REPUBLIC OF KENYA

KITUI COUNTY GOVERNMENT

MINISTRY OF HEALTH AND SANITATION

KITUI COUNTY INTEGRATED SMART SURVEY REPORT

JUNE. 2023

Supported By

ACKNOWLEDGMENT

Kitui County government would like to express its heartfelt appreciation to the organizations and individuals who contributed to the planning and execution of the Nutrition SMART survey. We extend our gratitude to:

- The County Ministry of Health and Sanitation for their leadership, technical support, provision of secondary data, and coordination throughout the survey.

- The National Nutrition Information Working Group for their invaluable technical support during the survey process.

- WFP, World Vision, UNICEF, NDMA, USAID Advancing Nutrition, and the Kenya Red Cross Society (KRCS) for providing financial resources and technical assistance, which were instrumental in facilitating the successful implementation of the survey.

- Both County and National Government Administrations for their unwavering support during the survey period.

- The Kitui County Respondents for their cooperation and the information they provided throughout the survey.

- Finally, our heartfelt appreciation goes to the Survey Team for their dedication and hard work in ensuring the collection of high-quality data during this exercise.

EXECUTIVE SUMMARY

The Kitui County Ministry of Health and Sanitation, in collaboration with partners and the Nutrition Information Technical Working Group (NITWG), conducted a county-wide SMART survey covering all eight sub-counties in June 2023. The primary objective of the survey was to assess the nutritional status of two key demographic groups: children aged 6-59 months and women of reproductive age (15-49 years) in Kitui County.

The specific objectives of the survey were as follows:

- To determine the prevalence of malnutrition among children aged 6-59 months.
- To assess malnutrition levels among women of reproductive age using Mid-Upper Arm Circumference (MUAC) measurements.
- To evaluate immunization coverage for measles, Oral Polio Vaccines (OPV 1 and 3), and vitamin A supplementation among children aged 6-59 months.
- To estimate the coverage of iron/folic acid supplementation during pregnancy among women of reproductive age.
- To assess de-worming coverage for children aged 12 to 59 months.
- To determine the prevalence of common illnesses among children under five.
- To collect information on potential underlying causes of malnutrition, including household food security, water, sanitation, and hygiene practices.
- To establish the minimum dietary diversity for women of reproductive age.
- To assess Minimum Meal Frequency, Minimum Acceptable Diet, and Minimum Dietary Diversity among children aged 6-23 months.
- To estimate the Crude Mortality Rate (CMR) and Under-Five Mortality Rate (U5MR) for the County.

This is the information about the Standardized Monitoring of Relief and Transitions (SMART) methodology survey conducted in Kitui County in 2023. Here's a summary of the key findings and conclusions:

1. **Survey Overview**:
    - Two-stage cluster sampling was used to select a sample of 335 children aged 6-59 months from 680 households in 48 clusters.
    - Household-related data was collected, including food security, livelihoods, water sanitation, hygiene, and access to healthcare services.
    - The survey was conducted from May 29th to July 18th, 2023, with development, approval of the methodology, data collection, analysis, dissemination at the county level, and validation at the national level by NITWG.
2. **Nutrition Status**:
    - The prevalence of Global Acute Malnutrition (GAM) in the county was 6.1%, with a 95% confidence interval of 3.8% to 9.6%.

- The severe acute malnutrition (SAM) rate was 0.3%, with a 95% confidence interval of 0.0% to 2.2%.
- The prevalence of GAM was slightly higher than the prevalence observed in the Kenya Demographic and Health Survey (KDHS) of 2022 (4.9%).

3. **Common Illnesses**:
    - Common illnesses reported by households included ARI/cough (33.73%), fever with chills resembling malaria (15.22%), watery diarrhea (4.78%), and other illnesses (5.67%).
    - ARI/cough was the most frequently mentioned illness.
4. **Vitamin A Supplementation**:
    - Vitamin A supplementation for children aged 6-11 months was at 72.5%, slightly below the national target of 80%.
    - For children aged 12-59 months, the supplementation rate was 88.47%.
    - The combined Vitamin A supplementation for children aged 6-59 months was at 86.57%, exceeding the national target.
    - However, only 46.1% of children aged 12-59 months received Vitamin A supplementation twice a year.
5. **Nutrition Situation**:
    - The nutrition situation in Kitui County was classified as IPC phase 2 (stressed) according to WHO classification for the severity of the nutrition situation.
    - There was a significant increase in the rate of malnutrition.
    - Risk factors for acute malnutrition, including chronic food insecurity, poor child care practices, low dietary diversity, and poor sanitation and hygiene, need to be addressed as part of a comprehensive recovery strategy in the county.

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ABBREVIATIONS & ACRONYMS

BCG	Bacillus Calmette–Guérin
CHMT	County Health Management Team
CI	Confidence Interval
CSG	County Steering Group
CSI	Coping Strategy Index
COVID19	Corona Virus Disease 2019
ENA	Emergency Nutrition Assessment
EPI	Expanded Program on Immunization
EWS	Early warning System
FSL	Food Security and Livelihood
GAM	Global Acute Malnutrition
HAZ	Height for Age Z-score
IDP	Internally Displaced Persons
IFAS	Iron Folate Supplementation
IMAM	Integrated Management of Acute Malnutrition
IPC	Integrated Phase Classification
KNBS	Kenya National Bureau of Statistics
MAM	Moderate Acute Malnutrition
MUAC	Mid Upper Arm Circumference
NDMA	National Drought Management Authority
NIWG	Nutrition Information Working Group
ODK	Open Data Kit
OPV	Oral Polio Vaccine
PPS	Probability proportional to size
PLW	Pregnant and Lactating Women
SAM	Severe Acute Malnutrition
SD	Standard Deviation
SMART	Standardized Monitoring and Assessment in Relief and Transitions
UNICEF	United Nations Children's Fund
VAS	Vitamin A supplementation
WASH	Water Sanitation and Hygiene
WAZ	Weigh for Age Z-score
WFP	World Food Program
WHO	World Health Organization
WHZ	Weight for Height Z-score

1. INTRODUCTION

1.1 Background Information

Kitui County is located in Kenya and covers an area of 30,496.5 square kilometers. It shares borders with seven other counties, including Tharaka Nithi and Meru to the North, Embu to the Northwest, Machakos and Makueni to the West, Tana River to the East, and Taita Taveta to the South. The county's estimated population is 1,234,568 persons as projected from the 2019 Census. This population figure serves as a reference point for various development and planning activities in the county. Kitui County is characterized by three major livelihood zones:

- Marginal Mixed Farming: This zone covers 44% of the total population and likely represents areas where farming conditions are challenging.
- Mixed Farming: Covering 52% of the population, this zone suggests a mix of agricultural activities and potentially more favorable farming conditions.
- Formal/Unskilled Employment: This livelihood zone, covering 4% of the population, may indicate areas with a significant presence of formal job opportunities or unskilled labor as a primary livelihood source.

The county has faced crop failure in successive seasons, including the short rains in 2020, the long rains in 2021, and the long rains in 2022. These failures were attributed to poor rainfall performance, which can have a significant impact on agricultural productivity and food security in the region.

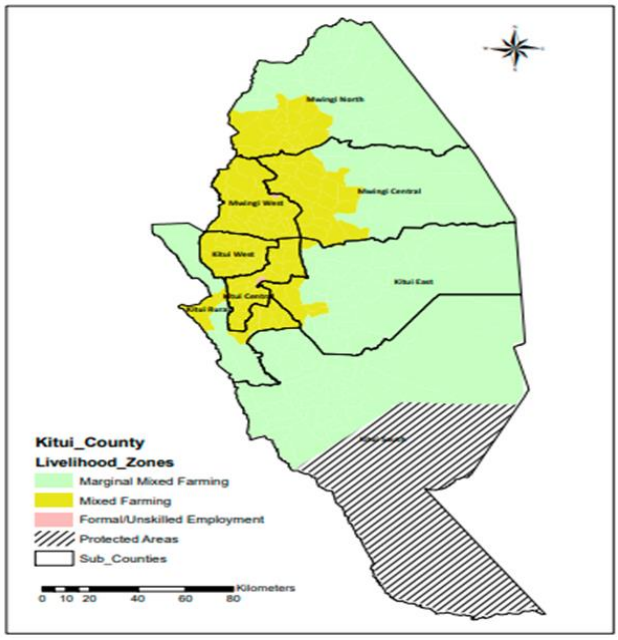

Figure 1: Kitui County Zones

The County has had relatively high rates of chronic malnutrition with a reduction from 45.8% in 2014 to 25.1% in 2022 is a notable improvement. Below charts demonstrate admission trends in outpatient therapeutic program (OTP) and supplementary feeding program (SFP)

OTP admissions **SFP admissions**

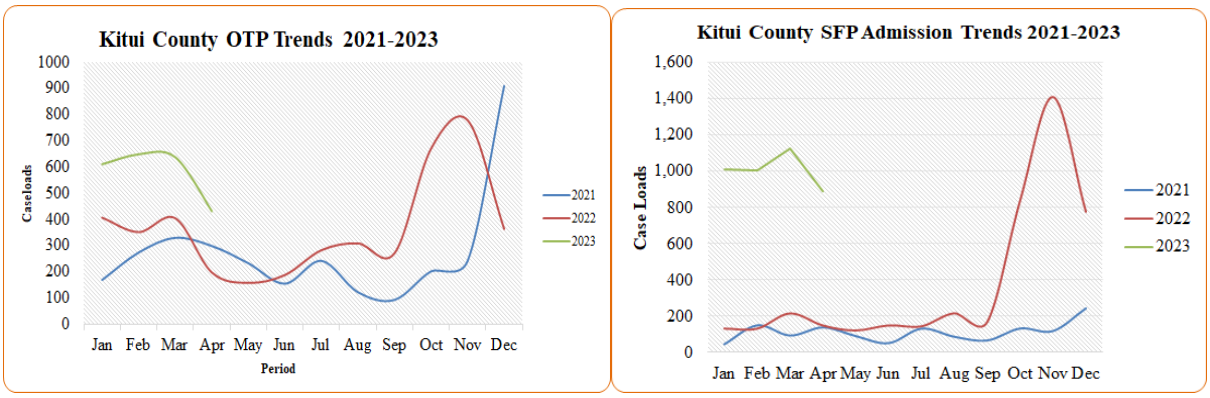

Figure 2: Child Malnutrition Trends 2021-2023

The county has 123 mapped integrated outreach sites, and 80 of them (65%) are operational. Integrated outreach sites are essential for reaching communities with nutrition and healthcare services. There are 165 operational IMAM health facilities in the county. These facilities play a crucial role in identifying and treating cases of acute malnutrition. By April 2023, SAM proxy coverage as a proportion of the annual target was at 87.83%. This indicates that nearly 88% of the annual target for severe acute malnutrition cases had been reached. Additionally, the coverage as a proportion of annual caseloads was at 65.88%, suggesting that nearly 66% of the expected cases had been covered. By the end of April 2023, MAM proxy coverage as a proportion of the annual target was at 99.6%, indicating that nearly 100% of the annual target for moderate acute malnutrition cases had been reached. The coverage as a proportion of annual caseloads was at 199.3%, indicating that coverage exceeded the expected caseload by almost double.

1.2 Survey Justification

The county has consistently been classified as being in IPC AMN Phase 3 "Crisis Phase" in both the 2022 Short Rains Assessment (SRA) and the 2022 Long Rains Assessment (LRA). This classification signals a persistent issue of acute malnutrition among children under five years old. Conducting a survey is essential to monitor the situation more closely and understand the underlying causes. The absence of a SMART survey since November 2016 means that there has been a significant gap in obtaining up-to-date and accurate data on the nutrition status in the county. Nutrition situations can change over time, and it's crucial to have current information to inform policy and intervention decisions effectively. The National Drought Management Authority's (NDMA) Early Warning System (EWS) bulletin for April 2023 indicates that the

county is in the recovery phase. This shift in classification underscores the importance of conducting a survey to validate and quantify the extent of this recovery. It's vital to confirm whether the improvements mentioned in the bulletin are reflected in the actual nutrition data on the ground.

1.3 Survey Objective:

The main survey objective was to assess the nutrition status of children aged 6-59 months and women of reproductive age (15-49 years) in Kitui County.

1.3.1. Specific Objectives:

1. The Prevalence of Malnutrition: To determine the prevalence of malnutrition among children aged 6-59 months, which is crucial for understanding the nutritional status of this vulnerable age group.
2. To assess malnutrition levels among women of reproductive age using Mid-Upper Arm Circumference (MUAC) measurements, which can indicate the nutritional status of women.
3. To determine the coverage of important vaccinations, including measles, Oral Polio Vaccines (OPV 1 and 3), and vitamin A supplementation in children aged 6-59 months, ensuring that children are receiving essential immunizations.
4. To estimate the coverage of iron and folic acid supplementation during pregnancy in women of reproductive age, which is essential for maternal and child health.
5. To assess the coverage of de-worming treatments for children aged 12 to 59 months, which is important for addressing parasitic infections.
6. To determine the prevalence of common illnesses among children under five, providing insights into the health status of this age group.
7. To collect information on potential underlying causes of malnutrition, such as household food security, water, sanitation, and hygiene practices, which helps identify factors contributing to malnutrition.
8. To establish the minimum dietary diversity among women of reproductive age, assessing the variety of foods consumed in their diets.
9. To assess the Minimum Meal Frequency, Minimum Acceptable Diet, and Minimum Dietary Diversity for children aged 6-23 months, which are important indicators of child nutrition.
10. To estimate the Crude Mortality Rate (CMR) and Under-five Mortality Rate (U5MR) for the County, which provide critical information on mortality trends and the overall health of the population.

1.4 Survey Timing

The survey was conducted towards the start of the dry season, in the month of June 2023 as shown in table 1. The results of the survey will be used in the LRA 2023.

Table 1: Survey Timing

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Dry Season			Long Rain			Dry Cool Season			Short Rains-		

2.0 METHODOLOGY

The use of SMART methods is recognized and widely accepted in the field of nutrition assessment. These methods ensure consistency, reliability, and comparability of data collected across different regions and time periods. The inclusion of concurrent data sets on Water, Sanitation, and Hygiene (WASH) and Food Security and Livelihood (FSL) alongside nutrition data provides a holistic understanding of the living conditions and factors contributing to nutrition outcomes. This comprehensive approach is crucial for designing targeted intervention. The survey was conducted in strict adherence to guidelines set by the Ministry of Health (MoH) at both the county and national levels. This demonstrates a commitment to following established protocols and ensuring data accuracy and quality. Presenting the survey methodology to the County Nutrition Technical Forum (CNTF) and the National Nutrition Information Working Group (NIWG) for validation is a best practice. It ensures that the methodology is reviewed and approved by relevant experts and stakeholders, enhancing the credibility of the survey. Proper planning and rigorous training of survey teams are essential components of data collection. This ensures that data collectors are well-prepared to carry out the survey and collect accurate and reliable data. Field testing is an important step to fine-tune data collection tools and procedures. It helps identify and address any issues or challenges that may arise during the actual data collection process. Data entry and analysis are critical steps in transforming raw data into meaningful insights. Following standardized procedures for these tasks ensures that the data is processed accurately and can be used effectively for decision-making.

2.1 Survey Area

There are a total of 8 sub counties in Kitui County, the survey therefore covered the entire area.

Table 2: Survey Area (the Kitui County's sub counties)

No	Survey area (sub counties)
1	Kitui Central
2	Kitui South
3	Kitui East
4	Kitui West
5	Kitui Rural

No	Survey area (sub counties)
6	Mwingi West
7	Mwingi North
8	Mwingi Central

2.2 Anthropometry sample size calculation

The Sample size was determined using ENA for SMART software, 2020 (Version January 11 2020). The table 3 below summarizes the sample size calculations.

Table 3: Sample size calculation for anthropometric

Parameter	Kitui County	Rationale
Estimate (GAM)	4.9%	As derived from the KDHS 2022 report. County is in recovery phase hence SRA IPC AMN thresholds may not be feasible.
Desired Precision	3.0%	Rule of the thumb (Generally do not expect high rates of GAM).
Design Effect	1.5	Rule of thumb.
Estimated Number of Children	325	As per ENA output.
Average HH Size	4.4	From the 2019 census report.
Non-Response Rate (%)	3	
Proportion of Children Under 5	11.95	From KNBS 2019 Census report.
Estimated Number of Households	708	As per ENA output.
Number of Households per Day	15	From previous experience, teams can cover as most of the area is not sparsely populated.

2.3: Mortality sample size calculation

Table 4 below provides a rationale for calculating sample size for mortality:

Table 4: Sample size Calculation for Mortality

Parameter	Kitui County	Rationale
Estimate death rate	**0.41**	KNBS 2019
Desired Precision	0.3	Rule of the thumb
Design Effect	1.5	Rule of thumb
Recall Period(days)	**77**	Based on Good Friday and the midpoint of data collection which was 21.5 giving 77.7 days
Non-Response Rate (%)	3	
Average Household Size	4.4	KNBS 2019
Estimated Number of Households	714	As per ENA output
Estimated Population to be included	3028	As per ENA output
Estimated number of households per day	15	From previous experience, teams can cover as most of the area is not sparsely populated
Number of Clusters	48	
Number of Teams	8	8 teams collecting data for 6 days

Since the anthropometry sample computation had 708 households while the mortality sample had 714 households, the latter was used as the household sample for the survey.

2.4: Villages (Clusters) and Household Selection

Two-stage sampling was used to select villages/ clusters and households for data collection;

1st stage: The updated list of villages and their respective populations were entered into the ENA for SMART software (Jan 11th 2020 version). The software assigned 48 clusters based on probability proportional to size (PPS) methodology.

2nd stage: At the village level, 15 HHs were selected by simple random sampling upon getting the updated list of households in the village/cluster.

The County is relatively expansive. It was expected that teams could manage to reach up to 15 households in a day.

2.5: Survey Team Composition

The survey was conducted by eight teams each with one team leader and two enumerators. The enumerators and team leaders were selected competitively through consultations between World Vision Kenya, UNICEF and the County Ministry of Health and Sanitation. The table below shows the survey team members;

Table 5: Survey Team Composition

Responsibility	Number/ Team	Total Number	Actors
Team leaders	1	8	Department of Health And partners
Survey Enumerators	2	16	Department of Health And partners
Supervision	Roving	5 (3 GOK and 2 partners)	Department of Health And partners.
Village guides	1 per cluster	56	1 in each selected cluster and 1 guide per team during the pilot stage.

A Multi-stakeholder approach was used to ensure full participation through a CNTF forum. There were 4 coordinators (3 County MOH, 1 NDMA) and other coordinators from supporting partner staff.

2.6: Survey Team Training

A comprehensive training of the survey teams was carried out for a period of 4 days. The training entailed sampling methods; anthropometric measurements; interviewing techniques; and completion of questionnaires by use of tablets. Standardization tests and pilot test formed part of the training on the 3rd and 4th day respectively. The standardization involved each Enumerator taking the anthropometric measurements of 10 children twice. This informed the reorganization of the teams before the actual data collection.

2.7: Data Collection Methods and Tools

Anthropometric and household questionnaires mounted on a mobile phone application (Kobo Collect) were used to collect the survey data**.** Data management and aggregation was supported by the technical teams from Kitui County Ministry of Health and Sanitation with technical support from the NITWG, UNICEF, World Vision and NDMA. Data was recorded into Kobo collect and aggregated into an online server on a daily basis. The data was thereafter downloaded from the server and exported to Excel and ENA for SMART software for daily quality checks and feedback to the teams.

2.8: Data Entry, Analysis and Report

Data for nutritional anthropometry collected using Kobo collect was uploaded to the server on a daily basis. Daily plausibility checks were done to ensure quality on anthropometry and mortality data. Anthropometric and mortality data was also analyzed using ENA for SMART software 2020 (version January 11, 2020), while other data sets were analyzed using Epi info 7.

2.9: Organization of the Survey

The table below summarizes the activity schedule for Kitui County SMART survey, 2023.

Table 6: The Activity Schedule

Activity	**By**	**Survey timeline**
County Nutrition Technical Forum approval of Methodology	DoH/Partners	29th May 2023
Presentation of methodology to NITWG	DoH/CIWG	2nd June 2023
Recruitment of survey team	DoH/WVK/	5th – 9th June 2023

Training survey team	DoH, NITWG and partners	14th - 17th June 2023
Field data collection	DoH, Partners	19th – 24th June 2023
Data analysis	DoH/IWG/Partners	26th June – 1st July 2023
Preliminary report	DoH/NITWG/partners	3rd to 8th July 2023
Presentation of the preliminary findings and draft report to CSG/CNTF/CHMT	DoH/CIWG	18/07/2023
Presentation of SMART survey findings to NITWG for validation	DoH	TBD
Writing of final report	DoH/CIWG	

3.0 SURVEY FINDINGS

This section presents findings from the survey.

3.1 SURVEY COVERAGE AND DEMOGRAPHIC CHARACTERISTICS

3.1.1. Survey Coverage and household demographics

The survey reached 680 (95.2%) households out of the planned 714 with 335 (103.1%) children aged 6-59 months reached against 325 targeted. A total of 3246 persons were reached in the 48 clusters. The average household size was 4.8% and a under-five proportion of 12.0% responded to the survey questionnaires.

Table 7: Household demographics

Indicator	Values
Sampled number of HHs	680
Sampled number of clusters	48
Sampled number of HHs with children under five	293
% of sampled HHs with children under five	43.08%
Average household size	4.8
Mid Interval Population Size	3245.5
Percentage of children under five	12.0%
Female % of the population	52.47%
Male % of the population	47.52%

3.1.2 Main Occupation of the household head

The main occupation of the household head was determined as crop farming/own farm labour at 53.09% followed by waged labor a t 23.97%, and petty trade at 6.32%, while employment (salaried) stood at 6.03%. Fishing and firewood/charcoal burning came as the least common occupations.

Table 8: Main occupation of the household head

HOUSEHOLD MAIN OCCUPATION	Frequency(n)	Percent (2023)
Crop farming/Own farm labour	361	53.09%
Employed (salaried)	41	6.03%
Firewood/charcoal	3	0.44%
Fishing	1	0.15%
Livestock herding	15	2.21%
Merchant/trader	25	3.68%
Others (Specify)	28	4.12%
Petty trade	43	6.32%
Waged labour (Casual)	163	23.97%

3.1.3 Main Source of the Income

Majority of the households' main current source of income is Casual labor (42.94%) followed by sales of crops (24.26%). This is as shown in Table 9.

Table 9: Main source of income

CURRENT SOURCE OF INCOME	Frequency	Percent	95% CI
Casual labor	292	42.94%	39.27%-46.69%
No income	44	6.47%	4.86%-8.58%
Others (Specify)	50	7.35%	5.62%-9.56%
Permanent job	34	5.00%	3.60%-6.91%
Petty trading e.g., sale of firewood	46	6.76%	5.11%-8.91%
Regular cash transfer program (HSNP or Inua Jamii)	3	0.44%	0.15%-1.29%
Remittance	12	1.76%	1.01%-3.06%
Sale of crops	165	24.26%	21.19%-27.63%
Sale of livestock	19	2.79%	1.80%-4.32%

Sale of livestock products	5	0.74%	0.31%-1.71%
Sale of personal assets	10	1.47%	0.80%-2.69%
Total	680	100.00%	

3.2 Access And Utilization of Health and Nutrition Services

As per the UNICEF conceptual framework, diseases and inadequate dietary intake are the immediate causes of malnutrition. Insufficient consumption of essential nutrients, either due to lack of access or poor feeding practices, combined with frequent infections or illnesses, directly compromises a child's nutritional status, leading to malnutrition. These factors often coexist, with poor nutrition making a child more susceptible to diseases, and illnesses further exacerbating nutritional deficiencies.
Additionally, delayed or inadequate health-seeking behaviors can exacerbate the effects of illnesses and further contribute to malnutrition. These factors often coexist, with poor nutrition making a child more susceptible to diseases, and illnesses further exacerbating nutritional deficiencies, especially when appropriate medical care is not sought in a timely manner.

3.2.1 Prevalence of common morbidities

The assessment on child morbidity was based on a recall period prior to the commencement of the survey. Diseases were noted and responses recorded. Additionally, zinc supplementation in the context of watery diarrhea was assessed.
The findings show that 33.73% of children were reported to have had acute respiratory infection/cough, 15.22% had fever with chills and 4.78% had watery diarrhea. No case of bloody diarrhea was reported. Other illnesses accounted for 5.67%.

Table 10: Prevalence of common morbidities

Level	Freq	Proportion	95% CI
ARI/COUGH symptoms	113	33.73%	(28.88% - 38.95%)
Fever with Chills like malaria	51	15.22%	(11.77% - 19.46%)
Watery diarrhea	16	4.78%	(2.96% - 7.62%)
Bloody diarrhea	0	0.0%	(1000.00-100.00%)
Other illnesses	19	5.67%	(3.66% - 8.69%)

Zinc supplementation during episodes of diarrhea has been shown to reduce the duration and severity of the illness. Regular intake of zinc supplements can also decrease the frequency of diarrheal episodes in children, enhancing their overall health and resistance to future occurrences.

Thus, zinc supplementation is a recommended intervention for the management and prevention of diarrhea, especially in areas where zinc deficiency and diarrheal diseases are prevalent. The survey found out that 43.8% of children who had watery diarrhea were managed with ORS and Zinc. On the other hand, 56.3% of water diarrhea cases were managed with ORS. This means that about 56.2% of diarrhea cases did not receive Zinc supplements as part of management.

3.2.2 Health seeking behavior

Health-seeking behavior refers to the action's individuals take in response to health concerns or symptoms. It encompasses the decisions people make about whether, when, and where to seek medical care. Factors influencing health-seeking behavior include cultural beliefs, socioeconomic status, accessibility to healthcare facilities, and perceived severity of the condition. Understanding these behaviors is crucial for designing effective health interventions and ensuring timely and appropriate utilization of healthcare services. In an effort to understand this, the findings show that 77% of households sought medical assistance. Of this, 53.85% sought assistance from a public clinic followed by private clinic/pharmacies at 38.46% as shown in figure 3.

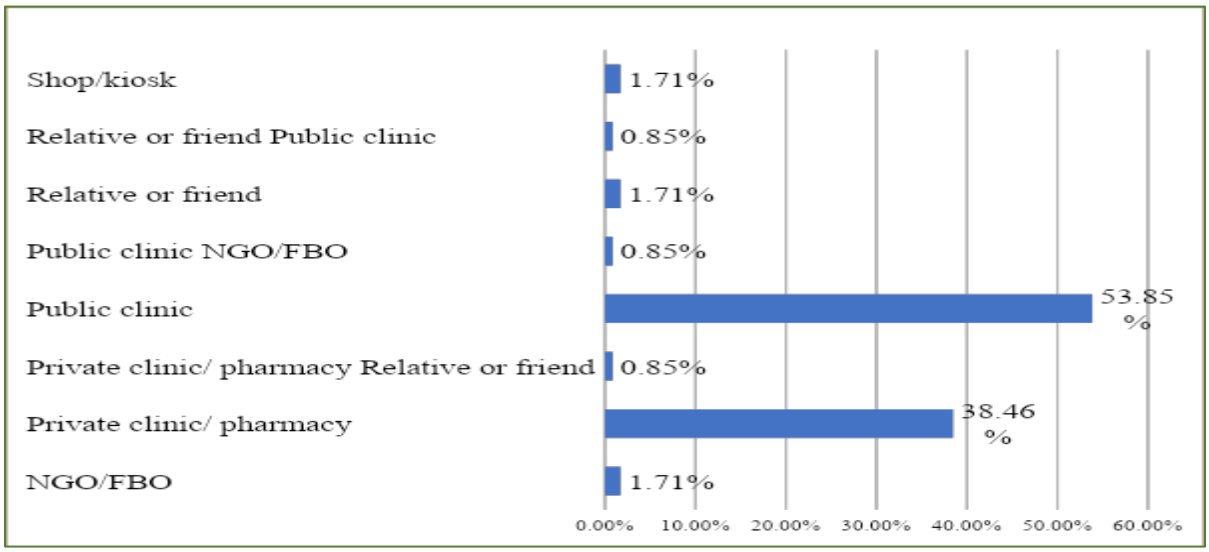

Figure 3: Health seeking behaviors

3.2.3 Vitamin A supplementation

Vitamin supplementation in children 6 to 59 months with two doses of vitamin A per year can impact their health and averting child mortality from a lower bound cause-specific effect size of 28% (diarrheal deaths averted) to an upper bound of 12%-24% all-cause mortality reduction. In Kenya, up to 85 per cent of children are vitamin A deficient, putting them at risk of illness and death.

Assessment of Vitamin A supplementation was done through checking on the mother child booklet as well as probing the caregivers on Vitamin A supplementation, the number of times given and the source. Assessment of Vitamin A for children aged between 6-11 months established a coverage of 72.5% while those 12-59months was 88.47%. Overall, coverage of Vitamin A for children 6-59months at least once was at 86.57%. However, 46.1% of children 12-59 months were supplemented twice in a year.

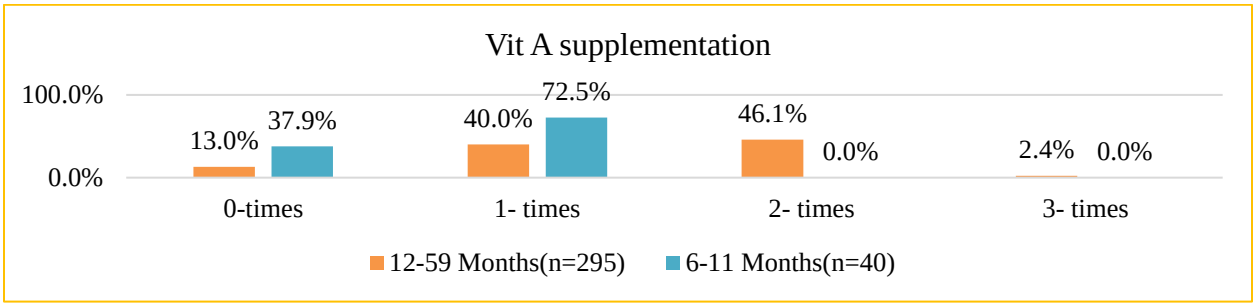

Figure 4: Vitamin A supplementation

3.2.4 Deworming for children 12-59 months

Worm infestation of the intestines can result in poor appetite, anemia, and poor growth. In areas where worm infestations are common, regular deworming is recommended. The World Health Organization (WHO) recommends that children in developing countries exposed to poor sanitation and poor availability of clean safe water to be de-wormed once every 6 months. Assessment of deworming for children aged 12-59months established that 57.63% and 27.46% of children have been dewormed once and twice in the past one year respectively. However, 13.22% were not dewormed at all. This could be attributed to poor documentation especially during campaigns. See the table below.

Table 11: Deworming for children 12-59 months

RECEIVED DEWORMERS	Frequency	Percent	Cum. Percent	95% CI
None (0)	39	13.22%	13.22%	9.57%-17.63%
1 time	170	57.63%	70.85%	51.77%-63.33%
2 times	81	27.46%	98.31%	22.44%-32.93%
3 times	4	1.36%	99.66%	0.37%-3.44%
4 times	1	0.34%	100.00%	0.01%-1.87%
Total	295	100.00%	100.00%	

3.2.5 Child Immunization

Immunization enhances one's body to resist to an infectious disease through administration of a vaccine. Immunization is one of the most cost-effective health investments, with proven strategies that make it accessible to even the most hard-to-reach and vulnerable populations averting 2-3 million death each year.

The survey used five antigens as proxies for immunization coverage. These are Bacille Calmette Guerin (BCG), Oral Polio Vaccine (OPV 1 and 3) and measles vaccine (1st and 2nd doses). BCG at birth for all children was verified with BCG scar on the left arm and/or confirmation by child health card. The coverage of the vaccines is as shown in Figure 5.

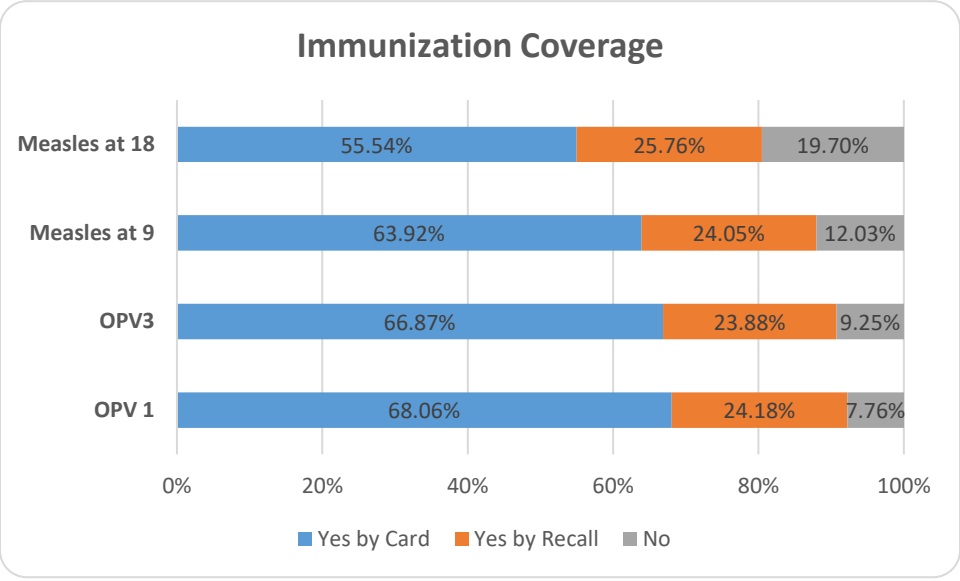

Figure 5: Immunization

3.3 Family MUAC Implementation

From the 680 households sampled, 89 (13.1%) had seen family MUAC; of these 89 only 27(30.3%) households had been sensitized on use of family MUAC. See the figure below.

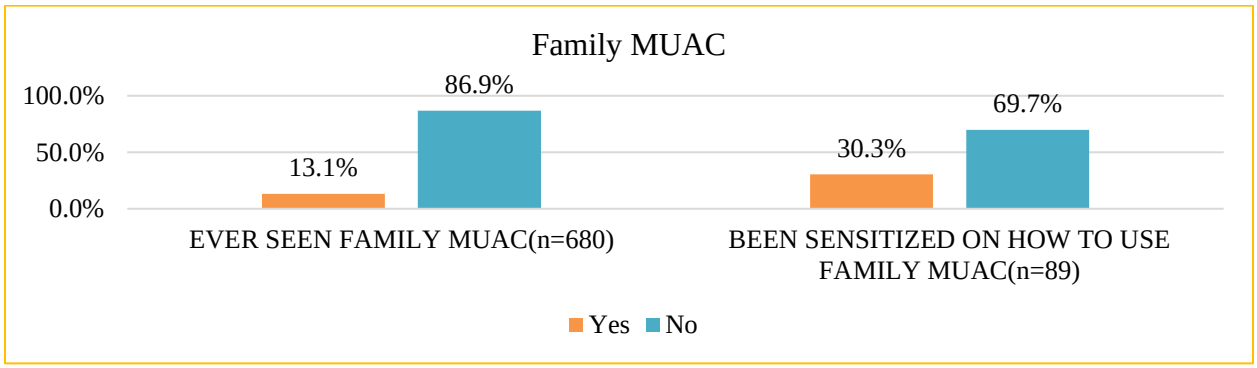

Figure 6: Family MUAC implementation

3.4 Water, Hygiene and Sanitation

3.4.1 Overview of water Hygiene and Sanitation

WASH typically refers to activities aimed at improving access to and use of safe drinking-water and sanitation as well as promoting good hygiene practices (e.g., handwashing with soap at critical times). Lack of improved water sources, poor sanitation and hygiene affect a child's nutritional status in many ways and expose billions of people, particularly children and the vulnerable, to a wide range of preventable diseases and are major contributors to the world's morbidity and mortality. Existing evidence supports at least three direct pathways: via diarrheal diseases, intestinal parasite infections and environmental enteropathy. WASH may also impact nutritional status indirectly by necessitating walking long distances in search of water and sanitation facilities and diverting a mother's time away from child care. This section focuses on the following WASH intervention categories; Water quantity, water quality, sanitation and hygiene practices.

3.4.2 Main Sources of Drinking water

The main sources of water for the households included rivers, boreholes, springs, shallow wells, piped water system, water pans and earth dams with about 30.1% of households obtaining their drinking water from improved sources namely; piped water system, borehole, protected spring or protected shallow well. This is a noted decline from 40% in February 2023 (2022 SRA Report). The rest (69.9%) obtained water from unsafe sources such as river, water pan, earth dam, water trucking, unprotected springs and dams/pans. Households consuming water from unsafe sources were susceptible to water-borne infection such as diarrhea, typhoid among others. See figure 7.

3.4.2 Distance to Water Source and Queuing Time

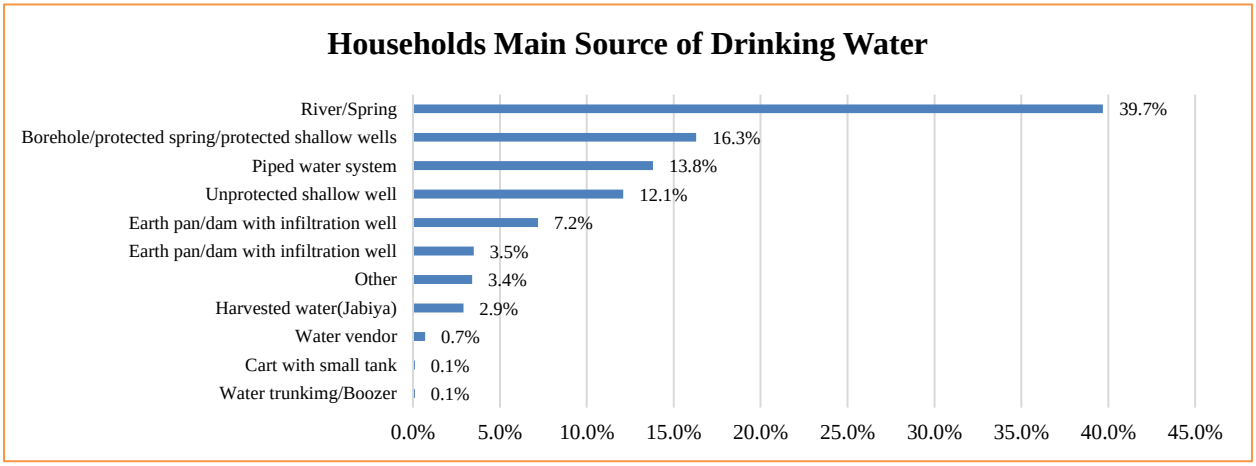

Figure 7: Main Source of drinking Water

The SPHERE standards under the WASH section propose that the maximum distance from any household to the nearest water point should be 500 meters. It also gives the maximum queuing time at a water source which should be no more than 15 minutes. Analysis of the distance to water sources indicated that, majority of the households (47%) trekked a distance of between 500m to 2.0km to access water from the sources. Only 35% of the households were within the SPHERE standards with distance to water sources being less than 500m. However, 17% of the households trekked more than 2km (1-2 hrs) to access water from the sources.

About 30% of the households' queued for water. From those who queue for water, 33% are queueing for water in less than 30 minutes, 33% queueing for water in 30-60 minutes and 34% queueing for more than one hour.

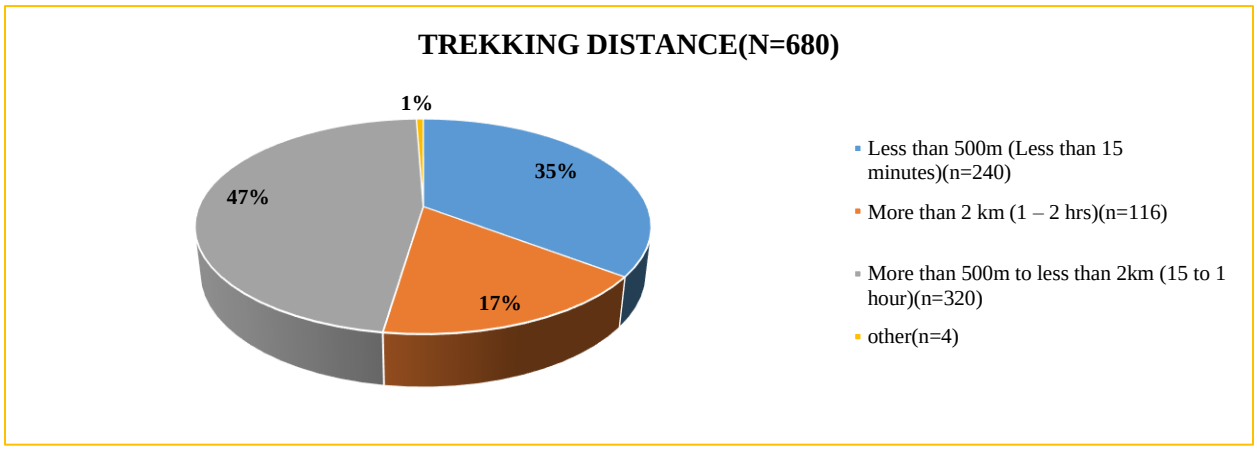

Figure 8: Household Trekking Distance to Water Source

3.4.3 Water Treatment and storage

Water treatment enhances protection of the microbiological (or chemical, such as arsenic) quality of drinking-water. Water quantity and quality is of vital importance for the ecosystem. The lack of water is further aggravated by insufficient treatment of water, particularly with rapid population growth. From the survey, only 19% of households were treating their water before drinking. Out of those who treat water, the majority (58%) of the households treated their water using chemicals, followed by 41% of the households who treated water by boiling. However, 1.0% of households treated water through pot filtration.

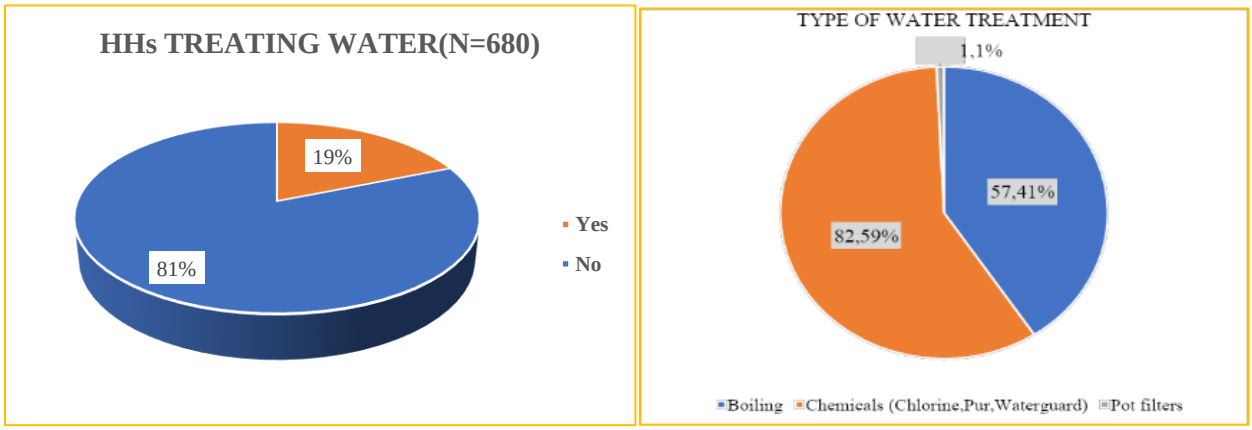

Figure 9: Treatment and Storage Methods for Drinking Water

3.4. 5 Water payment and consumption

According to SPHERE handbook for minimum standards for WASH, the average water uses for drinking, cooking and personal hygiene in any household should be at least 15 liters per person per day. Analysis of water utilization within the sampled households showed that 42% of the households use the recommended of at least 15 liters per person per day. While majority of households (58%) consume less than 15 liters per person per day.

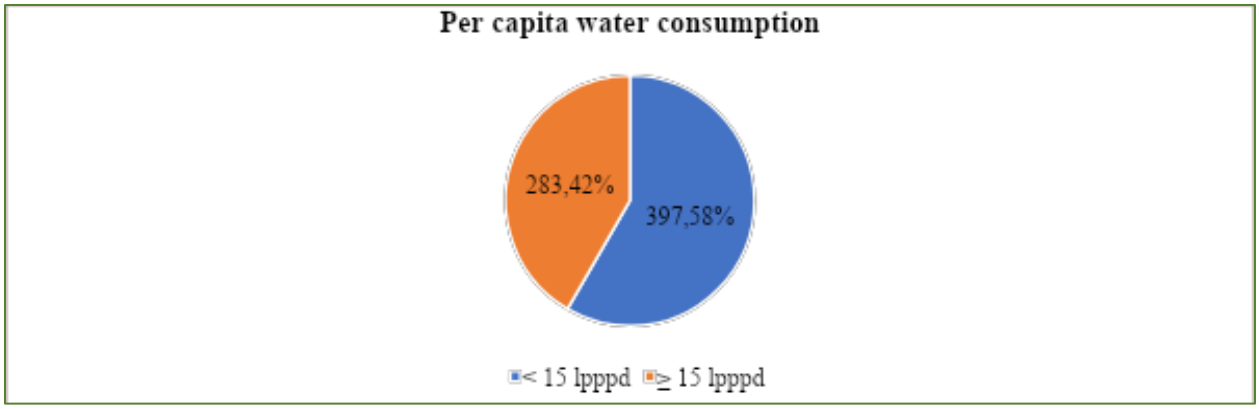

Figure 10: Water Consumption per Person per Day

3.4.4 Sanitation

Sanitation refers to provision and use of facilities and services that safely dispose of human urine and faeces, thereby preventing contamination of the environment. Inadequate sanitation is a major cause of diseases world-wide and improving sanitation is known to have a significant beneficial impact on health both at households and across communities. Access to proper sanitation practices reduces food and waterborne diseases and ultimately contributing to decrease in chronic malnutrition in children. Assessment of sanitation access revealed that about 88% of households in the County had recommended relieving points (pit latrine, composite toilet and flush/pour toilets) with about 11.8% of households reported to be using the bush out the field as points of relieve (open defecation) as shown below.

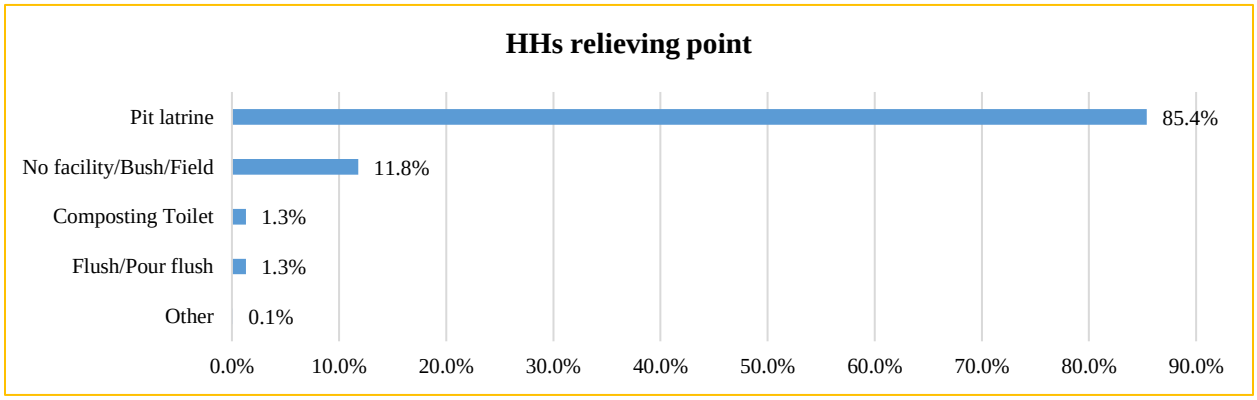

Figure 11: Household relieving point

3.4.5 Hygiene

Hygiene refers to the practice of hand washing with soap after defecation, disposal of child faeces, prior to preparing and handling food, and before eating. Hand washing with soap is the single most cost-effective intervention in preventing diarrhea diseases. The four critical hand washing moments include; after visiting the toilet/latrine, before cooking, before eating and after taking children to the toilet/latrine.

3.4.5.1 Hand washing Equipment/Points

From the results revealed that 10 percent of the households had no handwashing station in their dwelling place. Household with hand washing station (sink/taps) fixed in their dwelling place/yard/plot stood at 5% with 33% of households having mobile object (bucket/jug/kettle) as shown in figure 12.

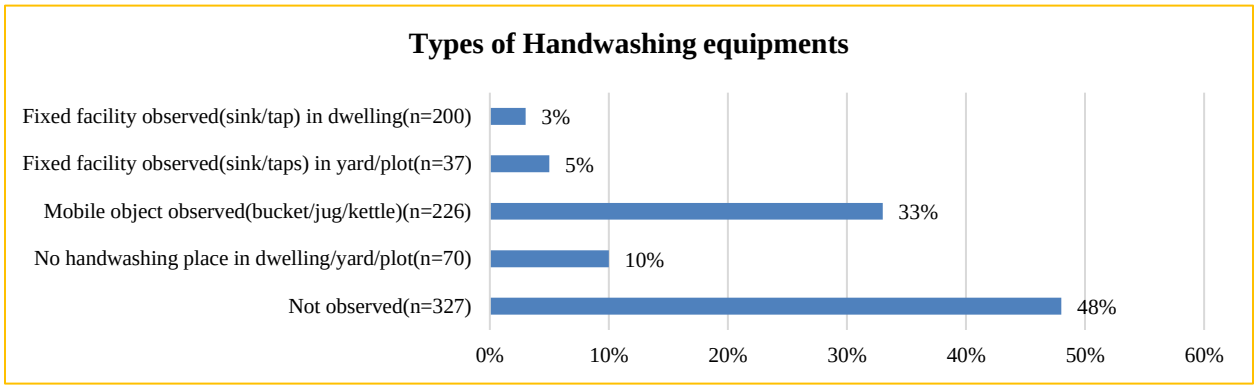

Figure 12: Hand washing equipment

3.4.5.2 Hand washing Practice

The findings revealed that only 2.6 % of the households are practicing the 4 critical moments of hand washing. Majority of the household in the county have learnt and are practicing handwashing after visiting toilet and before eating. And only a few are practicing handwashing before cooking and after taking children to the toilet.

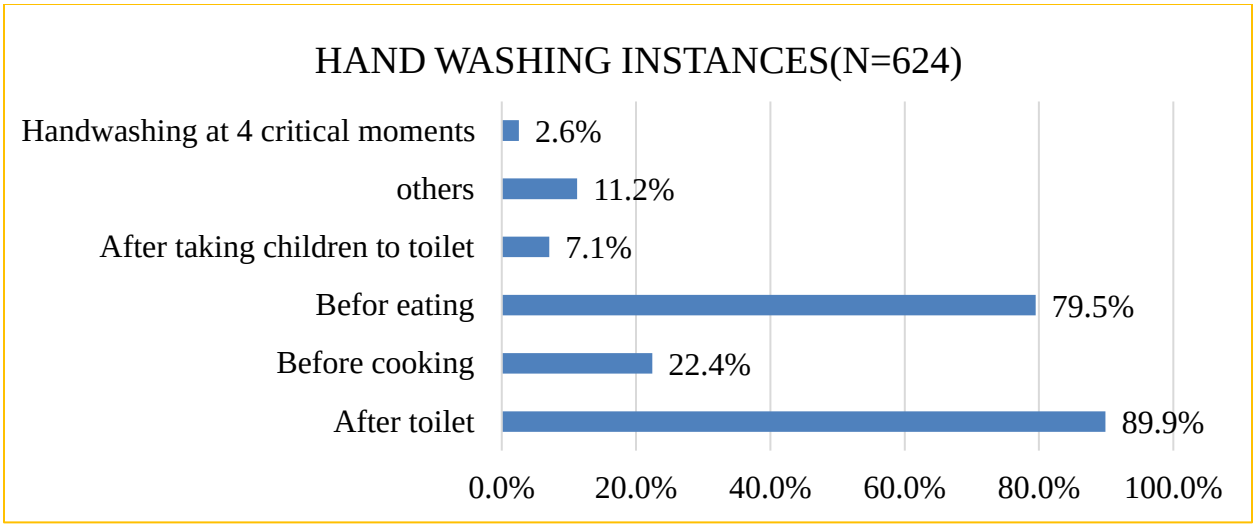

Figure 13: Hand washing instances

3.4.2.1 Hand washing with Soap and Water

Majority (53.37%) of the households in the county are washing hands with soap and water while 42.15% of the households are washing hands with water only. And only 4.33% use soap on instances when they can afford it.

Table 12: Hand washing with soap and water

USE FOR HANDWASHING	Frequency	Percent	Cum. Percent	95% CI
Only water	263	42.15%	42.15%	38.33%-46.06%
Soap and water	333	53.37%	95.51%	49.44%-57.25%
Soap when I can afford it	27	4.33%	99.84%	2.99% -6.22%
traditional herb	1	0.16%	100.00%	0.03% -0.90%
Total	624	100.00%	100.00%	

3.5 Food Security Indicators

3.5.1 Household Dietary Diversity (24-hour Recall)

Household dietary diversity (HDDS) is used as a proxy indicator to measure the socio-economic ability of households to access a variety of foods and food consumption can be triangulated with other food-related information to contribute towards providing a holistic picture of the food and

nutrition security status in a community or across a broader area. The household dietary diversity was assessed using a 24-hour recall period.

Majority (49.12%) of the households ate from more than 5 food groups 40.44% ate between 3 to 5 food groups in the last 24 hours, whereas 10% of the HHs could only afford less than 3 food groups in the last 24 hours The figure below illustrates food groups accessed at the household level.

Table 13: Household dietary diversity

HDDS CLASSIFICATION	Frequency	Percent	Cum. Percent	95% CI
3-5 FG	275	40.44%	40.44%	36.82%-44.17%
Less than 3 FG	71	10.44%	50.88%	8.36%-12.97%
More than 5 FG	334	49.12%	100.00%	45.38%-52.87%

3.5. 2 Household IPC Classification

Majority (49.12%) of the households are in IPC phase 1 while 50.88% are in IPC phase 2, 3, and IPC phase 4-5.

Table 14: Household IPC Classification

HDDS IPC CLASSIFICATION	Frequency	Percent	Cum. Percent	95% CI
IPC Phase 1 (6-12 FGs)	334	49.12%	49.12%	45.38%-52.87%
IPC Phase 2 (5 FGs)	123	18.09%	67.21%	15.38%-21.16%
IPC Phase 3 (3-4 FGs)	152	22.35%	89.56%	19.38%-25.63%
IPC Phase 4-5 (0-2 FGs)	71	10.44%	100.00%	8.36%-12.97%
Total	680	100.00%	100.00%	

3.5. 3 Frequency of the food Consumed

Cereals (staple) were the most (85.3%) consumed, while fish was the least consumed foods at 1.0% as shown in the figure below.

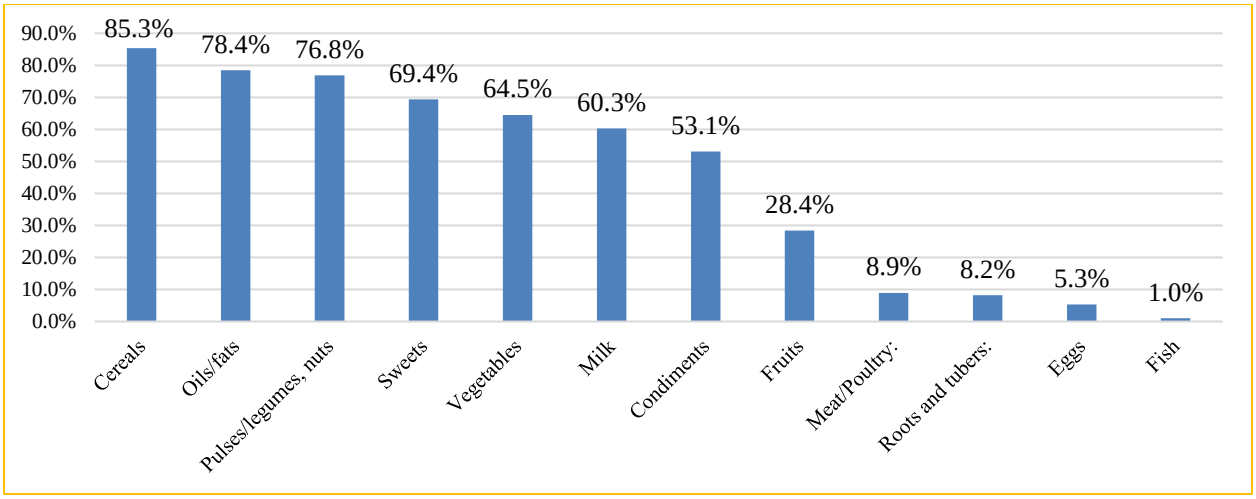

Figure 14: Frequency of the Food Consumed

3.5. 4 Food Consumption Score.

The food consumption score is an acceptable proxy indicator to measure caloric intake and diet quality at the household level by giving an indication of food security status of the household. It's a composite score based on dietary diversity, food frequency and relative nutritional importance of different food groups. Majority of the Households (87.1%) had good Food consumption score, while 8.38% of the households had borderline food consumption score (FCS) whereas 4.56% had poor FCS. See the table below.

Table 15: Food Consumption Score

FOOD CONSUMPTION SCORE	Frequency	Percent	Cum. Percent	95% CI
Borderline FCS	57	8.38%	8.38%	6.53%-10.71%
Good FCS	592	87.06%	95.44%	84.33%-89.38%
Poor FCS	31	4.56%	100.00%	3.23%-6.40%

3.5. 5 Coping Strategy Index.

Coping strategies are usually indicative of food security challenges and can be used to evaluate the seriousness of food shortages or crises. 18.53% of the HHs in the county are at IPC Phase3-5- that is Crisis. Another 18.82% are at Stressed- that is IPC Phase 2 and the remaining majority are at IPC phase 1.

Table 16: Coping Strategy Index

rCSI IPC category	Freq	Percent	95% CI
None (IPC Phase 1)	426	62.65%	58.95%-66.20%
Stressed (IPC Phase 2)	128	18.82%	16.06%-21.93%
Crisis (IPC Phase 3-5)	126	18.53%	15.79%-21.62%
Total	**680**	**100%**	

3.5. 6 Coping Strategy Index

Most of the households had little or no hunger (76.32%), with 4.26% households in the severe hunger score. See the figure below.

Table 17: Household Hunger Scor

HOUSEHOLD HUNGER SCALE	Frequency	Percent	95% CI
Little or no hunger in the household	519	76.32%	72.99%-79.37%
Moderate hunger in the household	132	19.41%	16.61%-22.55%
Severe hunger in the household	29	4.26%	2.99% -6.06%
Total	680	100.00%	

3.6 Maternal nutritional status

Maternal nutrition status is a critical determinant of maternal and child health outcomes. Adequate nutrition during pregnancy and lactation is essential for the health and well-being of both the mother and the child. Poor maternal nutrition can lead to complications during pregnancy, low birth weight, and other adverse neonatal outcomes. It can also impact the mother's ability to breastfeed and provide essential nutrients to the child.

3.6.1 Women physiological status

A total of 444 women from the sampled households were within the reproductive age of (15-49 years); 4.28% of them were Pregnant, 31.31% were lactating while 0.90% were pregnant and lactating mothers, while 63.51% were neither pregnant nor lactating.

Table 18: Women Physiological status

WOMEN PHYSIOLOGICAL STATUS		
PHYSIOLOGICAL STATUS	**Frequency (N)**	**Percent**
Lactating	139	31.31%
Not Pregnant & Not Lactating	282	63.51%
Pregnant	19	4.28%
Pregnant & Lactating	4	0.90%

3.6.2 MATERNAL NUTRITION [MUAC]

MUAC measurement was used to assess maternal nutrition status. The survey unveiled that 1.58% of the total women of reproductive age of 15-49 years were acutely malnourished with a MUAC less than 21cm while 98.42% of them had normal nutritional status (≥21cm)

3.6.3 ANC Attendance and IFAS consumption

Supplementary iron or iron-folate is effective in preventing anemia and neural tube defects among infants. IFAS consumption for 0-90 days, 91-180 days and 180 days and above is at 42.3%, 49.6% and 8.1%. Almost all pregnant women (99%) in the county are attending their ANC clinics. Follow-up and referral of the 1% women who are still not attending their ANC clinics would be important to ensure 100% coverage

The proportion of pregnant mothers who adhered to the recommended more than 180 days' period in the consumption of iron-folate was at 8.1%. The proportion of iron-folate supplementation, adherence and frequency of supplementation is below WHO benchmarks of >80%. This could be attributed to low awareness among mothers on the benefits of iron-folate supplementation on maternal and infant health and the need to consume within the recommended duration of the pregnancy.

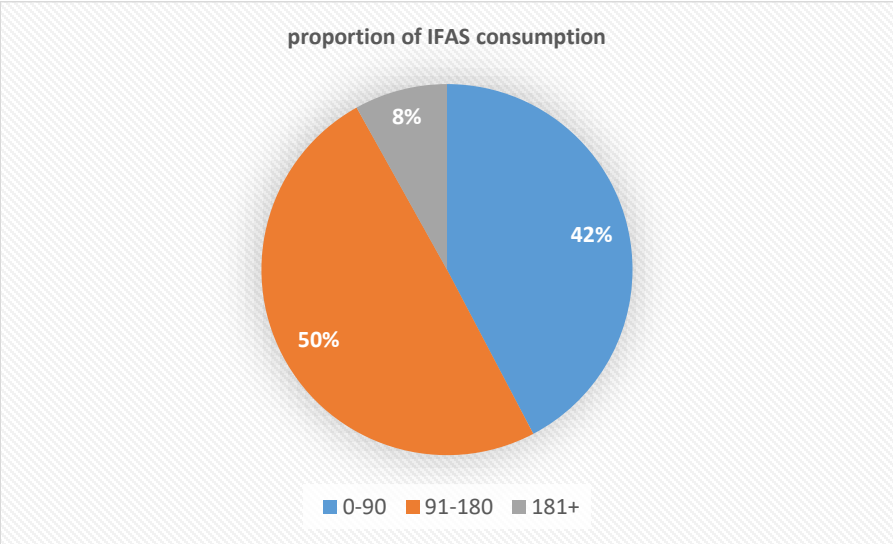

Figure 15: IFAS consumption

3.6.3 Minimum Dietary Diversity (24-Hour Recall)-Women

The physiological needs of women make them vulnerable to both nutrition status and food security. It's even more critical during pregnancy and lactation as this can have implication on their fetus and infants. Majority of the women (84.46%) were consuming less than 5 food groups in a day while 15.54% were consuming 5 or more food groups. Culturally, women in the survey area prioritize other family members eating (men and children).

Table 19: Minimum dietary diversity for women

MINIMUM DIETARY DIVERSITY FOR WOMEN 15-49)	Frequency	Percent	Cum. Percent	95% CI
<5 FG (Poor)	250	84.46%	84.46%	79.82%-88.39%
≥ 5 FG (Good)	46	15.54%	100.00%	11.61%-20.18%

3.7 Nutrition status of children 6-59 months

3.7.1 Prevalence of acute Malnutrition based on Weight-for-Height Z scores (WHZ)

The prevalence of Global Acute Malnutrition (GAM) rate for the County was 6.1 % (3.8- 9.6 95% C.I.). The Moderate acute malnutrition (MAM) rate was 5.8 % (3.6- 9.1 95% C.I.) and the Severe Acute malnutrition (MAM) rate was 0.3 % (0.0-2.2% 95% C.I), in this assessment no cases of oedema were observed. The findings indicate a medium nutrition situation according to WHO classification. The prevalence is however slightly higher than the prevalence observed in the KDHS (4.9%).

Table 20: Prevalence of acute malnutrition based on weight -for-height z-score (and/or oedema) and by sex

Prevalence of acute malnutrition based on weight-for-height z-scores (and/or oedema)

	All n = 329	Boys n = 165	Girls n = 164
Prevalence of global malnutrition (<-2 z-score and/or oedema)	(20) 6.1 % (3.8 - 9.6 95% C.I.)	(14) 8.5 % (4.8 - 14.5 95% C.I.)	(6) 3.7 % (1.7 - 7.6 95% C.I.)
Prevalence of moderate malnutrition (<-2 z-score and >=-3 z-score, no oedema)	(19) 5.8 % (3.6 - 9.1 95% C.I.)	(13) 7.9 % (4.3 - 14.0 95% C.I.)	(6) 3.7 % (1.7 - 7.6 95% C.I.)
Prevalence of severe malnutrition (<-3 z-score and/or oedema)	(1) 0.3 % (0.0 - 2.2 95% C.I.)	(1) 0.6 % (0.1 - 4.4 95% C.I.)	(0) 0.0 % (0.0 - 0.0 95% C.I.)

The prevalence of oedema is 0.0 %

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3.7.2 Prevalence of acute Malnutrition based on Mid Upper Arm Circumference (MUAC)

Children with a MUAC less than 115 mm have a highly elevated risk of death compared to those who are above the survey recorded GAM and MAM prevalence by MUAC of 3.0% (1.3-6.7 95% CI) and a SAM prevalence of 0.0% (0.0- 0.0 95% CI). There is however a higher GAM and MAM prevalence among girls 4.2% (1.6-10.7 95%C. I) than boys 1.8% (0.6-5.6 95% C.I)

Table 21: Prevalence of acute malnutrition based on MUAC cut offs (and/or oedema) and by sex

Prevalence of acute malnutrition based on MUAC cut off's (and/or oedema) and by sex

	All n = 333	Boys n = 167	Girls n = 166
Prevalence of global malnutrition (< 125 mm and/or oedema)	(10) 3.0 % (1.3 - 6.7 95% C.I.)	(3) 1.8 % (0.6 - 5.6 95% C.I.)	(7) 4.2 % (1.6 - 10.7 95% C.I.)
Prevalence of moderate malnutrition (< 125 mm and >= 115 mm, no oedema)	(10) 3.0 % (1.3 - 6.7 95% C.I.)	(3) 1.8 % (0.6 - 5.6 95% C.I.)	(7) 4.2 % (1.6 - 10.7 95% C.I.)
Prevalence of severe malnutrition (< 115 mm and/or oedema)	(0) 0.0 % (0.0 - 0.0 95% C.I.)	(0) 0.0 % (0.0 - 0.0 95% C.I.)	(0) 0.0 % (0.0 - 0.0 95% C.I.)

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3.7.3 Prevalence of combined acute malnutrition and by sex

The prevalence of combined acute malnutrition based on MUAC was 8.1% (5.3-12.1 95% C. I). It is higher in boys 9.6% (5.7-15.7 95% C.I) than girls 6.6% (3.4-12.5 95% C.I)

Table 22: Prevalence of combined acute malnutrition and by sex

Prevalence of combined acute malnutrition and by sex

	All n = 333	Boys n = 167	Girls n = 166
Prevalence of combined GAM (WHZ <-2 and/or MUAC < 125 mm and/or oedema)	(27) 8.1 % (5.3 - 12.1 95% C.I.)	(16) 9.6 % (5.7 - 15.7 95% C.I.)	(11) 6.6 % (3.4 - 12.5 95% C.I.)
Prevalence of combined SAM (WHZ < -3 and/or MUAC < 115 mm and/or oedema	(1) 0.3 % (0.0 - 2.2 95% C.I.)	(1) 0.6 % (0.1 - 4.3 95% C.I.)	(0) 0.0 % (0.0 - 0.0 95% C.I.)

*With SMART or WHO flags a missing MUAC/WHZ or not plausible WHZ value is considered as normal when the other value is available

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3.7.4 Prevalence of Underweight based on Weight-for-Age Z scores (WAZ)

A weight-for-Age z-score (WHZ) compares a child's weight to the weight of a child of the same age and sex to classify nutritional status. The prevalence of children underweight was 20.4 % (15.9 - 25.9 95% C.I.) While severely underweight was 3.0 % (1.7 - 5.5 95% C.I.).

Table 23: Prevalence of Underweight based on Weight-for-Age z-score (WAZ)

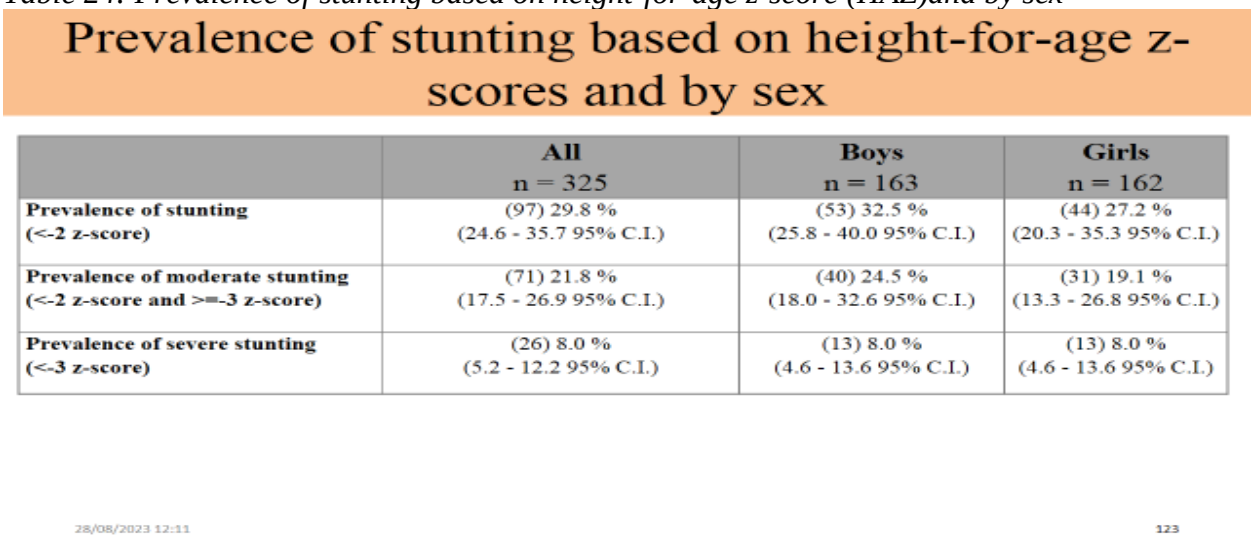
	All n = 328	**Boys** n = 164	**Girls** n = 164
Prevalence of underweight (<-2 z-score)	(67) 20.4 % (15.9 - 25.9 95% C.I.)	(37) 22.6 % (16.6 - 30.0 95% C.I.)	(30) 18.3 % (12.9 - 25.2 95% C.I.)
Prevalence of moderate underweight (<-2 z-score and >=-3 z-score)	(57) 17.4 % (13.5 - 22.1 95% C.I.)	(33) 20.1 % (14.5 - 27.2 95% C.I.)	(24) 14.6 % (9.8 - 21.4 95% C.I.)
Prevalence of severe underweight (<-3 z-score)	(10) 3.0 % (1.7 - 5.5 95% C.I.)	(4) 2.4 % (0.7 - 7.9 95% C.I.)	(6) 3.7 % (1.7 - 7.7 95% C.I.)

3.7.4 Prevalence of stunting based on Height-for-Age Z scores (HAZ)

Stunting as a chronic form of malnutrition refers to poor linear growth or inadequate length/height relative to age. Stunting in early childhood is associated with vulnerability to poor cognitive development and learning ability.

The reported stunting prevalence was 29.8 % (24.6 – 35.7 95% C.I.). There was high stunting prevalence among boys 32.5 % (25.8 – 40.0 95% C.I.) than girls 27.2 % (20.3 – 35.3 95% C.I.).

Table 24: Prevalence of stunting based on height-for-age z-score (HAZ)and by sex



Prevalence of stunting based on height-for-age z-scores and by sex

	All n = 325	Boys n = 163	Girls n = 162
Prevalence of stunting (<-2 z-score)	(97) 29.8 % (24.6 - 35.7 95% C.I.)	(53) 32.5 % (25.8 - 40.0 95% C.I.)	(44) 27.2 % (20.3 - 35.3 95% C.I.)
Prevalence of moderate stunting (<-2 z-score and >=-3 z-score)	(71) 21.8 % (17.5 - 26.9 95% C.I.)	(40) 24.5 % (18.0 - 32.6 95% C.I.)	(31) 19.1 % (13.3 - 26.8 95% C.I.)
Prevalence of severe stunting (<-3 z-score)	(26) 8.0 % (5.2 - 12.2 95% C.I.)	(13) 8.0 % (4.6 - 13.6 95% C.I.)	(13) 8.0 % (4.6 - 13.6 95% C.I.)

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3.8 Infant and Young Child Feeding (IYCF)

The Minimum Meal Frequency (MMF)has improved significantly from 59.3% in 2017 to 79.8%. This suggests that a higher percentage of children are now receiving the recommended number of meals per day. The percentage of children receiving a minimum acceptable diet has also improved, albeit slightly, from 22% to 23.6%. While any improvement is positive, this figure remains relatively low, indicating that efforts to improve diet quality should continue. The minimum dietary diversity has shown a decrease, from 32.8% in 2017 to 23.6%. This is a concerning trend as it suggests that fewer children are receiving a diverse range of foods in their diet, which is important for their nutrition and development.

Table 25: Complimentary feeding Indicators

Complementary feeding indicator	Age range	Frequency	Proportion	95% CI
Minimum Dietary Diversity (MDD)	6-23 Months	26	23.6%	16.2-33.0
Minimum Meal Frequency (MMF)	6-23 Months	87	79.8%	71.1- 86.9
Minimum Acceptable Diet (MAD)	6-23 Months	26	23.6%	16.2 – 33.0
Zero Vegetable or Fruit Consumption (ZvF)	6–23 Months	39	35.8%	26.83-45-5
Unhealthy Food Consumption (UFC)	6–23 Months	30	27.5%	19.4 - 36.9

Sweet Beverage Consumption (SwB)	6–23 Months	35	32.1%	23.5 - 41.7
Egg And /Or Flesh Food Consumption (EFF)	6–23 Months	13	11.9%	6.5 – 19.5

3.8.1 Frequency of food consumed

The table below shows a comparison of meal consumption between the breastfed and the non-breastfed child. It indicates that the non-breastfed child majorly gets animal milk and not the recommended infant formular there is also a minimum consumption of eggs, dairy and dairy products. This may predispose the children to acute and chronic malnutrition.

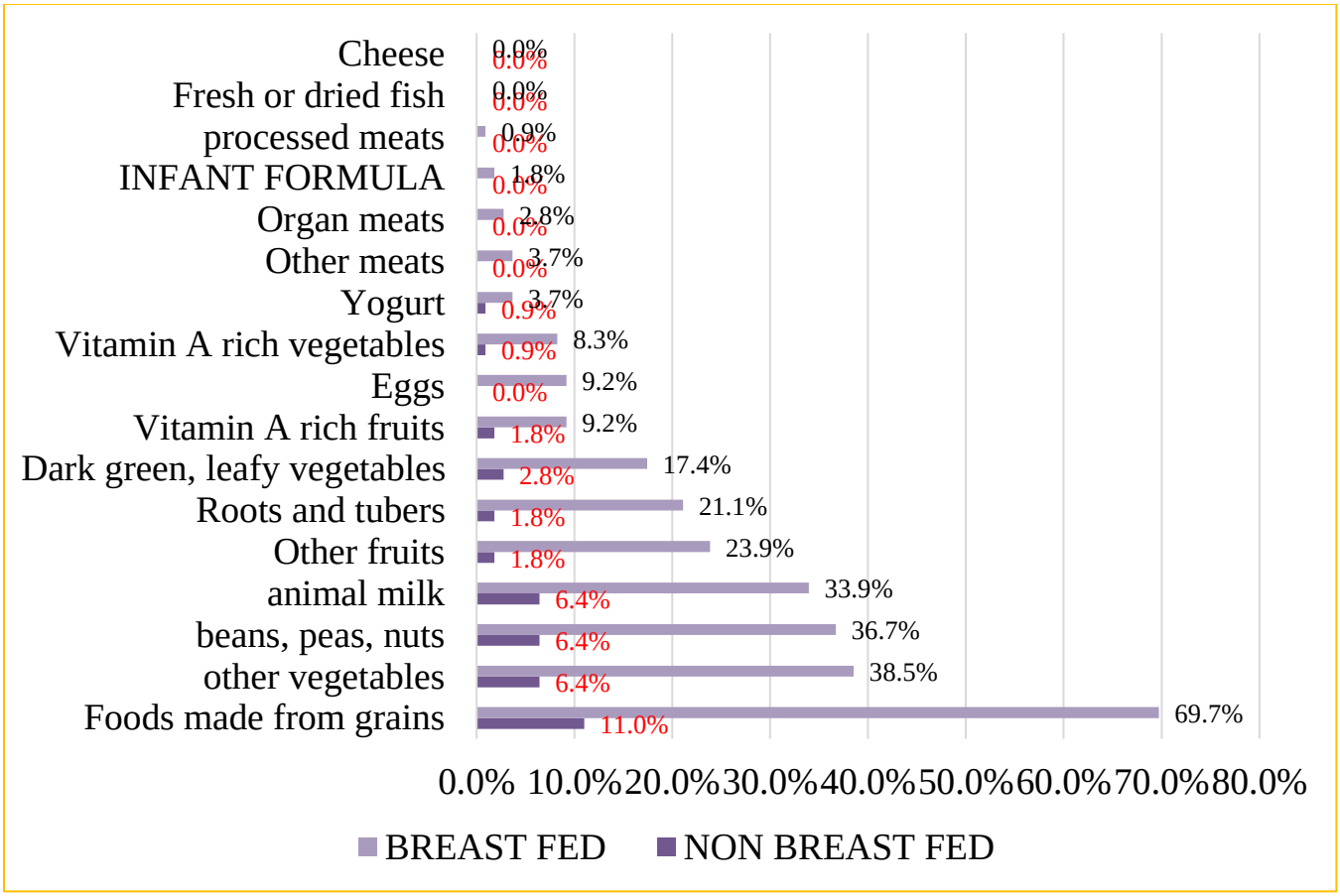

Figure 16: Frequency of food consumed by breast-fed and non-breastfed child

4.0 CONCLUSION

1. **Prevalence of Acute Malnutrition**: The prevalence of acute malnutrition in children aged 6-59 months is 6.1%, with 0.3% of children classified as severely acutely malnourished based on Weight-for-Height Z-score (WHZ). The point estimate indicates a medium nutrition situation, but the confidence interval (CI) suggests a range from normal to medium. While the situation is not severe, it's slightly higher than the national prevalence observed in the Kenya Demographic and Health Survey (KDHS).

2. **Prevalence of Stunting and Underweight**: The prevalence of stunting is 29.8%, indicating a high threshold, while the prevalence of underweight is 20.4%, indicating a medium threshold. Both figures are higher than the national prevalence reported in the KDHS.

3. **IYCF Complementary Feeding Practices**: The complementary feeding practices assessed show suboptimal performance compared to the Kenya Assessment of Basic Nutrition and Health Services (KABP) survey of 2017. This suggests that there may be challenges in achieving recommended infant and young child feeding practices.

4. **Zinc and ORS Administration**: Poor practice in the administration of Zinc and Oral Rehydration Solution (ORS) during diarrheal episodes, with less than half (43.8%) of children receiving both, indicates a need for improved management of childhood diarrhea.

5. **Documentation of Vitamin A Supplementation (VAS) and Deworming**: Poor documentation of VAS and deworming, with some children receiving these interventions more than twice in the past 12 months, suggests the need for better record-keeping and coordination of health services.

6. **Comparison with KDHS**: The prevalence of acute malnutrition is slightly higher in the county compared to the national KDHS data. Similarly, the prevalence of stunting and underweight is also higher in the county than in the national KDHS. These disparities may warrant further investigation to understand the underlying factors contributing to these differences.

5.0 KEY RECOMMENDATIONS

SHORT TERM RECOMMENDATIONS

1. **Sensitize and Train Healthcare Providers**: Ensuring that healthcare providers are knowledgeable about Infant and Maternal Nutrition (IMAM) is crucial. Proper training can help them identify and address malnutrition effectively.
2. **Scale-up Static IMAM Sites**: Increasing the number of static IMAM sites makes healthcare services more accessible to the community, especially those in remote areas.
3. **Mass Screening and Outreaches**: Identifying and targeting hotspot areas for mass screening and outreach efforts can help in early detection and intervention for acute malnutrition cases.
4. **Strengthen Supply Chain**: An efficient supply chain ensures that nutrition commodities and supplies are readily available when needed, preventing shortages in critical resources.
5. **Scale-up Baby Friendly Community Initiative**: Promoting breastfeeding and providing support to mothers and infants through the Baby Friendly Community initiative is essential for infant nutrition.
6. **Coordination Meetings**: Regular coordination meetings at the county and sub-county levels facilitate collaboration among stakeholders, streamlining efforts to combat malnutrition.
7. **Family MUAC Approach**: The Mid-Upper Arm Circumference (MUAC) approach is a quick and reliable way to detect malnutrition in children. Scaling this up helps with early detection and intervention.
8. **Quality of Care**: Continuous mentorship and supportive supervision ensure that healthcare providers maintain a high standard of care for malnourished children.
9. **SBCC on WASH**: Social Behavior Change Communication (SBCC) for Water, Sanitation, and Hygiene (WASH) interventions is crucial for preventing the causes of malnutrition related to poor hygiene and sanitation.
10. **School Health and Nutrition Education**: Incorporating health and nutrition education into schools helps create awareness and promote healthy habits among children.
11. **IMAM Surge Approach**: Being prepared for case load surges during emergencies is vital for a quick response to increased malnutrition cases.
12. **Health and Nutrition Surveillance**: Regular monitoring and surveillance provide data that helps in planning and adapting interventions as needed.
13. **Cash Transfer Program**: Providing cash transfers to households with malnourished children can help alleviate their vulnerability and improve their access to essential resources.

MEDIUM TO LONG TERM

1. **Biannual Nutrition Assessment**: Regular nutrition assessments provide crucial data to monitor the nutrition situation, allowing for timely interventions and adjustments in the nutrition program.
2. **Enhance Food Security**: Empowering communities with agri-nutrition knowledge helps them produce and access nutritious food, improving food security at the household level.
3. **Hiring More Healthcare Providers and Promoters**: Increasing the healthcare workforce enhances the capacity to provide nutrition interventions both at healthcare facilities and within the community.
4. **Advocacy for Increased Budget Allocation**: Adequate budget allocation for nutrition commodities and supplies is essential to ensure the availability of resources needed for effective nutrition programs.
5. **Multi-Sectorial Collaborations**: Collaboration across sectors ensures that nutrition-sensitive interventions are integrated into various programs, addressing the root causes of malnutrition.
6. **Nutrition Financial Tracking**: Tracking nutrition funds helps ensure transparency and accountability in the allocation and utilization of resources for nutrition programs.
7. **Support Nutrition-Sensitive Activities**: Initiating activities like kitchen gardens and demonstration gardens promotes healthy eating habits and access to nutritious foods at the community level.
8. **Cash Transfer Programs**: Providing social protection through cash transfers to households with malnourished children can help alleviate their financial burden and improve their access to essential resources.
9. **Coverage Assessment**: Identifying barriers to effective Infant and Maternal Nutrition (IMAM) programming is essential to tailor interventions to specific needs and challenges in the county.
10. **WASH Facilities**: Access to clean water and sanitation facilities is crucial for preventing the causes of malnutrition related to poor hygiene and sanitation.
11. **Income Generating Activities**: Establishing income-generating activities in the community helps build resilience, especially after drought emergencies, by providing alternative sources of livelihood

5.0 ANNEXES

5.1 Appendix 1: Organization Kitui County Integrated SMART Survey Activities

Activity	By	Survey timeline
County Nutrition Technical Forum approval of Methodology	DoH/Partners	29th May 2023
Presentation of methodology to NITWG	DoH/CIWG	2nd June 2023
Recruitment of survey team	DoH/WVK/	5th – 9th June 2023
Training survey team	DoH, NITWG and partners	14th - 17th June 2023
Field data collection	DoH, Partners	19th – 24th June 2023
Data analysis	DoH/IWG/Partners	26th June – 1st July 2023
Preliminary report	DoH/NITWG/Partners	3rd to 8th July 2023
Presentation of the preliminary findings and draft report to CSG/CNTF/CHMT	DoH/CIWG	18/07/2023
Presentation of SMART survey findings to NITWG for validation	DoH	By end of July 2023
Writing of final report	DoH/CIWG	August 2023

5.2 Appendix 2: Kitui County SMART Survey Plausibility Report

Overall data quality

Criteria	Flags*	Unit	Excel.	Good	Accept	Problematic	Score
Flagged data (% of out of range subjects)	Incl	%	0-2.5 0	>2.5-5.0 5	>5.0-7.5 10	>7.5 20	**0** (1.2 %)
Overall Sex ratio (Significant chi square)	Incl	p	>0.1 0	>0.05 2	>0.001 4	<=0.001 10	**0** (p=0.956)
Age ratio(6-29 vs 30-59) (Significant chi square)	Incl	p	>0.1 0	>0.05 2	>0.001 4	<=0.001 10	**2** (p=0.099)
Dig pref score - weight	Incl	#	0-7 0	8-12 2	13-20 4	> 20 10	**0** (6)
Dig pref score - height	Incl	#	0-7 0	8-12 2	13-20 4	> 20 10	**0** (4)
Dig pref score - MUAC	Incl	#	0-7 0	8-12 2	13-20 4	> 20 10	**0** (4)
Standard Dev WHZ	Excl	SD	<1.1 and	<1.15 and	<1.20 and	>=1.20 or	
.	Excl	SD	>0.9 0	>0.85 5	>0.80 10	<=0.80 20	**0** (0.98)
Skewness WHZ	Excl	#	<±0.2 0	<±0.4 1	<±0.6 3	>=±0.6 5	**1** (0.27)
Kurtosis WHZ	Excl	#	<±0.2 0	<±0.4 1	<±0.6 3	>=±0.6 5	**1** (0.28)
Poisson dist WHZ-2	Excl	p	>0.05 0	>0.01 1	>0.001 3	<=0.001 5	**0** (p=0.300)
OVERALL SCORE WHZ =			0-9	10-14	15-24	>25	**4** %

The overall score of this survey is 4 %, this is excellent.

There were no duplicate entries detected.

Percentage of children with no exact birthday: 29 %

Anthropometric Indices likely to be in error (-3 to 3 for WHZ, -3 to 3 for HAZ, -3 to 3 for WAZ, from observed mean - chosen in Options panel - these values will be flagged and should be excluded from analysis for a nutrition survey in emergencies. For other surveys this might not be the best procedure e.g. when the percentage of overweight children has to be calculated):

Line=26/ID=: **WHZ (5.839)**, HAZ (-6.778), Height may be incorrect
Line=81/ID=: HAZ (-4.653), Age may be incorrect
Line=91/ID=: HAZ (-6.832), WAZ (-5.606), Age may be incorrect
Line=164/ID=: **WHZ (4.917)**, WAZ (2.539), Weight may be incorrect
Line=219/ID=: HAZ (1.805), Height may be incorrect

Line=227/ID=: HAZ (3.277), Age may be incorrect
Line=231/ID=: HAZ (-4.608), Age may be incorrect
Line=267/ID=: **WHZ (-3.819)**, HAZ (-6.350), WAZ (-5.595)
Line=277/ID=: **WHZ (2.777)**, WAZ (2.169), Weight may be incorrect
Line=282/ID=: HAZ (2.722), Age may be incorrect
Line=285/ID=: WAZ (2.410), Age may be incorrect

Percentage of values flagged with SMART flags:WHZ: 1.2 %, HAZ: 2.4 %, WAZ: 1.5 %

Age distribution:

Month 6 : ####
Month 7 : ########
Month 8 : #####
Month 9 : ############
Month 10 : #####
Month 11 : #####
Month 12 : #######
Month 13 : ####
Month 14 : ##
Month 15 : ####
Month 16 : #####
Month 17 : ########
Month 18 : #######
Month 19 : ######
Month 20 : ###
Month 21 : ######
Month 22 : #########
Month 23 : ######
Month 24 : ##########
Month 25 : ##########
Month 26 : ##########
Month 27 : ########
Month 28 : #########
Month 29 : ############
Month 30 : ##########
Month 31 : ###
Month 32 : #
Month 33 : ############
Month 34 : #####
Month 35 : ##########
Month 36 : #####
Month 37 : #####
Month 38 : ###
Month 39 : ###########

Month 40 : ###
Month 41 : ###
Month 42 : ########
Month 43 : #######
Month 44 : ###
Month 45 : ####
Month 46 : ######
Month 47 : ######
Month 48 : ##########
Month 49 : #########
Month 50 : ############
Month 51 : ####
Month 52 : ####
Month 53 : ##
Month 54 : ###
Month 55 : ##
Month 56 :
Month 57 : ##
Month 58 : ####
Month 59 : ########

Age ratio of 6-29 months to 30-59 months: 1.02 (The value should be around 0.85).: p-value = 0.099 (as expected)

Statistical evaluation of sex and age ratios (using Chi squared statistic):

Age cat.	mo.	boys	girls	total	ratio boys/girls
6 to 17	12	35/38.8 (0.9)	36/38.6 (0.9)	71/77.4 (0.9)	0.97
18 to 29	12	54/37.5 (1.4)	43/37.3 (1.2)	97/74.7 (1.3)	1.26
30 to 41	12	37/36.7 (1.0)	36/36.5 (1.0)	73/73.2 (1.0)	1.03
42 to 53	12	31/36.1 (0.9)	43/35.9 (1.2)	74/72.0 (1.0)	0.72
54 to 59	6	10/17.9 (0.6)	8/17.8 (0.5)	18/35.6 (0.5)	1.25
6 to 59	54	167/166.5 (1.0)	166/166.5 (1.0)		1.01

The data are expressed as observed number/expected number (ratio of obs/expect)

Overall sex ratio: p-value = 0.956 (boys and girls equally represented)
Overall age distribution: p-value = 0.003 (significant difference)
Overall age distribution for boys: p-value = 0.018 (significant difference)
Overall age distribution for girls: p-value = 0.098 (as expected)
Overall sex/age distribution: p-value = 0.001 (significant difference)

Distribution of month of birth

Jan: ########################
Feb: ##################
Mar: ################################

Apr: ########################
May: ##########################
Jun: ##############################
Jul: ##################################
Aug: ##############################
Sep: ##################################
Oct: ################
Nov: ########################
Dec: ##################################

Digit preference Weight:

Digit .0 : ##################################
Digit .1 : ####################################
Digit .2 : ####################################
Digit .3 : ##
Digit .4 : ##############################
Digit .5 : ##############################
Digit .6 : ##
Digit .7 : ########################
Digit .8 : ##############################
Digit .9 : ##############################

Digit preference score: **6** (0-7 excellent, 8-12 good, 13-20 acceptable and > 20 problematic)
p-value for chi2: 0.420

Digit preference Height:

Digit .0 : ##################################
Digit .1 : ##############################
Digit .2 : ##############################
Digit .3 : ##############################
Digit .4 : ##############################
Digit .5 : ##
Digit .6 : ##############################
Digit .7 : ##
Digit .8 : ##############################
Digit .9 : ########################

Digit preference score: **4** (0-7 excellent, 8-12 good, 13-20 acceptable and > 20 problematic)
p-value for chi2: 0.803

Digit preference MUAC:

Digit .0 : ##################################
Digit .1 : ##############################
Digit .2 : ################################
Digit .3 : ##
Digit .4 : ###################################
Digit .5 : ##############################
Digit .6 : ##
Digit .7 : ################################
Digit .8 : ############################
Digit .9 : ##################################

Digit preference score: **4** (0-7 excellent, 8-12 good, 13-20 acceptable and > 20 problematic)
p-value for chi2: 0.861

Evaluation of Standard deviation, Normal distribution, Skewness and Kurtosis using the 3 exclusion (Flag) procedures

.	no exclusion	exclusion from reference mean (WHO flags)	exclusion from observed mean (SMART flags)
WHZ			
Standard Deviation SD:	1.11	1.06	0.98
(The SD should be between 0.8 and 1.2)			
Prevalence (< -2)			
observed:	6.3%	6.3%	
calculated with current SD:	8.5%	7.7%	
calculated with a SD of 1:	6.4%	6.6%	
HAZ			
Standard Deviation SD:	1.29	1.20	1.11
(The SD should be between 0.8 and 1.2)			
Prevalence (< -2)			
observed:	30.6%	30.0%	29.8%
calculated with current SD:	35.3%	32.8%	32.2%
calculated with a SD of 1:	31.4%	29.7%	30.4%
WAZ			
Standard Deviation SD:	1.08	1.08	0.98
(The SD should be between 0.8 and 1.2)			
Prevalence (< -2)			
observed:	20.7%	20.7%	
calculated with current SD:	22.1%	22.1%	
calculated with a SD of 1:	20.3%	20.3%	
Results for Shapiro-Wilk test for normally (Gaussian) distributed data:			
WHZ	p= 0.000	p= 0.000	p= 0.047
HAZ	p= 0.000	p= 0.013	p= 0.471
WAZ	p= 0.000	p= 0.000	p= 0.568
(If p < 0.05 then the data are not normally distributed. If p > 0.05 you can consider the data normally distributed)			
Skewness			
WHZ	1.01	0.58	0.27
HAZ	-0.29	0.24	0.01
WAZ	-0.03	-0.03	0.11
If the value is:			
-below minus 0.4 there is a relative excess of wasted/stunted/underweight subjects in the sample			
-between minus 0.4 and minus 0.2, there may be a relative excess of wasted/stunted/underweight			

subjects in the sample.
-between minus 0.2 and plus 0.2, the distribution can be considered as symmetrical.
-between 0.2 and 0.4, there may be an excess of obese/tall/overweight subjects in the sample.
-above 0.4, there is an excess of obese/tall/overweight subjects in the sample

Kurtosis

WHZ	4.39	2.15	0.28
HAZ	2.31	0.96	0.09
WAZ	1.75	1.75	0.01

Kurtosis characterizes the relative size of the body versus the tails of the distribution. Positive kurtosis indicates relatively large tails and small body. Negative kurtosis indicates relatively large body and small tails.
If the absolute value is:
-above 0.4 it indicates a problem. There might have been a problem with data collection or sampling.
-between 0.2 and 0.4, the data may be affected with a problem.
-less than an absolute value of 0.2 the distribution can be considered as normal.

Test if cases are randomly distributed or aggregated over the clusters by calculation of the Index of Dispersion (ID) and comparison with the Poisson distribution for:

```
WHZ < -2: ID=1.10 (p=0.300)
WHZ < -3: ID=1.00 (p=0.472)
GAM:      ID=1.10 (p=0.300)
SAM:      ID=1.00 (p=0.472)
HAZ < -2: ID=1.02 (p=0.435)
HAZ < -3: ID=1.32 (p=0.071)
WAZ < -2: ID=1.21 (p=0.153)
WAZ < -3: ID=1.01 (p=0.456)
```

Subjects with SMART flags are excluded from this analysis.

The Index of Dispersion (ID) indicates the degree to which the cases are aggregated into certain clusters (the degree to which there are "pockets"). If the ID is less than 1 and p > 0.95 it indicates that the cases are UNIFORMLY distributed among the clusters. If the p value is between 0.05 and 0.95 the cases appear to be randomly distributed among the clusters, if ID is higher than 1 and p is less than 0.05 the cases are aggregated into certain cluster (there appear to be pockets of cases). If this is the case for Oedema but not for WHZ then aggregation of GAM and SAM cases is likely due to inclusion of oedematous cases in GAM and SAM estimates.

Are the data of the same quality at the beginning and the end of the clusters?

Evaluation of the SD for WHZ depending upon the order the cases are measured within each cluster (if one cluster per day is measured then this will be related to the time of the day the measurement is made).

```
Time                                        SD for WHZ
point              0.8 0.9 1.0 1.1 1.2 1.3 1.4 1.5 1.6 1.7 1.8 1.9 2.0 2.1 2.2 2.3
01: 0.96 (n=47, f=0)  #######
02: 1.07 (n=45, f=0)  ###########
03: 1.31 (n=44, f=1)  ######################
04: 1.43 (n=42, f=1)  ##########################
05: 0.90 (n=41, f=0)  ####
06: 0.89 (n=33, f=1)  ####
07: 1.16 (n=27, f=0)  ###############
08: 1.02 (n=18, f=0)  #########
```

```
09: 1.06 (n=12, f=0)  OOOOOOOOOOO
10: 0.70 (n=09, f=0)
11: 1.01 (n=06, f=0)  ~~~~~~~~~
12: 0.59 (n=04, f=0)
13: 0.89 (n=02, f=0)  ~~~~

(when n is much less than the average number of subjects per cluster different symbols are used:
0 for n < 80% and ~ for n < 40%; The numbers marked "f" are the numbers of SMART flags found in
the different time points)
```

Analysis by Team

Team	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
n =	54	54	37	43	32	49	39	25
Percentage of values flagged with SMART flags:								
WHZ:	0.0	3.7	0.0	2.3	0.0	0.0	0.0	4.0
HAZ:	1.9	3.7	0.0	0.0	0.0	8.2	0.0	4.0
WAZ:	1.9	3.7	0.0	4.7	0.0	0.0	0.0	0.0
Age ratio of 6-29 months to 30-59 months:								
	1.08	1.16	1.64	1.05	0.78	0.48	1.05	1.78
Sex ratio (male/female):								
	1.00	1.08	0.85	0.95	1.13	0.81	1.05	1.50
Digit preference Weight (%):								
.0 :	9	9	22	7	6	6	10	12
.1 :	17	11	11	12	13	10	5	8
.2 :	7	9	11	26	13	8	5	12
.3 :	17	6	19	5	6	14	15	12
.4 :	9	7	0	19	6	12	5	8
.5 :	11	7	5	5	13	12	10	8
.6 :	11	17	16	9	9	10	21	12
.7 :	7	9	0	9	9	6	8	12
.8 :	2	13	8	9	3	8	13	12
.9 :	9	11	8	0	22	12	8	4
DPS:	14	10	23	23	17	9	16	9

Digit preference score (0-7 excellent, 8-12 good, 13-20 acceptable and > 20 problematic)

Digit preference Height (%):								
.0 :	7	9	14	9	25	10	10	0
.1 :	9	11	11	9	13	10	8	4
.2 :	6	7	14	14	6	10	15	4
.3 :	20	6	8	9	6	8	8	8
.4 :	15	7	8	5	6	8	18	12
.5 :	7	11	14	7	6	14	15	28
.6 :	9	9	5	12	9	16	5	16
.7 :	13	24	16	7	16	6	3	8
.8 :	7	6	8	23	6	12	5	0
.9 :	6	9	3	5	6	4	13	20
DPS:	15	17	13	17	20	12	16	29

Digit preference score (0-7 excellent, 8-12 good, 13-20 acceptable and > 20 problematic)

Digit preference MUAC (%):

.0 :	7	9	11	5	19	8	23	4
.1 :	9	9	8	12	6	4	10	16
.2 :	9	6	11	5	19	14	8	8
.3 :	11	13	14	9	9	14	5	20
.4 :	13	11	11	14	3	12	8	12
.5 :	11	6	3	16	6	4	15	12
.6 :	7	20	8	7	13	16	10	12
.7 :	6	9	8	16	9	8	10	8
.8 :	9	9	11	7	13	8	3	4
.9 :	17	7	16	9	3	10	8	4
DPS:	10	14	11	14	18	13	18	17

Digit preference score (0-7 excellent, 8-12 good, 13-20 acceptable and > 20 problematic)

Standard deviation of WHZ:

SD	1.13	1.11	1.04	1.23	0.95	0.96	1.07	1.49
Prevalence (< -2) observed:								
%	5.6	5.6	2.7	4.7			15.4	4.0
Prevalence (< -2) calculated with current SD:								
%	10.6	8.8	4.8	9.0			8.0	15.7
Prevalence (< -2) calculated with a SD of 1:								
%	7.9	6.6	4.1	4.9			6.6	6.6

Standard deviation of HAZ:

SD	1.28	1.46	1.00	1.11	1.31	1.56	0.91	1.34
observed:								
%	18.5	33.3		25.6	31.3	40.8		52.0
calculated with current SD:								
%	26.8	35.8		36.2	27.8	40.6		53.0
calculated with a SD of 1:								
%	21.3	29.8		34.8	22.0	35.6		54.0

Statistical evaluation of sex and age ratios (using Chi squared statistic) for:

Team 1:

Age cat.	mo.	boys	girls	total	ratio boys/girls
6 to 17	12	6/6.3 (1.0)	7/6.3 (1.1)	13/12.6 (1.0)	0.86
18 to 29	12	8/6.1 (1.3)	7/6.1 (1.2)	15/12.1 (1.2)	1.14
30 to 41	12	7/5.9 (1.2)	7/5.9 (1.2)	14/11.9 (1.2)	1.00
42 to 53	12	5/5.8 (0.9)	6/5.8 (1.0)	11/11.7 (0.9)	0.83
54 to 59	6	1/2.9 (0.3)	0/2.9 (0.0)	1/5.8 (0.2)	
6 to 59	54	27/27.0 (1.0)	27/27.0 (1.0)		1.00

The data are expressed as observed number/expected number (ratio of obs/expect)

Overall sex ratio: p-value = 1.000 (boys and girls equally represented)

Overall age distribution: p-value = 0.280 (as expected)
Overall age distribution for boys: p-value = 0.703 (as expected)
Overall age distribution for girls: p-value = 0.507 (as expected)
Overall sex/age distribution: p-value = 0.240 (as expected)

Team 2:

Age cat.	mo.	boys	girls	total	ratio boys/girls
6 to 17	12	6/6.5 (0.9)	9/6.0 (1.5)	15/12.6 (1.2)	0.67
18 to 29	12	7/6.3 (1.1)	7/5.8 (1.2)	14/12.1 (1.2)	1.00
30 to 41	12	7/6.2 (1.1)	5/5.7 (0.9)	12/11.9 (1.0)	1.40
42 to 53	12	7/6.1 (1.2)	5/5.6 (0.9)	12/11.7 (1.0)	1.40
54 to 59	6	1/3.0 (0.3)	0/2.8 (0.0)	1/5.8 (0.2)	
6 to 59	54	28/27.0 (1.0)	26/27.0 (1.0)		1.08

The data are expressed as observed number/expected number (ratio of obs/expect)

Overall sex ratio: p-value = 0.785 (boys and girls equally represented)
Overall age distribution: p-value = 0.316 (as expected)
Overall age distribution for boys: p-value = 0.788 (as expected)
Overall age distribution for girls: p-value = 0.329 (as expected)
Overall sex/age distribution: p-value = 0.178 (as expected)

Team 3:

Age cat.	mo.	boys	girls	total	ratio boys/girls
6 to 17	12	5/4.0 (1.3)	3/4.7 (0.6)	8/8.6 (0.9)	1.67
18 to 29	12	6/3.8 (1.6)	9/4.5 (2.0)	15/8.3 (1.8)	0.67
30 to 41	12	1/3.7 (0.3)	3/4.4 (0.7)	4/8.1 (0.5)	0.33
42 to 53	12	4/3.7 (1.1)	5/4.3 (1.2)	9/8.0 (1.1)	0.80
54 to 59	6	1/1.8 (0.5)	0/2.1 (0.0)	1/4.0 (0.3)	
6 to 59	54	17/18.5 (0.9)	20/18.5 (1.1)		0.85

The data are expressed as observed number/expected number (ratio of obs/expect)

Overall sex ratio: p-value = 0.622 (boys and girls equally represented)
Overall age distribution: p-value = 0.043 (significant difference)
Overall age distribution for boys: p-value = 0.416 (as expected)
Overall age distribution for girls: p-value = 0.099 (as expected)
Overall sex/age distribution: p-value = 0.015 (significant difference)

Team 4:

Age cat.	mo.	boys	girls	total	ratio boys/girls
6 to 17	12	3/4.9 (0.6)	6/5.1 (1.2)	9/10.0 (0.9)	0.50
18 to 29	12	9/4.7 (1.9)	4/4.9 (0.8)	13/9.6 (1.3)	2.25
30 to 41	12	8/4.6 (1.7)	3/4.8 (0.6)	11/9.4 (1.2)	2.67
42 to 53	12	0/4.5 (0.0)	9/4.8 (1.9)	9/9.3 (1.0)	0.00
54 to 59	6	1/2.2 (0.4)	0/2.4 (0.0)	1/4.6 (0.2)	
6 to 59	54	21/21.5 (1.0)	22/21.5 (1.0)		0.95

The data are expressed as observed number/expected number (ratio of obs/expect)

Overall sex ratio: p-value = 0.879 (boys and girls equally represented)
Overall age distribution: p-value = 0.361 (as expected)
Overall age distribution for boys: p-value = 0.015 (significant difference)
Overall age distribution for girls: p-value = 0.128 (as expected)
Overall sex/age distribution: p-value = 0.001 (significant difference)

Team 5:

Age cat.	mo.	boys	girls	total	ratio boys/girls
6 to 17	12	0/4.0 (0.0)	2/3.5 (0.6)	2/7.4 (0.3)	0.00
18 to 29	12	8/3.8 (2.1)	4/3.4 (1.2)	12/7.2 (1.7)	2.00
30 to 41	12	5/3.7 (1.3)	4/3.3 (1.2)	9/7.0 (1.3)	1.25
42 to 53	12	3/3.7 (0.8)	5/3.2 (1.5)	8/6.9 (1.2)	0.60
54 to 59	6	1/1.8 (0.5)	0/1.6 (0.0)	1/3.4 (0.3)	
6 to 59	54	17/16.0 (1.1)	15/16.0 (0.9)		1.13

The data are expressed as observed number/expected number (ratio of obs/expect)

Overall sex ratio: p-value = 0.724 (boys and girls equally represented)
Overall age distribution: p-value = 0.047 (significant difference)
Overall age distribution for boys: p-value = 0.050 (as expected)
Overall age distribution for girls: p-value = 0.484 (as expected)
Overall sex/age distribution: p-value = 0.009 (significant difference)

Team 6:

Age cat.	mo.	boys	girls	total	ratio boys/girls
6 to 17	12	4/5.1 (0.8)	3/6.3 (0.5)	7/11.4 (0.6)	1.33
18 to 29	12	6/4.9 (1.2)	3/6.1 (0.5)	9/11.0 (0.8)	2.00
30 to 41	12	6/4.8 (1.2)	8/5.9 (1.3)	14/10.8 (1.3)	0.75
42 to 53	12	5/4.8 (1.1)	8/5.8 (1.4)	13/10.6 (1.2)	0.63
54 to 59	6	1/2.4 (0.4)	5/2.9 (1.7)	6/5.2 (1.1)	0.20
6 to 59	54	22/24.5 (0.9)	27/24.5 (1.1)		0.81

The data are expressed as observed number/expected number (ratio of obs/expect)

Overall sex ratio: p-value = 0.475 (boys and girls equally represented)
Overall age distribution: p-value = 0.451 (as expected)
Overall age distribution for boys: p-value = 0.819 (as expected)
Overall age distribution for girls: p-value = 0.177 (as expected)
Overall sex/age distribution: p-value = 0.065 (as expected)

Team 7:

Age cat.	mo.	boys	girls	total	ratio boys/girls
6 to 17	12	7/4.7 (1.5)	5/4.4 (1.1)	12/9.1 (1.3)	1.40
18 to 29	12	4/4.5 (0.9)	4/4.3 (0.9)	8/8.8 (0.9)	1.00

Age cat.	mo.	boys	girls	total	ratio boys/girls
30 to 41	12	1/4.4 (0.2)	4/4.2 (1.0)	5/8.6 (0.6)	0.25
42 to 53	12	6/4.3 (1.4)	3/4.1 (0.7)	9/8.4 (1.1)	2.00
54 to 59	6	2/2.1 (0.9)	3/2.0 (1.5)	5/4.2 (1.2)	0.67
6 to 59	54	20/19.5 (1.0)	19/19.5 (1.0)		1.05

The data are expressed as observed number/expected number (ratio of obs/expect)

Overall sex ratio: p-value = 0.873 (boys and girls equally represented)
Overall age distribution: p-value = 0.609 (as expected)
Overall age distribution for boys: p-value = 0.340 (as expected)
Overall age distribution for girls: p-value = 0.930 (as expected)
Overall sex/age distribution: p-value = 0.240 (as expected)

Team 8:

Age cat.	mo.	boys	girls	total	ratio boys/girls
6 to 17	12	4/3.5 (1.1)	1/2.3 (0.4)	5/5.8 (0.9)	4.00
18 to 29	12	6/3.4 (1.8)	5/2.2 (2.2)	11/5.6 (2.0)	1.20
30 to 41	12	2/3.3 (0.6)	2/2.2 (0.9)	4/5.5 (0.7)	1.00
42 to 53	12	1/3.2 (0.3)	2/2.2 (0.9)	3/5.4 (0.6)	0.50
54 to 59	6	2/1.6 (1.2)	0/1.1 (0.0)	2/2.7 (0.7)	
6 to 59	54	15/12.5 (1.2)	10/12.5 (0.8)		1.50

The data are expressed as observed number/expected number (ratio of obs/expect)

Overall sex ratio: p-value = 0.317 (boys and girls equally represented)
Overall age distribution: p-value = 0.139 (as expected)
Overall age distribution for boys: p-value = 0.368 (as expected)
Overall age distribution for girls: p-value = 0.264 (as expected)
Overall sex/age distribution: p-value = 0.035 (significant difference)

Evaluation of the SD for WHZ depending upon the order the cases are measured within each cluster (if one cluster per day is measured then this will be related to the time of the day the measurement is made).

Team: 1

```
Time                                          SD for WHZ
point                0.8 0.9 1.0 1.1 1.2 1.3 1.4 1.5 1.6 1.7 1.8 1.9 2.0 2.1 2.2 2.3
01: 1.21 (n=07, f=0) ################
02: 1.09 (n=06, f=0) ############
03: 1.05 (n=06, f=0) ##########
04: 1.68 (n=06, f=0) ####################################
05: 0.76 (n=06, f=0)
06: 0.69 (n=06, f=0)
07: 1.26 (n=05, f=0) ##################
08: 1.63 (n=04, f=0) ##################################
09: 0.62 (n=04, f=0)
10: 1.14 (n=02, f=0) OOOOOOOOOOOOO
```

(when n is much less than the average number of subjects per cluster different symbols are used: 0 for n < 80% and ~ for n < 40%; The numbers marked "f" are the numbers of SMART flags found in the different time points)

Team: 2

```
Time                                              SD for WHZ
point                  0.8 0.9 1.0 1.1 1.2 1.3 1.4 1.5 1.6 1.7 1.8 1.9 2.0 2.1 2.2 2.3
01: 0.64 (n=06, f=0)
02: 1.11 (n=06, f=0)   #############
03: 0.29 (n=06, f=0)
04: 1.69 (n=06, f=0)   ####################################
05: 0.85 (n=06, f=0)   ##
06: 1.52 (n=05, f=1)   ##############################
07: 1.07 (n=05, f=0)   ###########
08: 0.19 (n=03, f=0)
09: 1.24 (n=02, f=0)   OOOOOOOOOOOOOOOOOO
10: 0.34 (n=02, f=0)
11: 1.46 (n=02, f=0)   OOOOOOOOOOOOOOOOOOOOOOOOOOOO
```

(when n is much less than the average number of subjects per cluster different symbols are used: 0 for n < 80% and ~ for n < 40%; The numbers marked "f" are the numbers of SMART flags found in the different time points)

Team: 3

```
Time                                              SD for WHZ
point                  0.8 0.9 1.0 1.1 1.2 1.3 1.4 1.5 1.6 1.7 1.8 1.9 2.0 2.1 2.2 2.3
01: 0.83 (n=06, f=0)   #
02: 1.36 (n=06, f=0)   ########################
03: 0.86 (n=05, f=0)   ###
04: 0.97 (n=05, f=0)   #######
05: 0.94 (n=04, f=0)   ######
06: 0.82 (n=04, f=0)   #
07: 1.66 (n=03, f=0)   ####################################
```

(when n is much less than the average number of subjects per cluster different symbols are used: 0 for n < 80% and ~ for n < 40%; The numbers marked "f" are the numbers of SMART flags found in the different time points)

Team: 4

```
Time                                              SD for WHZ
point                  0.8 0.9 1.0 1.1 1.2 1.3 1.4 1.5 1.6 1.7 1.8 1.9 2.0 2.1 2.2 2.3
01: 1.46 (n=06, f=0)   ############################
02: 1.09 (n=06, f=0)   ############
03: 0.73 (n=06, f=0)
04: 2.37 (n=06, f=1)   ################################################################
05: 0.45 (n=06, f=0)
06: 0.97 (n=04, f=0)   #######
07: 1.23 (n=04, f=0)   ##################
08: 0.52 (n=03, f=0)
```

(when n is much less than the average number of subjects per cluster different symbols are used: 0 for n < 80% and ~ for n < 40%; The numbers marked "f" are the numbers of SMART flags found in the different time points)

Team: 5

```
Time                                              SD for WHZ
point                  0.8 0.9 1.0 1.1 1.2 1.3 1.4 1.5 1.6 1.7 1.8 1.9 2.0 2.1 2.2 2.3
01: 0.80 (n=06, f=0)
02: 0.93 (n=06, f=0)   #####
03: 0.73 (n=05, f=0)
```

```
04: 0.46 (n=05, f=0)
05: 1.10 (n=05, f=0)  #############
06: 0.57 (n=03, f=0)
07: 1.81 (n=02, f=0)  OOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOO
```

(when n is much less than the average number of subjects per cluster different symbols are used: 0 for n < 80% and ~ for n < 40%; The numbers marked "f" are the numbers of SMART flags found in the different time points)

Team: 6

```
Time                                          SD for WHZ
point                 0.8 0.9 1.0 1.1 1.2 1.3 1.4 1.5 1.6 1.7 1.8 1.9 2.0 2.1 2.2 2.3
01: 0.95 (n=06, f=0)  ######
02: 1.18 (n=06, f=0)  ################
03: 1.25 (n=05, f=0)  ##################
04: 0.91 (n=05, f=0)  #####
05: 0.79 (n=05, f=0)
06: 0.94 (n=05, f=0)  ######
07: 0.54 (n=04, f=0)
08: 0.64 (n=04, f=0)
09: 2.09 (n=02, f=0)  OOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOO
10: 0.32 (n=02, f=0)
11: 1.00 (n=02, f=0)  OOOOOOOO
12: 0.01 (n=02, f=0)
```

(when n is much less than the average number of subjects per cluster different symbols are used: 0 for n < 80% and ~ for n < 40%; The numbers marked "f" are the numbers of SMART flags found in the different time points)

Team: 7

```
Time                                          SD for WHZ
point                 0.8 0.9 1.0 1.1 1.2 1.3 1.4 1.5 1.6 1.7 1.8 1.9 2.0 2.1 2.2 2.3
01: 0.78 (n=05, f=0)
02: 0.96 (n=04, f=0)  #######
03: 1.02 (n=05, f=0)  #########
04: 1.51 (n=05, f=0)  ##############################
05: 1.03 (n=05, f=0)  ##########
06: 0.58 (n=05, f=0)
07: 0.64 (n=04, f=0)
08: 1.60 (n=03, f=0)  OOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOO
09: 1.32 (n=02, f=0)  OOOOOOOOOOOOOOOOOOOOO
```

(when n is much less than the average number of subjects per cluster different symbols are used: 0 for n < 80% and ~ for n < 40%; The numbers marked "f" are the numbers of SMART flags found in the different time points)

Team: 8

```
Time                                          SD for WHZ
point                 0.8 0.9 1.0 1.1 1.2 1.3 1.4 1.5 1.6 1.7 1.8 1.9 2.0 2.1 2.2 2.3
01: 0.29 (n=06, f=0)
02: 0.91 (n=05, f=0)  #####
03: 3.14 (n=05, f=1)  ##################################################################
04: 0.56 (n=04, f=0)
05: 1.03 (n=04, f=0)  ##########
```

(when n is much less than the average number of subjects per cluster different symbols are used: 0 for n < 80% and ~ for n < 40%; The numbers marked "f" are the numbers of SMART flags found in the different time points)

5.3 Appendix 3: Sampled Clusters

Sub County	LOC- NAME	Sub-Loc NAME	Geographical unit	Population size	Cluster
Kitui Central	KYANGWITHYA EAST	MUTUNE	MUTUNE	696	1
Kitui Central	KYANGWITHYA EAST	MULUNDI	KWAKAME	177	RC
Kitui Rural	MALIKU	MALIKU	KALIMANI	220	2
Kitui Central	KYANGWITHYA WEST	NDUMONI	NDUMONI	243	3
Kitui Central	TOWNSHIP	KALUNDU	KWA-KAMANDO	271	RC
Kitui Central	MULANGO	KYAMBITI	KITUTI 'A'	406	RC
Kitui Central	MIAMBANI	MUTULA	VINDA	156	4
Kitui West	KWA MUTONGA	MUTONGA	KALIANI	165	5
Kitui West	MUTULU	KATHUMA	KILUIYA	268	6
Kitui West	MUSENGO	MUSENGO	KYATHANI	445	7
Kitui West	MUTONGUNI	MITHINI	MITHINI	587	8
Kitui Central	USIANI	YALATANI	KITULINI	172	9
Kitui West	MUTANDA	SANGALA	KIKUMINI	182	10
	MBUSYANI	MUKAMENI	UNGAATU	393	11
Kitui Rural	KISASI	NGANGANI	MBITINI	111	12
Kitui East	NZAMBANI	MALUMA	KANGWENI	302	13
Kitui East	MBITINI	MBITINI	KIVUNU	590	14
Kitui Rural	KWA-VONZA	KANYONYONI	KINAINI	186	15
Kitui Rural	KANYANGI	MASIMBA	KANYANYI MKT	279	16
Kitui Rural	NTHONGONI	MUVITHA/KATHIMBONI	MUVITHA	250	17
Kitui East	MWITIKA	KAVINGO	KALULI	450	18
Kitui East	ENDAU	KATHUA	IMUVIA	370	19
Kitui East	ZOMBE	KASUNGUNI	KIMANGAU	517	20
Kitui South	MUTOMO	MWALA	KENZE	249	21
Kitui South	KIBWEA	KAWELU	KALIMBANI	158	22
Kitui South	IKANGA	KIANGWA	KATETHI	257	23
Kitui South	MUTHA	NGAANI	NGOSINI	416	24
Kitui East	VOO	KASASI	YAMASAU	253	25
Kitui South	MUTHIMA	KIATU	MAKUTANO	175	26
Kitui South	SIMISI	ILAMBA	NGWANI	224	27
Kitui South	KASAALA	NZAMBA	MEMBOO	299	28
Kitui South	ATHI	KILAWA	MWAMBA ISYUKO	211	29
Kitui South	KALIVU	MAKAIE	MAKUE	176	30
Mwingi Central	MWINGI	ITHUMBI	NDIANI	491	31

Mwingi Central	MWINGI	KANZUI	KANZUI	405	RC
Mwingi West	MUMBUNI	KWANUNGU	KISUNGULA/NZUNGUNI	290	32
Mwingi Central	WAITA	IKUUSYA	KANYEKINE 'B'	423	33
Mwingi West	KYETHANI	KARURA	MAKUTANO	325	34
Mwingi Central	NGUNI	MWASUMA	NGUNI TOWN	964	35
Mwingi Central	MBUVU	KALANGA	KITOVOTO/KWANYUMU	347	36
Mwingi West	NZAUNI	MUIVU	MITHITHINI	538	37
Mwingi West	KYOME	KYOME	MUNYUNI	420	38
Mwingi West	NGUUTANI	KAKULULO	MATHUNYANI	491	RC
Mwingi Central	WINGEMI	KYANGATI	KALANGUNGI	572	39
Mwingi Central	NUU	NGAANI	NDUYUNI/IMWAMBA	637	40
Mwingi Central	MUI	NGUNGI	UKATI	211	41
Mwingi North	KAMUWONGO	KAMUWONGO	KAMUWONGO	551	42
Mwingi North	KIMANGAO	KIMU	MWANGENI/KATHULA	428	43
Mwingi North	NGOMENI	IKIME	YAMWENZE	397	44
Mwingi North	MASYUNGWA	KATHIANI	UTING'AA	401	45
Mwingi North	MUKONG'A	IKONGO	IKONGO	300	46
Mwingi North	KAKUYU	TYAA KAMUTHALE	MALATANI	357	47
Mwingi North	MUTANDA	WANGUTU	WESUNGI	433	48

5.4 Appendix 4: Kitui County Survey Teams

ENUMERATORS				
NO	**NAME**	**GENDER**	**SUB-COUNTY**	**WARD**
1	BEATRICE KATHINI ALELA	F	KITUI SOUTH	MUTHA
2	YVONNE MWIKALI SAMMY	F	KITUI RURAL	KANYANGI
3	RUTH KALISA	F	KITUI CENTRAL	TOWNSHIP
4	ESTHER SALEE	F	MWINGI CENTRAL	KIVOU
5	MATTHEW MURIMI	M	KITUI RURAL	VONZA
6	ROBERT MUSYOKA MUTIA	M	KITUI SOUTH	MUTOMO/KIBWEA
7	ESTHER MALOMBE	F	KITUI CENTRAL	TOWNSHIP
8	MARY MWENDE	F	KITUI WEST	MATINYANI
9	ANJELINA MAIYU	F	KITUI CENTRAL	TOWNSHIP
10	VICTORIA SYOKAU MULINGE	F	KITUI CENTRAL	TOWNSHIP
11	JOHN MUNYOKI	M	KITUI CENTRAL	MULANGO WARD
12	MWANZIA SAMMY	M	MWINGI NORTH	MULANGONI
13	PATRICK WAMBUA GIDEON	M	KITUI RURAL	KWA VONZA
14	DEBRA MBULA KITHONGA	F	MWINGI WEST	NGUUTANI
15	JACQUIZ VULI MWAMBU	M	KITUI CENTRAL	MULANGO
16	SYLVESTER MUSYOKA	M	KITUI EAST	NZAMBANI
TEAM LEADERS				
NO	**NAME**	**GENDER**	**SUBCOUNTY**	**WARD**
1	FRIDAH SAMMY	F	MWINGI CENTRAL	WAITA
2	SYLVIA MUULI	F	KITUI CENTRAL	MULANGONI
3	SAMUEL MULONZYA	M	MWINGI NORTH	KYUSO
4	CAROLYINE MUSYOKA	F	MWINGI CENTRAL	WAITA
5	ROSALIA KIMULI	F	KITUI SOUTH	MUTOMO
6	LEAH MULWA	F	KITUI RURAL	KWA VONZA
7	DUNCAN MUTISYA	M	MWINGI NORTH	KYUSO
8	ELIZABETH MWANIA	F	KITUI WEST	KAUWI