute to the existing body of knowledge and generate information for the county to use, as well as to obtain data and information on the social, health, nutritional, economic, political and environmental effects of poor sanitation on different groups in the county.

The research studied the following aspects:

- The effects of poor sanitation on public health, the environment and well-being
- The social effects of poor sanitation on different groups (by age, gender and ability)
- The political role and economic cost of poor sanitation in the selected counties
- The effects of poor sanitation on the environment, such as on the quality of underground and surface water. The study obtained data on excreta management in the rural and urban areas of the county.

4 Source: https://www.delivery.go.ke/countyprojects/28
5 Ministry of Health and WSP. 2014. County Sanitation Profiles – Elgeyo Marakwet County
6 Source: 2015/16 Approved annual development plan for Elgeyo Marakwet County

Household toilet facilities

Chapter 2: Study Design and Justification

2.1 Methodology Overview

The research study used a mixed methods design that comprised a case-control quantitative study, qualitative interviews in the community (key informant interviews and focus group discussions), observation, review of health facility data on under-five morbidity and mortality and water sampling and testing.

Cases and controls were recruited at health facilities selected to achieve the required rate of recruitment and representation. Table 1 summarises the sample, by place of recruitment.

Table 1: Recruitment by facility type

	Total		Controls		Cases	
	n	%	n	%	n	%
Hospital	0	0.0	0	0.0	0	0.0
Health Centre	127	36.9	61	37.7	66	36.3
Dispensary	217	63.1	101	62.4	116	63.7
FBOS	0	0.0	0	0.0	0	0.0
Other (Specify)	0	0.0	0	0.0	0	0.0

Recruitment took place from Monday to Saturday. All children brought to the health facilities on these days and who were eligible for inclusion were recruited into the study.

What is a case-control design?

A case–control study is an investigation that compares a group of people with a disease (such as diarrhoea) to a group of people without the disease. It is used by epidemiologists to identify and assess factors that are associated with diseases or health conditions, with the ultimate goal of preventing such diseases.

A case–control study begins with a group of cases of a specific disease or condition. A group of people without that disease or condition is selected as control, or comparison, subjects. The investigator then seeks to compare cases and controls with respect to previous exposures to factors of interest. Information about prior exposure may be obtained by a variety of methods, including self-administered questionnaires, interviews and medical examinations.

In case–control studies, information about exposure is generally collected after the disease has already occurred. It looks back (retrospectively) to see if an exposure to something in particular (e.g. in the environment) was more likely in the group with the condition than in the group without.

Researchers trace backwards to identify possible exposures or factors that may have contributed to the condition. This study design helps determine if a previous exposure, such as sanitation status or environment, is linked to a current condition, such as having a disease (diarrhoea).

Cases were children under five years of age who presented to the participating health facilities with diarrhoea (as defined by the health worker, with a minimum requirement of three or more loose or watery stools in the previous 24 hours). Controls were children in the same age range who reported with any other infection or trauma but without diarrhoea.

After the child had been examined by a health worker, the parent or guardian was interviewed at the clinic using a structured questionnaire. Information on the child, the episode of illness, the family's access to water supply and sanitation facilities, household hygiene practices and a wide variety of socio economic variables was collected. In addition, all the cases and controls were visited at their homes and the parent or guardian who had been interviewed at the clinic was re-interviewed. The water and sanitation facilities available to the family and the general household conditions were also observed.

2.2 Sampling

The study used convenience sampling to select all children under five attending the selected health facilities from February 1-10, 2018.

Selection of cases

All diarrhoeal patients under five years of age admitted to the selected health facilities from February 1-10, 2018 were recruited into the study after their parents consented to participate. If the parent did not consent to the study, the child was not recruited. The consent form was read out to the parent or caregiver to confirm their understanding and willingness to participate in the study.

To ensure that cases selected for the study represented a homogeneous entity, a strict definition of diarrhoea was established. A case was defined as a child under five years of age having three or more episode of loose, liquid or watery stools or at least one bloody loose stool within 24 hours. In addition, the age of a child was verified by cross-examining the information provided in their health and vaccination cards.

Selection of controls

In this study, non-diarrhoeal patients under five years of age admitted to the selected health facilities from February 1-10, 2018 were selected into the study. The recruitment of controls was carried out after their parents consented to participate. The selection of controls who were attending the health facilities had some important practical and scientific advantages because they were easy to identify and readily available in sufficient numbers.

Inclusion criteria

All the children under five years of age attending the selected health facilities were eligible for the study. With respect to the parents of children recruited into the study, the mothers were best able to provide adequate information about the children and other variables surrounding the child's environment because the mothers spent more time with their children than did the fathers.

2.3 Data collection techniques

To obtain this information, the researchers used the following methods to collect information in Elgeyo Marakwet County:

- *Household surveys* (with informed consent) were held with the parents or guardians of the 344 children selected for follow-up, to establish the knowledge, attitudes and practices of the communities in relation to sanitation and hygiene. The researchers inquired about the number of children under the age of five who had ever died from water and sanitation-related diseases in the family; the cost of water and sanitation-related diseases in the family; how the family manages faecal matter; and about cultural norms surrounding sanitation that the family observed, among other issues. The interviews were conducted using a questionnaire.
- *Review of health facility data on children under the age of five:* The researchers also reviewed data from selected healthcare facilities in the county to identify the number of children under five seeking treatment for any illness; those treated for water and sanitation-related diseases; the number that have died; and specifically, those that have died from water and sanitation-related diseases.
- *Field interviews with selected informants:* The researchers held key informant interviews with local and national government officials and heads of water and sewerage companies to engage them in the research process, and to understand the WASH situation in each county from their perspective. The researchers also held focus group discussions (FGDs) with groups of residents in the research communities to gather more information on sanitation in the community and the management of human waste, among other issues. FGDs were also held with individuals who empty toilets (pit emptiers) in the communities, to explore management of waste and their perceptions about risk of water contamination, among other issues.
- *Water sample testing:* The researchers also collected water samples from all the sources that the households in the study were using, including water taps, water vendors, wells, boreholes, springs and tanks for collecting rainwater. The team used high quality testing kits to detect whether the water was contaminated by faecal matter, which poses a risk to human health (See Annex for full testing protocol).
- *Review of sub-county weekly epidemic monitoring data:* The researchers also conducted a review of health facility records and community health extension workers' weekly summary tool to identify areas prone to outbreaks of sanitation-related illnesses.

The study methods are summarised in Table 2 by study objective.

Table 2: Summary of data collection methods used in the study

Study objective	Focus & scope	Data collection approach
To examine the effects of poor sanitation on public health and nutrition	Analysis of all causes and water related causes of mortality in each county over the last six months	• Review of health facility records in sampled facilities - review of under-five all-cause mortality data in the sampled health facility and comparison of all-cause mortality to child mortality due to water and sanitation-related diseases
	Analysis of risk factors for diarrhoea for cases and controls	• A health facility interview and data review of caregivers of children under five who attended the health facility (using a health facility screening tool) • Anthropometric measures • Household survey • Focus group discussion on sanitation experience and emptying service within communities (focused on men and women – the elderly, young to middle-aged and opinion leaders) • Key informant interview guide for local and national government ministries and departments • Water quality assessment tool
To examine the social effects of poor sanitation on different groups	Analysis of social effect of poor sanitation on the following groups: • Children • Women • Persons with disability • Elderly	• Household survey • Focus group discussion on sanitation experience and emptying service within communities (focused on men and women – the elderly, young to middle-aged and opinion leaders) • Key informant interview guide for local and national government ministries and departments
	Analysis of epidemic data three months prior to the study Water testing for main sources of water in the epidemic zones	• Sub-county level review of weekly data related to (i) sanitation-related epidemic monitoring data collected weekly in the county through the sub-counties (ii) a review of community health extension workers' weekly summary tool • Water testing and analysis for main sources of water in the epidemic zones

Study objective	Focus & scope	Data collection approach
To examine the political role and economic cost of poor sanitation	Analysis of the political and economic cost of poor sanitation	• Household survey • Focus group discussion on sanitation experience and emptying service within communities (focused on men and women – the elderly, young to middle-aged and opinion leaders) • Key informant interview guide for local and national government ministries and departments
To examine the effects of poor sanitation on the environment (e.g. quality of underground and surface water) and obtain data on excreta management in the rural and urban areas of the county	Water analysis of underground and surface water Analysis of the excreta management in urban and rural areas of the county	• Household chorine and pH test, present and absence of coliform (using a water sampling and analysis monitoring form) • Faecal sludge management situational assessment tools • Key informant interview guide for the heads of water and sewerage companies; instructions to the participants • Key informant interview guide for local and national government ministries and departments
To establish trends during the devolution years and compare pre-devolution data with data obtained for the years since devolution	Qualitative analysis of the trends of sanitation-related epidemics pre- and during devolution Qualitative analysis of the trends of sanitation surveillance and epidemic reporting pre- and during devolution	• Key informant interview guide for local and national government ministries and departments • Desk review of documents
To evaluate the extent to which the sanitation activities as planned in the CIDP have materialised in the county	A policy analysis of the planning, funding and sanitation-related activities in the county	• Key informant interview guide for local and national government ministries and departments •

Chapter 3: Key Findings

3.1 Socio-economic status of selected families and household characteristics

The findings show that nearly all of the 344 respondents in the household survey (93%) were female (151 women in control and 170 in case group). Over half of the respondents were aged between 25 and 39 years. Most of the respondents in the control group were aged 30-39 years (35%) but the largest age segment in the case group was 25-29 years (37%). There were no notable differences in the other age ranges, with a small number aged under 19 years (7 in controls and 8 in case group) and over 50 years (2 respondents in controls and 4 in cases).

In both groups, the majority was married (87.5%) and the main occupation was farming (49%). There were more farmers in the case group (52%) than in the control (46%). Other occupations reported included self-employment (11.7% controls and 10.4% cases) and housewife (22% controls and 21% cases). A total of six respondents in both groups reported being disabled or living with a disability and seven were either too young to work or students. Over 70% had lived in the same location for over five years.

About a third of the respondents (31%) had completed primary school, with more control respondents (33%) in this category than cases (29%). Although a small proportion, slightly more respondents in the control group (4.3%) had no formal education compared to the control group (2.8%). This is shown in Table 3.

Table 3: Respondents' education attainment

Education Level	Total		Controls		Cases	
	n	%	n	%	n	%
No formal	12	3.5	7	4.3	5	2.8
Incomplete Primary	51	14.8	21	13.0	30	16.5
Complete Primary	106	30.8	53	32.7	53	29.1
Incomplete Secondary	59	17.2	30	18.5	29	15.9
Complete Secondary	89	25.9	36	22.2	53	29.1
College	26	7.6	14	8.6	12	6.6
Higher level	1	0.3	1	0.6	0	0.0

The respondents were almost evenly distributed across the three wealth quintiles: 115 (33%) were classified poor; 117 (34%) were in the middle quintile; and 112 (33%) were classified wealthy. There were slightly more case group respondents in the poor quintile (34%) than in the control group (33%). Over 90% of the households in both groups own livestock and agricultural land. The median income in the previous 12 months before the survey shows that households in the control group earned between KSh 10,000-55,000/-, while those in the control group earned between KSh 12,000-52,000/-. About 41% of the households in the control group and 39% of those in the case group had borrowed cash for food in the past month.

At least 90% of the total sample of respondents in both categories lived in their own homes, and most of the homes had either one or two bedrooms. Thirty-five percent of the total sample (37% control and 33% cases) lived in houses classified as temporary and more case families (56.6%) than control (52.5%) lived in semi-permanent houses. More case families (29.7%) had seven family members or more sleeping in the homestead the night before the interview than control group (22%), indicating they were larger families.

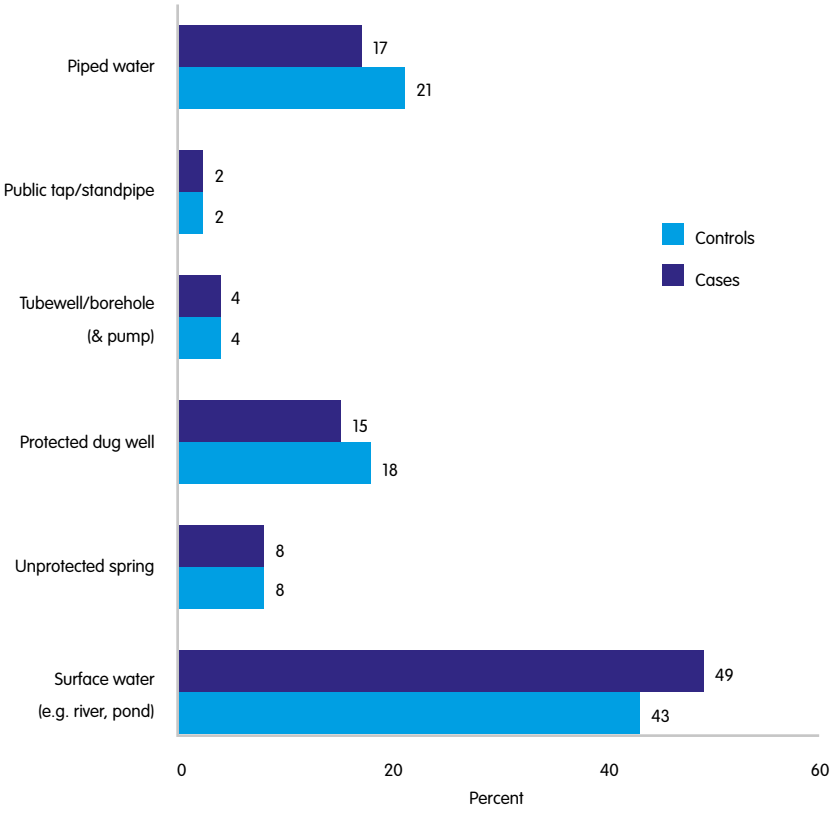
Household disease burden and healthcare-seeking behaviour

Prompt and appropriate health seeking is critical in the management of childhood illnesses. The respondents in the household survey were asked a range of questions to establish the disease burden in the household and healthcare seeking behaviour. Asked whether anyone in the household had sought treatment for illness in the previous six months, 89% of the respondents said yes. More respondents (89%) in the case group than control (83%) said a family member had sought medical treatment in the six months prior to the study. Most illnesses were reported to have occurred in the wet and dry seasons, with more occurring in the wet season in both groups.

Only 17% of all respondents said they had a family member suffering chronic illness and taking medicine regularly, with more of these in the control group (26%) than the case group (17%). In 24 households (10 in controls and 14 in cases), the respondent said that a family member had been diagnosed with a disability. More households reported having a family member diagnosed with asthma or chronic respiratory illness in the control group (6.2%) than in the case households (3%) and for eye infections it was 5% of controls and 3% of cases. There were very low reported cases of cardio-vascular illnesses and diabetes in both groups.

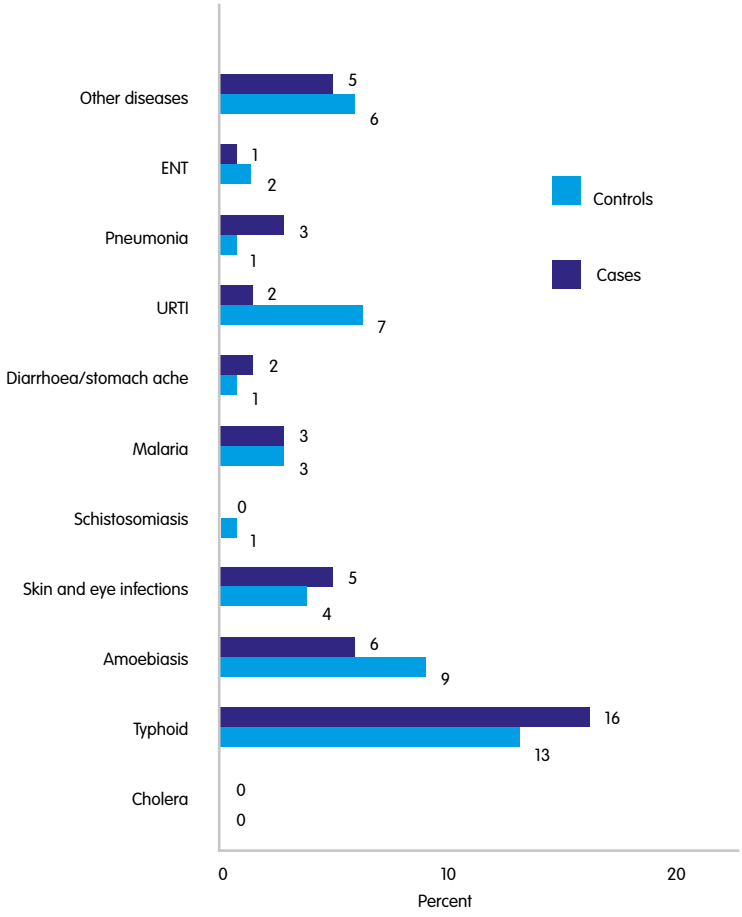
An examination of the household healthcare-seeking patterns shows that over 80% (in both groups) sought treatment from public facilities. More case households (89%) than control households (81%) sought treatment in public facilities. Conversely, more households in the control group (15%) sought treatment in private facilities than those in the case group (11%). Several households were self-prescribing or buying medicines over the counter: nearly 10% bought medicine from the pharmacy or used local herbs and 5% got medicine from the local shops (Figure 1). On average, the households in the control group spent more on treatment of illness on the most recent visit (KSh 1500, within a range of KSh 200-2000) than the households in the case group (KSh 500, in a range of KSh 200-1500), possibly due to their higher use of private facilities.

Figure 1: Where families sought assistance last time they were sick



Respondents were also asked whether any family members had sought care in the six months prior to the study for a range of diseases that included those related to sanitation (cholera, typhoid, amoebiasis, skin and eye infections and schistosomiasis). The results show that while the incidence of disease was generally low in this community, sanitation-related illnesses were the most common reason the community sought treatment (Figure 2).

Figure 2: Illness for which family member sought treatment in the past six months

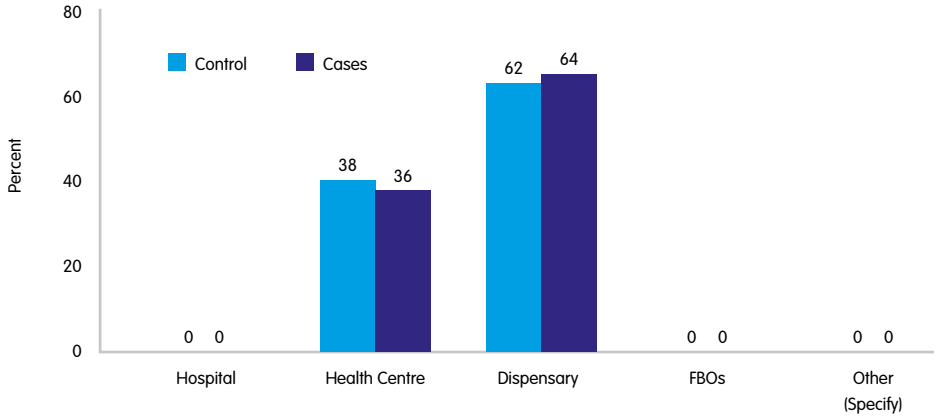


As illustrated in Figure 2, slightly more households in the case category had a family member who was treated for sanitation-related illness than in the control group. For instance, 16.5% of the case households had a member treated for typhoid, compared to 13% in controls, and similar trends were seen for skin and eye infections (5%, compared to 4% in control group) and diarrhoea or stomach ache (four households compared to one household in the control group). This suggests a possible link between the incidence of diarrhoea in children and poor sanitation at household level. As with spend on all illnesses, families in the control group spent more on treatment of diarrhoea on the most recent visit (KSh 600-1500) than the cases group (KSh 200-1450). Again, this may be related to the type of facility from which the treatment was obtained.

3.2 Effects of poor sanitation on public health, the environment and well-being

The research study examined a range of factors related to the health of children in the sample, to draw conclusions regarding their well-being. The study screened and recruited 344 children aged under five (162 in the control group and 182 in the cases group). Of the 344 children, 52% were boys and 48% were girls. The case group had more boys (57%) than the control group, and there were more girls in the control group (52%). In terms of age, 32% were under one year and 68% were aged between one and four years. Thirty-seven percent of the children in the control group and 26% in the case group were under one year old, while 63% in the control group and 73% in the cases were aged between one and four years. Over 60% were being treated at a dispensary at the time of recruitment in the study, as illustrated in Figure 3.

Figure 3: Proportion of children in study sample by type of facility



a) Effects of poor sanitation on child morbidity and mortality

The study collected data to make conclusions on the relationship between poor sanitation and observed health status of the child. The findings support the need for focus on prevention of diarrhoea as part of an overall public health strategy for improving child health and nutrition.

In terms of weight, the results show that although the case group had older children (73% aged 1-4 years), they had a lower median weight at 10 kg, compared to the control group at 11 kg. Other health status indicators were more or less the same for both groups: the median height was around 80cm and the median measurement of the upper arm circumference was 14mm.

Cases had a **lower median weight**, suggesting malnutrition.

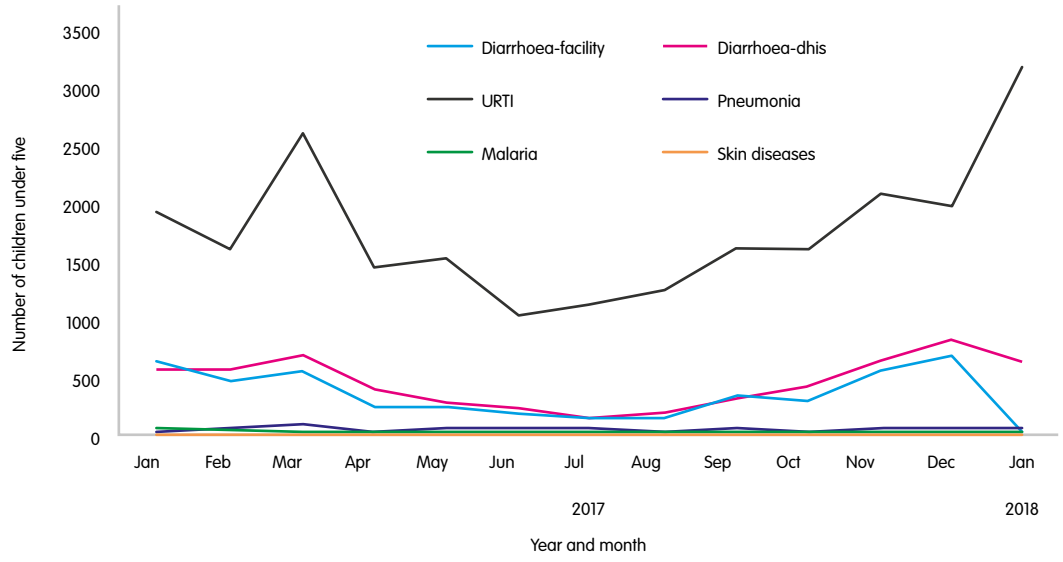
The children in the case group were also more significantly affected by diarrhoea compared to the ones in the control group: 79% had suffered diarrhoea in the previous two weeks, compared to only 10% in the control group, as illustrated in Table 4. This suggests that the children in the case group were prone to recurrent diarrhoea.

Table 4: Reported incidence of diarrhoea two weeks before survey and how it was managed

Child characteristic	Total		Controls		Cases		p-value
	n	%	n	%	n	%	
Diarrhoea in past two 2 weeks							
Yes	160	46.5	17	10.49	143	78.57	<0.001
No	183	53.2	144	88.89	39	21.43	
Don't know	1	0.3	1	0.62	0	0	
Child received ORS supplement							
Yes	122	76.3	11	64.71	111	77.62	0.237
No	38	23.8	6	35.29	32	22.38	
Child received Zinc supplements							
Yes	88	55.0	4	23.53	84	58.74	0.006
No	72	45.0	13	76.47	59	41.26	

Data drawn for this study from the Ministry of Health (MoH) DHIS database and facility for 2017 show that diarrhoea is the second most common illness for children aged five years and under after URTI (Figure 4).

Figure 4: Leading causes of under-5 morbidity in Elgeyo Marakwet County

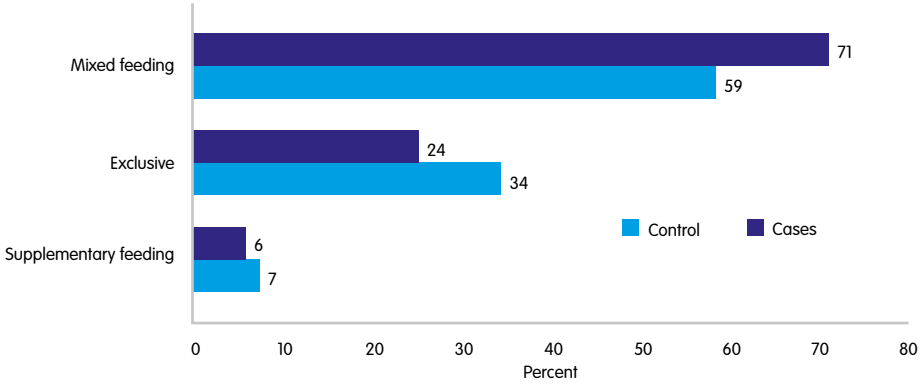


b) Risk factors associated with child diarrhoea among the study population

Infant feeding practices

The household survey respondents were also questioned regarding the feeding practices for all children who were aged below six months in both control and case households. The results show that over half the children in the sample were receiving mixed feeding (59% in the control and 71% in the case group). However, more children in the control group (34%) were on exclusive breastfeeding than in the case group (24%). These data suggest that the children in the case category were more exposed to risky feeding practices that can contribute to increased risk of having diarrhoea.

Figure 5: Reported infant feeding practices (under 6 months old)



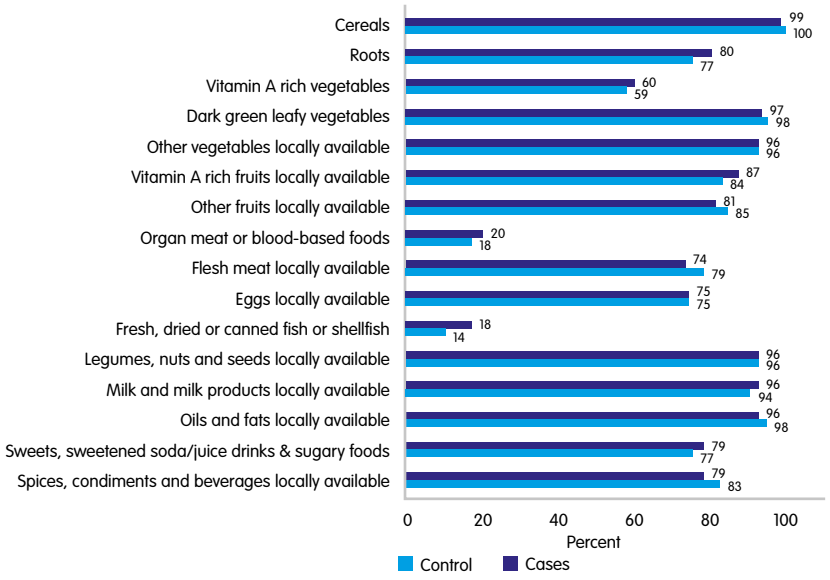
Women's Focus Group Discussion

Household nutrition practices

According to the household survey results, over 80% of the households in both groups produce their own food, with only 7.4% in the control and 5.5% in the case group reporting that they purchase food. Three households (all in control group) reported that their main source of food was gathering or eating wild fruits. In over 90% of the households in both groups, family members have three meals or more per day. Only six respondents said that a member of their family did not eat at home the previous day. Asked why, one respondent said the family member was sick and one said that that the food was not suitable for the family member, while the rest took meals elsewhere.

Figure 6 illustrates the most commonly eaten foods in the sample households. Nearly all households in both groups ate cereal-based food, dark green leafy vegetables and other locally available vegetables, milk, nuts, legumes, oils and fats, with almost no difference between the control and case groups, except in the consumption of fish (18% case families ate fish, compared to 14% of the controls).

Figure 6: Type of food eaten by household members in last seven days



Although the proportions are small, the results show that some households had altered their food habits to cope with inadequate supply in the previous month. Over 10% of the respondents said that household members ate wild foods (12.4% control and 13% cases), as illustrated in Table 5. More case families skipped meals for an entire day (4%) or borrowed food (19%) than control households (2.5% and 16.7% respectively).

Table 5: Coping strategies adopted by household in the last one month

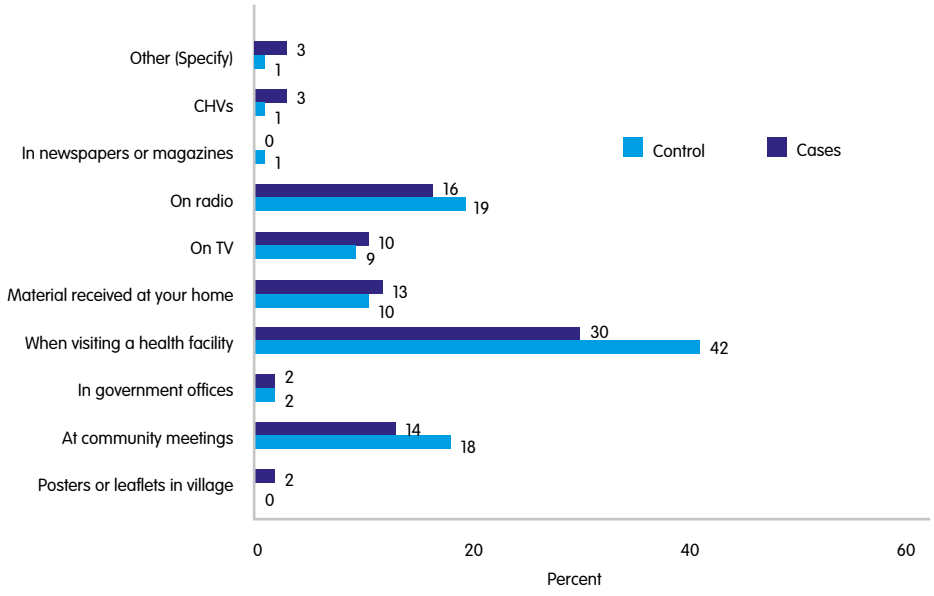
	Total		Controls		Cases	
	n	%	n	%	n	%
Reduce the number of meals per day	26	7.6	13	8.0	13	7.1
Skip food consumption for an entire day	11	3.2	4	2.5	7	3.9
Reduce size of meals	38	11.1	20	12.4	18	9.9
Restrict consumption of adults to allow more for children	16	4.7	9	5.6	7	3.9
Borrow food from a friend or relative	62	18.0	27	16.7	35	19.2
Purchase food on credit	144	41.9	68	42.0	76	41.8
Consume wild foods (normal wild food)	44	12.8	20	12.4	24	13.2
Sell livestock	20	5.8	9	5.6	11	6.0
Sell household goods	15	4.4	10	6.2	5	2.8

SAFI latrine Demo site installation in Kaptarakwa ward

Exposure to sanitation messages and information

Household respondents were also asked questions to gauge their exposure to common sanitation and hygiene messages. The findings show that the majority saw, heard or received messages on sanitation and hygiene at a health facility, on radio or at a community meeting, but more than six months before the survey. Overall, more respondents in the control group (58%) had been exposed to messages on sanitation and hygiene than those in the case group (54%). Notably, more respondents in the control group (42%) heard such messages when visiting a health facility compared to those in the case group (30%), suggesting a possible link between exposure to messages and information on sanitation and hygiene and the child having diarrhoea.

Figure 7: Where respondent saw, heard or received sanitation messages



Most of the messages heard by all those in the sample who reported hearing any (55.8%) were about washing hands with soap, treating drinking water and using a latrine, as illustrated in Table 6.

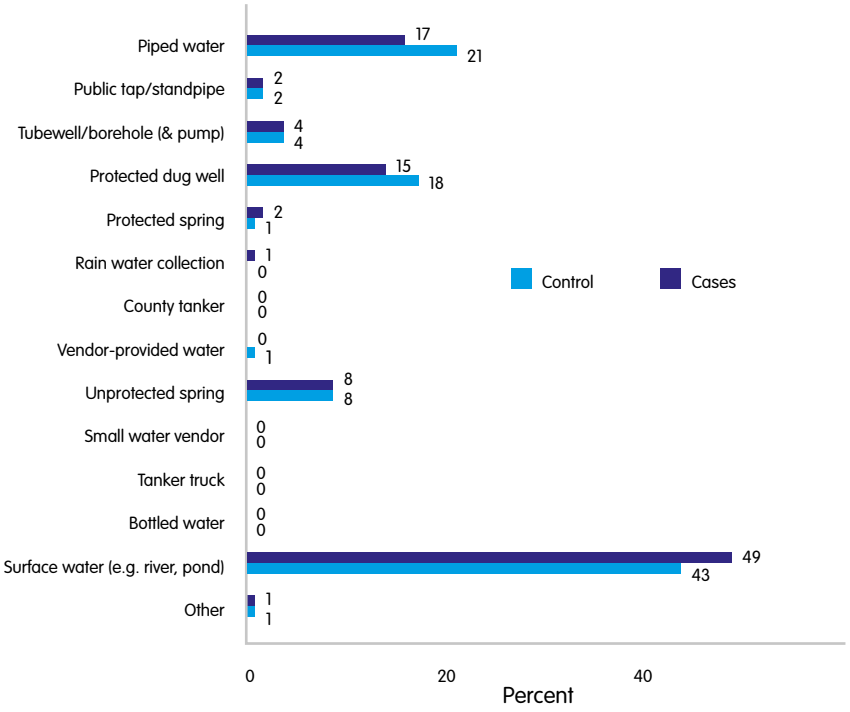
Table 6: Sanitation and hygiene messages seen, heard or received

	Controls		Cases	
	n	%	n	%
Build a latrine	19	11.7	29	15.9
Latrine use / stop open defecation	52	32.1	51	28.0
Safe disposal of infants' faeces	32	19.8	23	12.6
Wash hands with soap	77	47.5	76	41.8
Treat drinking water	67	41.4	56	30.8
Wastewater management	4	2.5	5	2.8
Proper solid waste disposal	8	4.9	13	7.1

Quality of household water

The study classified common water sources into improved and unimproved. Under improved sources are piped water, public tap and tube well, borehole with pump and protected wells and springs. Among unimproved water sources are unprotected wells and springs, water provided by small vendors and all surface water (rivers and ponds). The research findings show that nearly half of the households in the sample used surface water as their main water source (43% controls and 49% cases). More control households used water from improved, protected sources than case households. For instance, 21% and 18% of control households use piped water and protected wells respectively, compared to 17% and 15% of case households. Most of the families used the same source of water all year round. Of those who were not satisfied with their current water source, 42% in the control group and 49% in the cases group said they were concerned about the "bad quality" of the water.

Figure 8: Main sources of drinking water for study sample (%)



For the majority of respondent households, the water source was less than two kilometres away. Over 60% of the households in both groups stored the water in a closed container or jerry can. Thirty-nine per cent of the case households stored the water in an open container compared to 32% of the control households.

Treatment of water at home before drinking is equally as important as the source in preventing water-borne diseases. The respondents were asked what their families did with the water at home before drinking. The results indicate that a large proportion did nothing to the water: about 71% of the case households reported doing nothing compared to 56% of those in the control group. In addition, only about 24% of the households in the case group reported boiling their water before drinking, compared to 38% of the control group. Very few households in both groups reported using chlorine to treat the water (5.6% control and 4.4% cases). These results suggest that the families in the case group were more exposed to water that may be contaminated, leading to the observed diarrhoea in the children.

Table 7: At-home water treatment in the sample households

Do you do anything to your water before drinking?	Total		Controls		Cases	
	n	%	n	%	n	%
Chlorination	17	4.9	9	5.6	8	4.4
Boiling	105	30.5	61	37.7	44	24.2
Pot filter	1	0.3	1	0.6	0	0.0
Strain through a cloth	1	0.3	0	0.0	1	0.6
Solar disinfection	0	0.0	0	0.0	0	0.0
Traditional herb	0	0.0	0	0.0	0	0.0
Let it stand and settle	9	2.6	6	3.7	3	1.7
Nothing	220	64.0	91	56.2	129	70.9
Other	0	0.0	0	0.0	0	0.0
Don't know	0	0.0	0	0.0	0	0.0

The study analysed water quality at point of consumption to determine the proportion of household water samples passing the designated water safety quality threshold.[1] The research team analysed 146 water samples for free chlorine levels and presence and absence of coliform. This involved using a quick and simple kit for testing chlorine residual. The Colilert test involves introducing an enzyme powder to 100 ml of water. After an incubation period of 24 hours, a positive result is indicated by a change in colour from yellow to magenta.

In Elgeyo Marakwet, the results showed 12.4% of the control group had treated water at the tap stands with free residual chlorine levels at an ideal range of 0.6-1.5 mg/L and pH of 7.4-7.6. While the Colilert test indicated that for case households, 53.3% tested positive, indicating possible presence of faecal or animal waste contamination. Further observation of the water indicated that 58.2% of the cases used water which was either turbid, had a smell or was coloured.

Table 8: Results of household water sample testing

	Total		Controls		Cases	
	n	%	n	%	n	%
Ideal values [0.6-1.5 Cl; 7.4-7.6pH]	43	12.5	20	12.4	23	12.6
Low values [Coli lert test done]	103	29.9	50	30.9	53	29.1
Unclassified water	198	57.6	92	56.8	106	58.2

1

Caregivers' hygiene habits: hand washing and toilet use

The hygiene habits of a child's caretaker are an important factor in preventing hygiene-related infections. The study examined household respondent's hand-washing habits, because unwashed hands after toilet use contribute significantly to faecal contamination of food and water. Respondents were asked about instances in the previous 24 hours when they had washed hands, and what they washed their hands with. The research team also made physical observations around the home for hand washing facilities.

The majority of respondents in both groups reported washing hands after toilet use: 87.6% of the control group respondents and 90% of the cases said they had washed hands after toilet use in the past 24 hours (Table 9). More respondents in the case households (11%) had not washed hands after toilet than in the control households (9%). Less than a quarter of the respondents in both groups reported washing hands after taking a child to the toilet (24% controls and 22% cases).

Table 9: Respondents' reported hand washing after toilet use in the past 24 hours

	Total		Controls		Cases		p-value
	n	%	n	%	n	%	
After toilet	306	89.0	142	87.7	164	90.1	
Before cooking	124	36.1	59	36.4	65	35.7	
Before eating	264	76.7	132	81.5	132	72.5	p= 0.050
After taking children to the toilet	79	23.0	39	24.1	40	22.0	
Other	8	2.3	3	1.9	5	2.8	

It is important to wash hands with soap or other detergent after toilet use to be completely clean. The household respondents were asked what they had used to wash their hands in the 24 hours before the survey. The results show that more respondents in the case households used only water (45.6%) than in the control households (38.3%), meaning they were exposed to much higher chances of contamination by faeces, as illustrated in Table 10.

Table 10: What the respondents used to wash hands with after using toilet in the past 24 hours

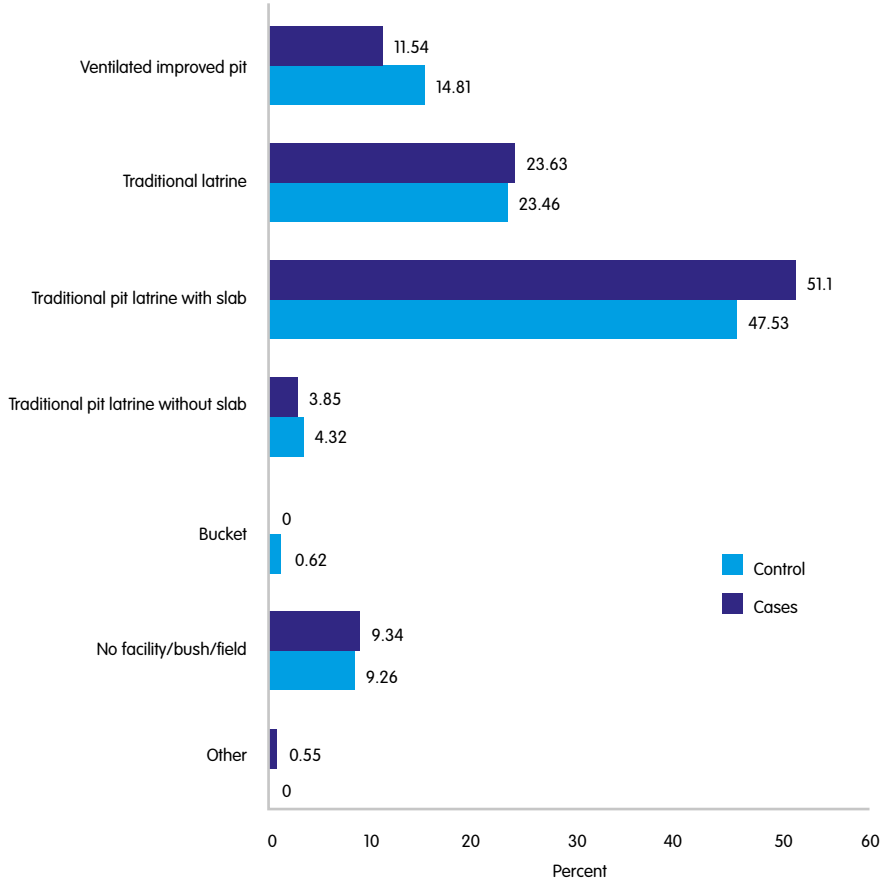
	Total		Controls		Cases	
	n	%	n	%	n	%
Only water	145	42.2	62	38.3	83	45.6
Soap and water	176	51.2	89	54.9	87	47.8
Soap when I can afford it	23	6.7	11	6.8	12	6.59
Traditional herb	0	0.0	0	0.0	0	0
Other (Specify)	0	0.0	0	0.0	0	0

Observation around the household by the research team found that in more households in the control group (40.7%) there was some evidence of a hand washing provision (bucket / jug / kettle, tippy tap, leaky tins) compared to the case group (35.7%). In 47.5% of the households in the control group, and 48.3% in the case group, no hand washing provision was observed. In addition, the researchers did not observe any soap or other detergent or hand washing product at the hand washing facility in 70% of the control households and 81% of the case households in which the respondent had said that they used soap or detergent to wash hands after toilet use. This suggests a high likelihood that the majority of families in both groups are not using soap or detergent to wash hands after toilet, with most of these in the case category, which may explain the incidence of diarrhoea in the child.

Type of sanitation facilities used by the households and faecal waste containment

The findings show that the most common sanitation facilities used by both groups are traditional pit latrine with slab, traditional latrine and ventilated improved pit (VIP) toilets. Both groups of households used similar toilet facilities: there were no significant differences in their use of either improved or unimproved toilets. More control households (14.8%) used VIP toilets than case households (11.5%), and about 9% of the families in both groups had no facility (use open defecation), as shown in Figure 9. No households reported being connected to the formal sewerage system or having flush toilets with septic tanks.

Figure 9: Type of toilet used by sample households



Over 60% of the families in both categories did not share toilets (65% controls and 64% cases). Slightly more households in the control group (10.2%) used a communal toilet (three or more households) than in the case group (6.7%).

Temporary toilets are all the residents can afford

FGDs with members of the community revealed perceptions in the community that improved latrines are used by the rich only, as they can afford the resources to construct a cemented slab and are few in number. The poor use the unimproved toilets due to the "prohibitive" cost of timber and construction cost. The toilets are constructed using locally available materials, which include timber castoffs and polythene bags and sacks for the superstructure.

"It is true not every family has a wooden latrine due to the cost involved in the construction, as such the majority of the community members in this area mostly use a pit latrine with a maize stalk super structure and a polythene bag as a door. This is because many families cannot afford material such as timber or iron sheets since they are expensive." (Respondent 2, FGD, Elgeyo Marakwet)

"The majority of community members here use a pit latrine with super structure constructed of cheap and locally available material such as wood and maize stalks. But there are some who are rich who use a pit latrine with cemented slab and wooden timber super structure and door. But they are very few in this community." (Respondent 3, FGD, Elgeyo Marakwet)

Subsequently, temporary toilets are thought to be common in the community because these are what the residents can afford. Some participants also felt that temporary toilets are preferred because of insecurity in the area, which makes investing in a more permanent structure infeasible.

"Many use pits latrines with structures constructed of leaves and maize stocks as they are cheap and easy to find, especially people living in areas prone to fighting since they can be moved any time due to insecurity. Hence, they construct temporary latrines and vita ikitokea wao wanahama [when fighting erupts, they move away]." (Respondent 3, FGD, Elgeyo Marakwet)

It appears from the FGDs and the household survey findings that in the research area, there are no sewer line connections, so families use pit latrines. It was reported in the FGDs that large institutions and schools use on-site septic tanks.

"Sometimes during the rainy season some people empty their sewer water outside, especially during the night."

Disposal of faecal waste

Most of the respondents in the household survey said they were aware that children's stools were harmful (89.5% control and 91.8% cases). Only 29 of the 344 respondents said they were not aware (9.3% control and 7.7% cases). Asked how they disposed of a child's stool, the majority in both groups said they put it, or rinsed it off, in the toilet or latrine (80.3% control and 76.9% cases), signifying that the majority of the households safely disposed of the child's stool. In 13 of the households, the respondents said that the child used the toilet or latrine, in 11 households the stool was buried and in 15 it was thrown into the garbage, as illustrated in Table 11.

Table 11: Household management of children's stools

	Total		Controls		Cases	
	n	%	n	%	n	%
Child used toilet or latrine	13	3.8	5	3.1	8	4.4
Put or rinsed into toilet or latrine	270	78.5	130	80.3	140	76.9
Buried	11	3.2	5	3.1	6	3.3
Thrown into garbage	15	4.4	6	3.7	9	5.0
Put or rinsed into drain or ditch	26	7.6	13	8.0	13	7.1
Left in the open	3	0.9	0	0.0	3	1.7
Other	4	1.2	3	1.9	1	0.6
Don't know	2	0.6	0	0.0	2	1.1

Survey respondents were asked questions regarding how the household manages filled-up pit latrines. Over 80% of the respondents said the toilet had never filled up (85.5% control and 86.3% case group). Of those that said the toilet ever filled up, they all (in both groups) reported that it had never over-flowed and that when it filled up it was closed or sealed. Asked if the toilet had been emptied in the past 1-2 years, 88% of the respondents in the control group and 87% in the case group said it had not, while the rest said they did not know if it had ever been emptied.

SAFI latrine production hub in Biretwo (Soy North ward)

In the FGDs, participants reported that when toilets fill up in the community, they are either abandoned and new ones constructed, or left to subside then re-used. The latrine is considered full when the faecal matter becomes visible, at about two feet, according to the participants. FGD participants reported that large institutions and commercial establishments such as hotels and schools empty pit latrines and septic tanks, usually hiring licensed exhauster services to empty and deliver the sludge for treatment in Eldoret town. Public toilets in town are sometimes emptied by private individuals hired for the task.

"[Home toilets are not emptied, but there are people who are hired to empty public toilets in the market. They discard waste in open drains]. We are forced to cover [the ditches]." (Respondent 2, FGD, Elgeyo Marakwet)

FGD participants complained that the exhauster services sometimes dumped the untreated sludge carelessly along the highways at night and during transportation.

"The honeysucker tanker is the common method. There is the possibility of unscrupulous attendants emptying the tanker in the forest." (Respondent 2, FGD, Elgeyo Marakwet).

"The tanker sometimes bursts on its way due to too much pressure because of long distances from Iten to Eldoret sewer plant." (Respondent 3, FGD, Elgeyo Marakwet).

An analysis of faecal sludge management in the county conducted in this study shows that about 57% of the faecal sludge in the county is safely managed, while the rest is not. The county does not appear to have off-site sanitation services. Of the 57% safely contained on site, only 1% is emptied and delivered to a treatment plant. About 30% of faecal matter is not contained and ends up in the environment, including 19% deposited directly through open defecation (Note. Validation of county faecal sludge management is ongoing and will be detailed and published as a Shit Flow Diagram Report).

In the FGDs, participants explained that some people defecate in the open when latrines are very far from their working areas and also because it has no cost.

"Many families use the bush and thickets. In market centres, polythene bag are used by those without toilets and where toilets are few and far apart and some people with low income such as hawkers do not have money to pay for these facilities." (Respondent 8, FGD, Elgeyo Marakwet)

"They mostly defecate along river banks, for example during daily activities like drawing water and firewood fetching." (Respondent 3, FGD, Elgeyo Marakwet)

Participants also expressed beliefs that the use of forests, rivers and bushes for open defecation is an old and common custom among the Marakwets.

"[…] open defecation has been practiced for many years in this community without any problems." (Respondent 9, FGD, Elgeyo Marakwet)

Small children are also allowed to defecate in the open even when latrines are available, with views expressed that their stool is not considered a big bother or risk.

Water source

3.3 Social effects of poor sanitation on different groups

This study sought to establish if there are any factors that contribute to poor sanitation among some groups in the community and the effects of such discrimination or exclusion. Overall, the results show that there is little social exclusion or discrimination in terms of toilet use in this community, and the only groups that may be affected are the elderly and those living with disability (PLWDs).

Household respondents were asked whether there were any reasons or occasions that barred some household members from using the household toilet. The results show that there are no occasions when a family member is not allowed to use the household toilet, and that the toilets are used equally by all members of the household, including the elderly and children, as illustrated in Table 12.

Table 12: Use of the household toilet by group

	Total		Controls		Cases	
	n	%	n	%	n	%
Children	309	89.8	145	89.5	164	90.1
Elderly	230	66.9	105	64.8	125	68.7
Disabled	79	23.0	39	24.1	40	22.0
Women	311	90.4	147	90.7	164	90.1
Men	306	89.0	144	88.9	162	89.0

In the FGDs, some of the discussion suggests that there may be restrictions in using a common toilet in the community, although this is not widely acknowledged. For instance, some participants suggested that women should not share toilets with men during their menstruation and should have their own toilet, and others said that local culture prohibits sharing of toilets between in-laws. However, it was felt that having segregated toilets on the same compound was not practical.

"… women sometimes need privacy, for example, during their menstrual period because they may not feel comfortable sharing a toilet with men and children. But due to poverty, families cannot construct separate latrines for the two genders. We need your support to provide latrines for women in the community." (Respondent 3, FGD, Elgeyo Marakwet)

Discussing who should be involved in the construction of toilets, FGD participants said that people living with a disability should be, suggesting that, although not expressly mentioned, this group faces exclusion in using the common facilities.

"People with disabilities should be involved so that they can suggest a design suitable for the nature of their disability."

Household respondents were also asked questions to gauge whether there were any security-related issues or other considerations that may affect the ability of some household members to use the toilet, thus contributing to poor sanitation. The results show that in the majority of cases in both groups, security may not be an issue and that the toilet is accessible all the time. In the majority of both groups, the toilet was located either in its own dwelling or within the yard, and only in about 13% of the cases (11.7% controls and 13.7% cases) was it located elsewhere. For the majority, the toilet was accessible all the time (night and day) (71.6% controls and 65.9% cases).

3.4 Political role and economic cost of poor sanitation in the selected counties

The ripple effect of sanitation-related illness on farming and income generating activties was discussed in Elgeyo Marakwet. The fact that an adult takes on additional responsiblities when a child is unwell or an adult has severe sanitation illness has a negative impact on their ability to perfom their other responsiblities and impacts on income.

Most women reported it would be impossible for husbands to take up casual jobs when engaged with a baby. One woman noted: *"My husband is a casual worker. When my children are sick and I'm at the hospital he cannot take up a job as he will need to take care of the other children and animals".* Consequently, both men and women agreed that such disruption affected agricultural activities not only because of loss of labour but also because the adults now had to juggle farming work and their additional household reponsiblities.

The qualitative findings demonstrate the cost associated with management of faecal sludge for large institutions in the county. Hotels and other large institutions are forced to transport faecal waste to Eldoret sewer plant. The owners of such institution reported the transportation as expensive and an increasing operational cost. One man explained: *"The owner of the latrine is the one who is tasked with the emptying of the facility when it is full. A tanker is contracted to do the emptying by the owner of the latrine. It cost between KSh12, 000 – to KSh 15, 000 to empty a toilet".*

The majority of men and women participating in the FGDs said that the cost of emptying and transportation varies based on the size of the septic tanks requiring emptying. One male pit emptier reported: *"It is sometimes charged according to the size of the septic tank but on average is KSh 15,000. The most common faecal sludge transport is the tanker from the private sector. However, there are those who empty their toilets into the environment. The risk of this mode of transport is leakage along the way".*

3.5 Effects of poor sanitation on the environment

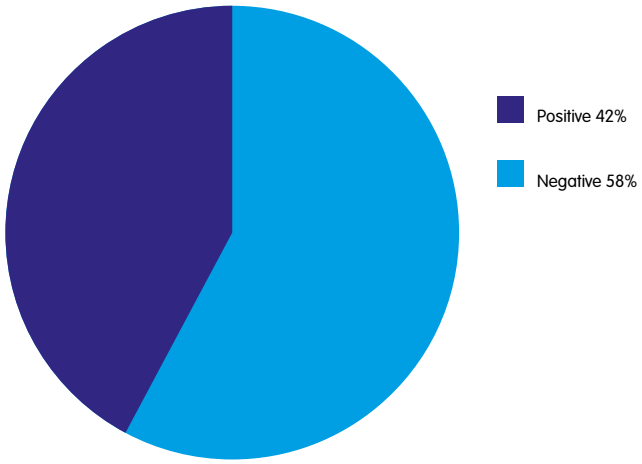
Poor disposal of human waste or excreta can contaminate the environment, contributing to poor health outcomes. The researchers analysed the effects of poor sanitation on the environment, to establish if poor faecal matter management had affected the quality of the water. Samples were collected of the water in some of the rivers and other public water sources in Elgeyo Marakwet County. The results revealed that the public water points tested were contaminated with a high presence of *E. coli*, as shown in Table 13, and thus is unfit for human consumption if untreated.

Table 13: Results of tests on public water sources

Site sample taken	# Coliforms in 100ml of untreated water	# (#Coliforms) in 100 ml of untreated water	Comments
Chesoi	>1800	425 (>1800)	Unsatisfactory for Human Consumption
Kapteren Village in Keiyo North	>1800	4 (>1800)	Unsatisfactory for Human Consumption
Kapsoinar Ward	>1800	6 (>1800)	Unsatisfactory for Human Consumption
Simotwo Village	>1800	4 (>1800)	Unsatisfactory for Human Consumption

Water used for human consumption was collected as tested at household level. Over 40% of the water tested from households tested positive for *E. coli*.

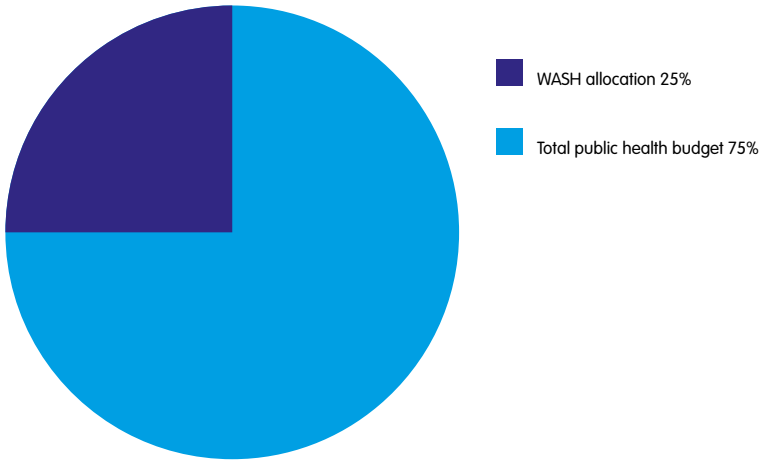
Figure 10: Results of tests for E. coli in household water



3.6 Trends during the devolution years

This study included an assessment of policy, legal and implementation issues facing counties as they seek to expand sanitation services. The results are summarised in the following sections. The study examined the sanitation-related budget for each county as demonstrated in Figure 11.

Figure 11: WASH budget allocation



The planning process is an integral part of the development process. The CIDP reflects the strategic midterm priorities of the county governments. The CIDP contains specific goals and objectives, a costed implementation plan, provisions for monitoring and evaluation and clear reporting mechanisms. It contains information on investments, projects, development initiatives, maps, statistics and a resource mobilisation framework. In Elgeyo Marakwet, issues related to sanitation feature in two key sectors: health and sanitation and environment, water and natural resources. In the health and sanitation sector, the county CIDP does not mention issues of sanitation as a sector priority. In particular, the CIDP identifies various health sector initiatives that will further improve health service delivery while sustaining the replicable health practices already in place. The health initiatives that the CIDP seeks to emphasise include: improvement and upgrading of health facilities; service delivery enhancement; community health strategy; efficient drugs and commodities management strategy; and cemeteries and mortuaries. While the other health issues are important, a focus on sanitation should be integrated into the next phase of preparation of the CIDP.

WASH strategies **have not been included in the CIDP**

The major waste disposal and sanitation facilities in Elgeyo Marakwet County are pit latrines. With growing urbanization, there is need to put in place proper sewerage treatment systems so as to cope with the rapid expansion.

The CIDP identified the following targets to be achieved by 2017:

- Develop four sewerage and treatment systems
- Put in place WASH strategies that will enable the county to achieve 100% latrine coverage
- Develop legal frameworks for use of septic tanks in human waste disposal systems.

Findings from interviews with the county leadership demonstrate that the county has put in place the WASH strategies, but they have not been included in the CIDP. The public health activities are anchored under the health and sanitation policy and the water policy. The county has a draft health and sanitation policy guided by the national guidelines that focuses on issues such as solid management at point of collection disposal. The draft policies indicate the responsibility at different levels, i.e. national, county and stakeholder levels.

"The county is also developing sanitation bills which are undergoing legislations at the county assembly and securing budgets to support sanitation activities." (KII, CPHO, Elgeyo Marakwet)

Policy gaps in the implementation of sanitation included gender and disabilities, which are not sufficiently incorporated into the policies and guidelines.

"A lot needs to be looked at as many disability needs are not met by the counties, for example in toilet facilities. In the area of women, some improved though not fully, for example, in the county assembly no one was elected and those who are there are only nominated. This is to show men have all decision making. In sanitation and hygiene, women are doing more than men in their homes." (KII, CPHO, Elgeyo Marakwet)

The sewerage is not in place while the legal frameworks are under development. The county does not have faecal sludge management policy at the moment. The county implementers reported a lack of the policy while the community reported a lack of the services.

"As a county we lack a faecal sludge management policy." (KII, CPHO, Elgeyo Marakwet)

"On sewer connectivity there is none in the county. On septic tanks we have some in peri urban and urban areas of the county." (KII, CHMTs)

One woman in a FGD reported: *"In Elgeyo Marakwet household are not connected to the sewer network, the majority of the population use latrines".*

Another man reported: *"The government has not constructed a sewer network, and before they can construct it they should ensure we all have proper latrines that can be connected to the sewer. Those people who have toilets use septic tanks hence a sewer is not necessary for now".*

Key implementation challenges reported include coverage of latrines in the county. Currently the coverage is reported to be low. The large proportion of land is covered by forests and timber millers and farmers near the working areas lack access to latrines thus practice open defecation.

"Coverage in terms of latrine provisions is still low. Most timber millers who work in the forest and in plantations lack latrines. This increases open defecation." (KII, CPHO, Elgeyo Marakwet)

Another challenge reported was low WASH budgets affecting planning and execution of activities. The county WASH activities are underfunded, funding is inconsistent and they lack partners to support implementation of the work. One key factor reported to contribute to the low funding was poor planning of the project priority targets by the ministry in charge of the department.

The survey results show that the percentage of households with access to improved sanitation in the County is 86.05%. In 2017, the percentage of households with access to improved sanitation in the County was 86.3%. This demonstrates a stagnation of households with improved sanitation facilities in the last year.

Table 14: Improved sanitation facilities vs Unimproved sanitation facilities

	Total		Controls		Cases	
	n	%	n	%	n	%
Unimproved	23	14.20	25	13.74	48	13.95
Improved	139	85.80	157	86.26	296	86.05
Total	162		182		344	

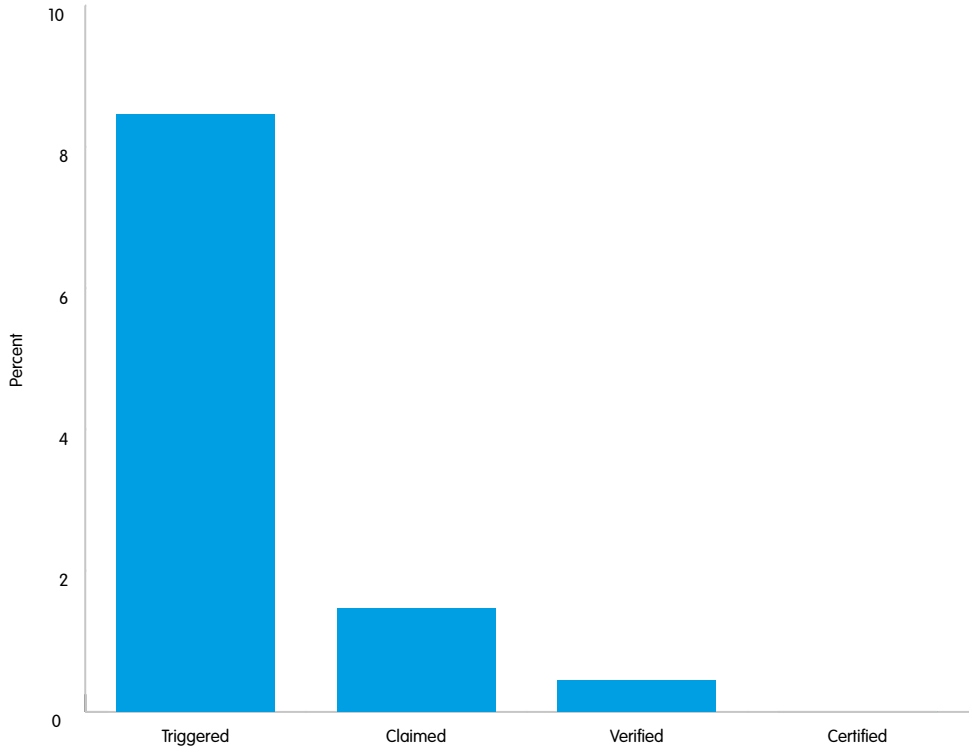
OR=0.81, 95%CI: 0.56 - 1.91 p-value = 0.902

Table 15: Trends of CLTS implementation in Elgeyo Marakwet

	Keiyo North			Keiyo South	Marakwet East	Marakwet West	Sub-county Unassigned
Indicator	2016	2017	2018	2016	2016	2016	2016
Triggered	66	8	22	33	4	36	21
Claimed	46	7	15	8	2	11	6
Verified	20	6	5	2		4	2
Certified		2					

The results show a poor performance of the CLTS implementation. The data was further compared to results presented in the Second Sanitation Conference in 2017 by Elgeyo Marakwet County. In 2017, the number of triggered and claimed villages were higher than 2018. Out of the 1225 villages in Elgeyo Marakwet, only 190 villages were reported as triggered in May 2018. This could imply incomplete data entry into the CLTS system.

Figure 12: ODF status in Elgeyo Marakwet as of May 2018



Community members taking lead in social mapping during a CLTS triggering session in Marakwet East sub-county.

Chapter 4: Conclusions and Recommendations

This study was conducted to gain more insights into the effects of poor sanitation on public health, the environment and well-being in Elgeyo Marakwet County. Poor sanitation is linked to diarrhoeal diseases, which are among the leading causes of morbidity and mortality in children under five. Poor sanitation is also associated with a number of infectious and nutritional outcomes which have great bearing on the health and well-being of the child.

With the support of this study, SNV, through the SSH4A project, aims to support Elgeyo Marakwet County to learn from the findings and take steps to improve its sanitation and hygiene activities.

The findings show that more of the households from which a child with diarrhoea was recruited (case households) were poorer than those in the control group. There were slightly more case group respondents in the poor quintile (34%) than in the control group (33%), and more households in the control group (15%) sought treatment in private facilities than those in the case group (11%). In addition, case families appear to be larger than control families, meaning there is a high likelihood of having congested living arrangements. In the study, 29.7% of the case families had seven family members or more who had slept in the homestead the night before the interview, compared to 22% in the control group, indicating they were likely to be larger families.

The results also suggest that more case households are exposed to higher risk of sanitation-related diseases than control households. According to the findings, in the six months before the survey, slightly more households in the case group had a family member who was treated for sanitation-related illness. For instance, 16.5% of the cases households had a member treated for typhoid, compared to 13% in the control group. Similar trends were seen for skin and eye infections (5%, compared to 4% in control group) and diarrhoea or stomach ache (four households compared to one household in the control group). This suggests that, in general, case households are more at risk of illnesses related to sanitation, and that children in these households are at aggravated risk of diarrhoea and related negative health outcomes.

In terms of the observed health status of the child, the results show that the children in the case group were more significantly affected by recurrent diarrhoea compared to those in the control group – 79% had suffered diarrhoea in the past two weeks, compared to only 10% in the control group. In addition, although the case group had older children (73% aged 1-4 years), they had a lower median weight at 10 kg, compared to the control group at 11 kg, indicating likelihood of poor nutrition. Although mixed feeding was found to be common in both groups, more children in the control group (34%) were on exclusive breastfeeding than in the cases group (24%) suggesting that they were more exposed to risky feeding practices that can contribute to increased risk of having diarrhoea.

Overall, more respondents in the control group (58%) had been exposed to messages on sanitation and hygiene than those in the case group (54%). Notably, more respondents in the control group (42%) heard such messages when visiting a health facility compared to those in the case group (30%), suggesting a possible link between exposure to messages and information on sanitation and hygiene and the child having diarrhoea.

In terms of water used by the households in the sample, the results also suggest there may be a link with the source, storage and treatment of the water and the child having diarrhoea. More control households used water from improved, protected sources than case households. Also, more case households (39% vs. 32%) stored the water in an open container. Significantly, about 71% of the case households reported doing nothing with the water, compared to 56% of those in the control group, and about 24% of households in the case group reported boiling their water before drinking, compared to 38% of the control group. The situation is aggravated by the finding that the public water points tested in this study

were contaminated with a high presence of *E. coli* and thus is unfit for human consumption if untreated. GIS mapping of the location of the cases and controls in relation to water sources, open defecation sites and pit latrines suggested that there may be a link between the proximity to open defecation sites and the likelihood of a child having diarrhoea.

Caregivers' sanitation and hygiene habits were also found to be more at risk of spreading contamination among the case households than in control households. For instance, more respondents in the case households (11%) did not wash hands after using the toilet (9% in control households). In addition, more respondents in the case households used only water (45.6%) than in the control households (38.3%), meaning they were exposed to higher chances of contamination by faeces.

The following recommendations can be made in view of these findings, for implementation by the Elgeyo Marakwet County government and partners implementing sanitation projects in the county:

- **Set up an initiative to mobilise the community to build improved toilets** to reduce the risk of water and environmental contamination through poorly disposed of faeces and open defecation. As shown in the findings, more of the households from which a child with diarrhoea was recruited were poorer than those in the control group. In the FGDs, the participants said that the community builds temporary toilets because of the perceived cost of building an improved one. Increasing the coverage of improved sanitation facilities in the community will reduce the risk of contamination and the resultant negative outcomes for children. Such an initiative requires that the county government increases the allocation to sanitation services in the annual budget, adopts the right policies and takes steps to mobilise more resources from the civil society partners active in the county.
- **Strengthen public awareness and education about sanitation and hygiene** and the risk posed by poor sanitation to the health and well-being of young children. The results have demonstrated that exposure to messages on sanitation and hygiene may be related to a child having diarrhoea, as more respondents in the control group (58%) had been exposed to such messages than those in the case group. Such public education and awareness initiatives should address personal hygiene habits and especially the need to wash hands with soap after the toilet in order to reduce contamination.
- **Address the high incidence of mixed feeding for children younger than six months**, who should still be on exclusive breastfeeding. The results show that more children in the control group were on exclusive breastfeeding than in the case group. This suggests that mothers of young children may not be getting the right information regarding child nutrition. The county government with its partners need to address this.
- **Health care providers should closely observe children presenting with diarrhoea** and link their families with community health workers for monitoring and support at home to address sanitation and prevent recurrent episodes. The results show that the children in the case group were significantly affected by recurrent diarrhoea compared to those in the control group.
- Ensure that the public water sources are treated appropriately to ensure the water is fit for human consumption. The results of this study suggest there may be a link between the source, household storage and treatment of the water and the child having diarrhoea. In addition, the public water points tested in this study were contaminated with a high presence of E.coli and thus are unfit for human consumption if untreated. The results also showed that nearly half of the faecal sludge is unsafely contained. To address this situation, the county government needs to ensure all public drinking water is treated, and appropriate measures taken to reduce the potential of contamination through poorly disposed of or contained faecal sludge. In addition, the government should consider expanding the sewerage system in densely populated areas.
- **The current CLTS reporting is incomplete** and therefore the current data cannot be used for monitoring or to improve programming. There is a need to build the county capacity to ensure completion of data entry.

Annex: Water testing protocol used in this study

WATER ANALYSIS

The national microbiology reference laboratory (NMRL) is a public health laboratory in the division of national public health laboratory services. The laboratory's mandate is to offer reference microbiology services and oversee all quality assurance programmes for microbiology.

SAMPLING PROCEDURES

Microbiological samples:

Microbiological samples should be collected in sterile plastic or glass bottles which NMRL supplies. NMRL supplies 100 ml sterile glass bottles. A sample volume of 200 ml should be sufficient for Faecal coliform and E. coli count.

Chemical analysis:

- Keep sample bottles closed until they are to be filled.
- Collect a sample that will be representative of the water being tested.
- Remove the cap of the bottle and ensure no contamination of cap or the neck of the bottle when filling occurs.

Potable water:

Apply the procedures as described above. Never sample leaking taps where water runs down on the outside of the tap. When collecting water from wells and boreholes, pump water for 5 minutes when a pump is fitted. When sample locations for a distribution system are identified, include dead-end sections and all the different lines in the sample programme.

Waste and effluent water:

Sampling frequency may be seasonal for recreational waters, daily for water supply intakes and even hourly for waste water where the quality may vary tremendously. Hold the sample bottle near its base in one hand and plunge it mouth downward below the surface of the water. This is especially important when sampling from a dam: never sample water from the surface.

Sample size:

Sample volume should be sufficient to carry out all tests required. A sample volume of 750 ml should be sufficient.

Sample identification:

Samples must be sufficiently identified. Important information that could be included for identification are:

- sampling date
- sampling time
- origin of sample
- type of sample.

Sample preservation and storage:

Although recommendations vary, the time between sample collection and analysis should, in general, not exceed six hours, and 24 hours is considered the absolute maximum. It is assumed that the samples will be immediately placed in a lightproof insulated box containing melting ice-packs with water to ensure rapid cooling. Sample temperature should be kept below 100C for a maximum transportation time of six hours. If ice is not available, the transportation time must not exceed two hours. It is imperative that samples are kept in the dark and that cooling is rapid.

Test	Turnaround time (days)	Charges
Water bacteriological analysis	7	2000

For more information on these findings, see:

Understanding the Effects of Poor Sanitation on Public Health, the Environment and Well-being. Report of a study conducted in Homa Bay, Elgeyo Marakwet and Kericho counties in Kenya. 2018.

Distribution of Diarrhoea and Associated Factors in Elgeyo Marakwet County - A Geospatial Analysis

Poor Sanitation is Key Contributor to Diarrhoea in Children in Elgeyo Marakwet County (Poster)

F-Diagram - Elgeyo Marakwet County

Elgeyo Marakwet County Shit Flow Diagram Report

Further information

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