MINISTRY OF HEALTH

INTEGRATED SMART SURVEY ISIOLO COUNTY KENYA-JANUARY 2019

Integrated SMART survey report Isiolo, KENYA

Report compiled by (Ministry of Health, Agriculture, Water, Livestock, NDMA among other partners) with technical support from Action Against Hunger

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Contents

ABBREVIATIONS

AAH	Action Against Hunger
BCC	Behavior Change Communication
BCG	Bacillus Calmette–Guérin
CI	Confidence Interval
CLTS	Community Led Total Sanitation
CNC	County Nutrition Coordinator
GAM	Global Acute Malnutrition
HFA	Height-for-Age
HHs	Households
HINI	High Impact Nutrition Interventions
ILRI	Integrated Livestock Research Institute
IMAM	Integrated Management of Acute Malnutrition
IPs	Implementing partners
KRCS	Kenya Red Cross Society
MOA	Ministry of Agriculture
MOH	Ministry of Health
MOW	Ministry of Water
MUAC	Mid Upper Arm Circumference
NDMA	National Drought Management Authority
NIWG	Nutrition Information working group
OPV	Oral Polio Vaccine
PPS	Probability Proportional to Population Size
SAM	Severe Acute Malnutrition
SFP	Supplementary Feeding Program
UNICEF	United Nations Children's Fund
WFA	Weight for Age
WFH	Weight-for-Height
WFP	World Food Program
WHO	World Health Organizations

EXECUTIVE SUMMARY

Isiolo County is one of the 23 ASALs Counties of Kenya covering 25,336km2 with an estimated population of 183,045 (Source: DHIS, Dec, 2018). It has 3 main livelihood zones; Pastoral,Agro-pastoral and Firewood/Formal employment representing 67%, 26% and 7% respectively[1]. It consists of three Sub-counties namely Isiolo, Garbatulla and Merti. The nutrition survey was conducted between 21st and 30thJanuary, 2019.

The Overall objective of the integrated survey was to determine the prevalence of malnutrition amongst children aged 6-59 months and women of reproductive age in Isiolo County. The Specific objectives were to determine; the prevalence of acute and chronic malnutrition in children aged 6-59 months; the immunization coverage for Measles, Oral Polio Vaccines (OPV 1 and 3)and vitamin A supplementation in children aged 6-59 months, deworming coverage in children aged 12-59 months; prevalence of common illnesses among Children 6-59 months,coverage of zinc and ORS for management of diarrhoea, coverage of iron / folic acid supplementation of mother with children below 24 months, the nutritional status of women of reproductive age (15-49 years) and collect contextual information on possible causes of malnutrition such as household food security, water, sanitation and hygiene (WASH) practices.

Methodology

The timing of the survey was aimed to inform the county health and nutrition and the findings to feed into the seasonal short rainfall performance assessment. The Isiolo County survey used Standardized Monitoring and Assessment in Relief and Transitions (SMART) methodology during the anthropometric survey in planning, training, data collection and analysis. The standard SMART survey questionnaire was created using kobo toolbox and downloaded into the smart phones and tablets using open data kit mobile application. Emergency Nutrition Assessment (ENA) software version 2011 (updated on 9th July, 2015) was used to calculate the sample size using various parameters giving a sample size of 569 households. Two stage cluster sampling was used whereby 41 clusters were to be sampled considering one team can visit a total of 14 households per day. Random number generator mobile application was used to sample the 14 households per village based on the updated list of households provided by the village guide. All the 41 clusters were covered. Besides anthropometric data, other data sets including immunization, nutrition, morbidity, Water, Sanitation and Hygiene (WASH), and food security were also collected during the survey.

Summary of findings

A total of 573 households were visited covering 569 children 6-59 months and 41 clusters. The survey involved 3028 persons with an average population of 5.27 persons per household. Proportion of children 6-59 months was 18.8% with proportion of children 0-23 months being 9.2%.

The overall data quality for anthropometric measurements was 3% indicating excellent performance. Table 1 below show a summary of survey findings based on the set indicators.

[1] NDMA livelihood classification for Isiolo County

Table 1: Summary of Results, Isiolo County; February 2018 to January 2019[2]

			Integrated nutrition survey[3]	
INDEX	**INDICATOR**		**February, 2018 (SMART)**	**January, 2018 (SMART)**
WHZ[4]-scores	Global Acute Malnutrition Weight for height <-2 z and/oedema		**13.8 %** (10.9 - 17.3 95% C.I.)	**9.2 %** (6.6 - 12.6 95% C.I.)
	Severe Acute Malnutrition Weight for height <-3 z and/oedema		**2.6 %** (1.6 - 4.2 95% C.I.)	**0.7 %** (0.2 - 2.4 95% C.I.)
HAZ[5]-scores	Stunting (<-2 z-score)		18.0%	**13.9 %** (10.4 - 18.4 95% C.I.)
WAZ[6]-scores	Underweight (<-2 z-score)		19.2%	**13.6 %** (10.1 - 18.1 95% C.I.)
MUAC[7]	Global Acute Malnutrition MUAC <125 mm and/or edema		4.8 % (3.3 - 6.8 95% C.I.)	**2.5 %** (1.2 - 4.9 95% C.I.)
	Severe Acute Malnutrition MUAC <115 mm and/or edema		1.8 % (1.0 - 3.2 95% C.I.)	**0.2 %** (0.0 - 1.3 95% C.I.)
Measles immunization coverage	9 Months by card		64.1%	72%
	18 Months by card		32.4%	55%
Vitamin A coverage	6-11 months ones		69.0%	67%
	6-59 months at least ones		65.0%	86%
	12- 59 months more than ones		49.5%	40%
Morbidity Patterns for 6-59 months	Ill in the last 2 weeks		46.5%	35.1%
	Type of illness	Fevers with chills like malaria	27%	31%
		ARI/Cough	54%	46%
		Watery diarrhea	13%	14%
Maternal nutrition status by MUAC	Pregnant and lactating women with MUAC <21cm		7.5%	4.7%
IFAS intake	Over 90 days during pregnancy		8.1%	6.0%
WASH	Protected water sources		72%	73.1%
	Distance to Main Water source	≤ 500M	63.4%	79.76%
		>500M-≤2km	23.1%	10.3%
		>2km	13.4%	9.95%
	Hand washing during four critical times		59.8%	66%
	Latrine coverage/open defecation		22.4%	22%
Food security and livelihoods	Food consumption score (FCS)	Poor	2.7%	2.3%
		Borderline	9.4%	11.0%
		Good	87.9%	86.7%
	Coping strategy index	Borrow food	3.09	3.8
		Restrict consumption	5.73	6.6

[2]Statistics for anthropometry are as per WHO 2006 Index
[3]Results presented in brackets are expressed with 95.0% confidence interval (CI)
[4]Weight for height Z scores
[5]Weight for age Z scores
[6]Weight for age Z scores
[7]Mid upper arm circumference

		for children to eat		
		Total weighted coping strategy score	17.8	18.7

Conclusion

Overall the nutrition Status of children in Isiolo County improved compared to the outcome of a SMART survey conducted in the same season in 2018. The current nutrition status of children in the County is in **Alert phase** (IPC Phase 2) with a global and severe acute malnutrition prevalence of 9.2 and 0.7 percent respectively a significant difference with p value 0.035 (GAM) and 0.027 (SAM) compared global and severe acute malnutrition prevalence of 13.8 and 2.6 percent respectively in 2018. The same significant improvement (p=0.027) where the percentage of children with underweight reduced from 19.2 in 2018 to 13.6 in 2019. The stunting levels were also noted to improve although with no statistical ssignificantdifference.

There was a reduction in the number of children under five reported to have fallen sick within two weeks recall period from 46.5 percent in 2018 to 35.1 percent in 2019.A Slightly higher number of children sought help from public health facilities in 2019 at 73 percent compared to 71 percent in 2018. Acute respiratory tract infections and fevers with chills like Malaria were the main morbidity at 46% and 31% respectively with a slight upsurge malaria in 2019 compared to 27% in 2018. Among the diarrhea cases reported 79 percent were reported to have been treated with ORS and Zinc an increase from 71.2 percent in 2018. Reduction in Acute respiratory tract infections and other diseasescan be attributed to an improvement in immunization coverage at 98.0%, 81.0%, 78.0%, 72% and 55% for BCG, OPV1, OPV3, Measles at 9 and Measles at 18 months respectively compared to 93.0%, 74.0%, 72.0%, 64% and 32% in 2018. There was also a notable improvement in Vitamin A Supplementation among children 6-59 months and deworming among children 12 to 59 months at least once from 65% and 60% in 2018 to 86% and 70% in 2019 respectively. The improved health service delivery and reduced morbidity coupled with appropriate health seeking behaviour can belinked with reduced wasting in Isiolo County. The unchanged number of diarrhea cases can be attributed to poor performance in WASH indicators with 22.0% of the households practising open defecation, and only 26.1% caregivers with children below 23 months washing hands at four critical times and only 21.8% of the households treating their drinking water.
Maternal nutrition status based on MUAC measurement among all women of reproductive age and pregnant and lactating women only showed an improvement with the two categories having MUAC of <21cm at 5.3% and 4.7% respectively in 2019 an improvement from 6.4% and 7.5% in 2018 respectively. Although71.6% mothers of children under two years were supplemented with iron and folic acid during their immediate previous pregnancy, the proportion that consumed iron and folic acid remains quite low. None of them consumed the supplements for the recommended 270 days and only 6.0% consumed the supplements for more than 90 days.

There was a notable improvement in food security indicator in the County compared to the same period 2018. The household dietary diversity increased with the proportion of households consuming more than 5 food groups increasing from 35.9% in 2018 to 59.3% in 2019. The major foods being consumed included cereals, legumes/pulses, sugars, oils and fats, milk and milk products. The

situation improvement is attributed to the heavy rains experienced during the long rains season. The county Food Consumption Score, which combines frequency of food intake and relative importance of each food, indicated 86.7% of the Households remaining at acceptable levels. However, Consumption of Iron rich and Vitamin A rich foods remained quite low with 38.5% of households at poor food consumption level not consuming iron rich foods and 69.2% not consuming vitamin A rich foods.

In conclusion it can be noted that the key drivers of poor nutrition status in Isiolo County include; Chronic food insecurity, High prevalence of childhood illness, Inadequate dietary diversity, Poor access to safe water, Poor hygiene and sanitation practices, and Inadequate basic structures (incomes and assets for the households).

Table 2: A Summary of the Recommendations Based on the Survey Findings

- Active case findings at the community and Nutrition surveillance and scale up of IMAM surge activities at health facilities. - Continued scale up of MIYCN (BFCI and BFHI) and IMAM activities	- Establish a Multi-sectoral platform for sensitization of the political class and coordination of implementation of nutrition (sensitive and specific) activities and advocate for employment of more nutritionist.
- Health education and Routine Vitamin A Supplementation and deworming at health facilities and integrated outreach activities;during mass screening, Malezi Bora etc.with emphasis proper documentation for monitoring	- Continued Vitamin A supplementation interventions in schools and ECDE and schools.
- Re introduction of MNP program targeting children 6-23 months for food fortification at household level.	- Health education on fortified foods at the markets and the importance of household food fortification
- Continuous engagement with the community on CLTs and health education on critical times for hand washing	- Continued Advocacyfor positive behavior changes on use of latrines
- Health education with key messages at the health facilities and outreach sites on the importance of consumingof iron folate during pregnancy.	- Foster male involvement as means of reaching women for iron folate supplements consumption. - Develop social behavior messages targeting the community on the need for pregnant to consume iron folate supplements.
- Targeted health education at the community level and through Community dialoguesPromoting use of hand washing stations.	- Increased coverage of CHS. - Scaling of baby WASH and BFCI and CLTS.
- Promote integrated kitchen gardening at household level. - Promote production consumption of Vitamin A rich fruits and vegetables.	- Promote small scale irrigated farming at household level for vegetables and fruits. - Establishing junior farmer field schools that promote consumption of diversified foods.

1.0 INTRODUCTION

1.0.1 Background Information

Isiolo County is among the arid and semi-arid lands of Kenya, located in the Pastoral North East cluster covering 25,336km2 with an estimated population of 185,417(Source: DHIS). It consists of three Sub Counties namely Isiolo Central, Garbatulla and Merti. The county is characterized by recurrent droughts, hot and dry climate with low and erratic rainfall patterns. It has 3 main livelihood zones; Pastoral, Agro-pastoral and Firewood/Formal employment representing 67%, 26% and 7% respectively as shown in *figure 1.1*.

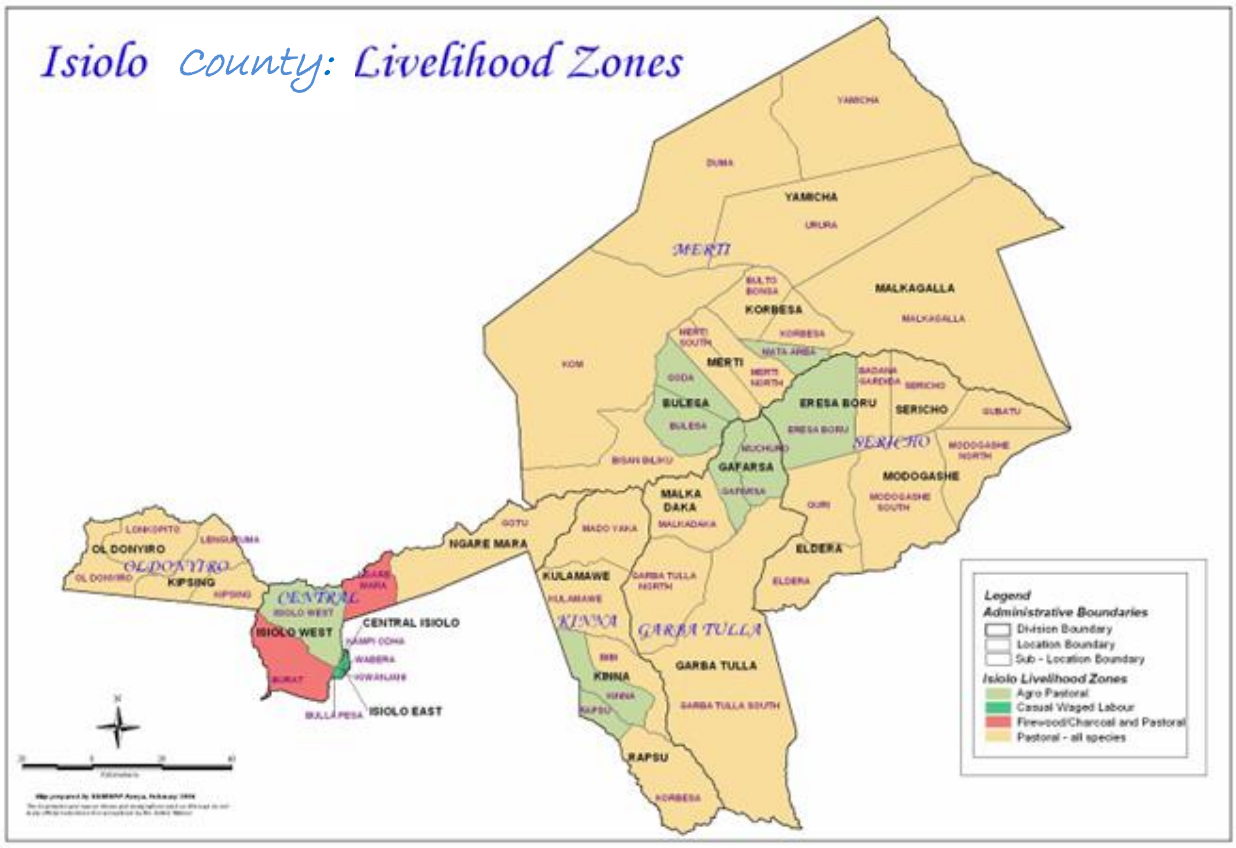


Figure 1.1: A map of Isiolo County livelihood zones.

Timing of the survey:

According to the Seasonal Calendar Isiolo has two rainfall seasons; long rains (March-May) and short rains; (October-December) season. The seasonal calendar also characterizes dry season into short (January-March) and long; June-October dry season as seen in figure 1.2. The county is highly depended on the short rains season.[8]

[8]National Drought Management Authority

▪ Land preparation ▪ Reduced milk yields ▪ Migration		▪ Migration to wet grazing areas ▪ High calving rates ▪ Milk yields increase ▪ Reduced pasture stress				▪ Long rains harvest ▪ Increased distance to water and ▪ Pasture ▪ Reduced water levels Kidding ▪ Community/HH coping measures taken				▪ Planting in Agro pastoral livelihood zones ▪ Migration from dry grazing areas ▪ Increased milk yield ▪ Reduced pasture stress	
Short dry period		**Long rains period**				**Long dry spell**				**Short rains**	
Jan	**Feb**	**Mar**	**April**	**May**	**June**	**July**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**

Figure 1.2: Isiolo County seasonal calendar

1.0.2 Justification

According to the February 2018 Short Rains Assessment, Integrated Phase Classification (IPC) for acute malnutrition among children under five, Isiolo County was ranked at serious phase (Phase 3) on Global and Severe Acute Malnutrition prevalence by WHZ at 13.8 %(10.9 - 17.3 95% C.I.) and 2.6 %(1.6 - 4.2 95% C.I.)respectively. The monthly early warning systems by NDMA bulletins for October, November and December 2018 indicated a normal food security phase with medium likelihood of drifting into stressed food security phase owing to poor October to December 2018 short rainfall performance at 47.5mm, which was low in amount and poorly distributed both temporarily and spatially as exhibited by less than 30% recharge of water pans, shallow wells and dams. Crop production was depressed due to low rainfall implying decline in food production and harvests were expected to reduce and consequently reduced supplies to the market with a possible likelihood of low income and increased commodity's market prices.Livestock sector was performing well attributed to good performance of the 2018 long rains. Body condition for all livestock species was good with improved milk production and was expected to improve further in all the livelihood zones hence fetching better prices in the market. The County in collaboration with partners had been implementing lifesaving health, nutrition & food security interventions for over eight years. The results of the survey provided updates of health, nutrition & food security situation progress in the County to inform further response actions and program adjustments. The SMART survey 2019 was based on seasonality trends and therefore, was used to track current health and nutrition situation at the County and feed into the short rains' assessment report of February 2019.

1.0.3 Objectives of the Survey

Overall objective:
The main objective of the integrated SMART survey was to determine the prevalence of malnutrition amongst children aged 6-59 months old and women of reproductive age (WRA), and morbidity rates in Isiolo County.

The Specific objectives were:

i. To determine the prevalence of acute and chronic malnutrition in children aged 6-59 months;
ii. To determine the immunization coverage for Measles, Oral Polio Vaccines (OPV 1 and 3), vitamin A supplementation and deworming in children aged 6-59 months;
iii. To determine the prevalence of common illnesses among Children 6-59 months.
iv. To determine the coverage of zinc and ORS for management of diarrhoea
v. To assess coverage and consumption of micronutrients powder in children aged 6-23 months.
vi. To establish coverage of iron / folic acid supplementation of mother with children below 24 months.
vii. To determine the nutritional status of women of reproductive age (15-49 years)
viii. To collect contextual information on possible causes of malnutrition such as household food security, water, sanitation and hygiene (WASH) practices.

2.0 SURVEY METHODOLOGY

2.0.1 Type of Survey

The SMART Method was used to conduct the survey in planning, training, data entry and analysis. Other data sets collected concurrently included data on Water Sanitation and Hygiene (WASH) and Food security and livelihood (FSL), Morbidity and Causes, immunization, deworming, supplementation. Secondary information and review of various existing surveillance data which included; NDMA monthly bulletins, Health Information System (DHIS) and previous assessments was undertaken prior to the survey. The entire exercise was done in consideration with all guidelines as stipulated by the Ministry of Health at county and national level. The survey methodology was presented to the County Information Technical Working Group members (CITWG) and National Nutrition Information Working Group (NITWG) for validation before commencement of data collection.

2.0.2 Sample size calculation

The Sample size was determined using ENA for SMART software (9thJuly 2015). *Table 2.1* outlines factors considered when determining the sample size calculation.

Table 2.1: Sampling Methodology for Anthropometric Survey

Data entered in ENA for SMART	Anthropometric survey	Rationale
Estimated prevalence	13.8%	• From contextual data (DHIS, NDMA EWS) it's showing an improving situation
±Desired precision	3.5%	• SMART Survey Rule of thumb. Lower confidence interval from previous survey • In order to meet the set objectives
Design effect	1.27	• Obtained from nutrition SMART survey 2017 results; to cater for heterogeneity within the County
Average household size	6	• From previous survey (2018)
Proportion of U5s	17.3%	• From DHIS
Non-response rate	3.0%	• Based on previous assessments ongoing community mobilization is expected to create awareness of upcoming assessment. In addition, there is likely low migration of populations
Households	**569**	
Children	**516**	

2.0.3 Sampling Procedures

A two-stage cluster sampling was used. **Stage 1** included determination of clusters from the population data (Census 2009) generated from ENA for SMART software version 2011 (9th July 2015) and **Stage 2** included household selection (simple random sampling) using random number generator mobile application. Village names, their respective population sizes and the required number of clusters were entered into ENA for SMART software version 2011 (9th July 2015); probability proportional to size (PPS) was be applied in stage one. A total of **41 clusters** were randomly sampled in stage one. This was in regards to the previous survey's experience that shows that each team could cover 14 households per day (569/14=40.6). In this stage the primary sampling unit was villages. An updated list of households was obtained at the village from community leaders in stage two; then **14 households** were randomly selected using simple random sampling for anthropometry.

The definition of a household was a shelter or more whose residents ate from the same "cooking pot" the day preceding the survey. Households to be surveyed were selected randomly using the updated list of households in the selected village/segment.

2.0.4Training Framework

The training took four days from 21st to 24th January, 2019 with standardization test and pilot test as part of the training package. The survey teams were trained on; introduction to SMART survey, survey objectives, sampling, mobile based data collection tool (Open data Kit), anthropometric measurements, interviewing techniques, field procedures and data quality assurance.

2.0.5Survey Teams and Supervision

The survey had a total of seven teams with each team having three enumerators and one team leader. The team leaders were obtained from county government sectors. Eighteen enumerators were recruited based on the previous surveys' experiences with NDMA drought monitors given the first priority. Coordination and supervision of the entire process was led by the County Nutrition Coordinator under technical support from development partners' staff. Data quality assurance process was maintained by observing the following steps:

- Validation of survey methodology by the National and County Nutrition information working group.
- Training of survey team as per SMART methodology including undertaking both standardization and pilot test.
- Daily supervision and support of the team during data collection.
- Daily feedback sessions on plausibility and questionnaire.
- Continuous data monitoring and primary analysis of all data sets on kobo toolbox server.

2.0.6Case Definitions and Inclusion Criteria

Primary data was collected from the sampled villages to make conclusions with regard to the survey objectives for a period of seven days.

2.0.6.1 Selection of children for anthropometry

All children between 6-59 months of age staying in the selected household were included in the sample. The respondent was the primary caregiver of the index child/children. If a child and/or the caregiver were temporarily absent, then the survey team re-visited the household to collect the data at an appropriate time.

2.0.6.2Selection of women for determination of nutritional status

The mother of the index child within the reproductive age (15-49years) in the identified households and any other household member within the age bracket was enlisted in the study and their MUAC measurements taken.

2.0.6.3 Anthropometric data was collected from all eligible children aged 6-59 months. The children were targeted with the following information;

Age: The child's immunization card, birth certificate or birth notification were the primary source for this information. In the absence of these documents, a local calendar of events developed from

discussions with community members, enumerators and key informants. Age calculation chart was used for ease of identifying age in months (see Annex).

Child's Sex: This was recorded as either '***m***' for male or '***f***' for female.

Weight: A seca digital weighing scale was used to measure the children's weight. The electronic scales were calibrated on daily basis using a standard weight to confirm measurements and any faulty scales were replaced. In order to enhance accuracy and hence quality, of emphasis was placement of weight scale to a hard-flat surface, minimal or no movement of the child, minimal clothing, taking repeated weight taking at least twice to achieve a difference of not more than 0.2kgs and accurate recording of measurements to the nearest 0.1kg.

Height: length was taken for children less than 2 years of age while those children above 2 years of age were measured while standing. A height board was used to measure length/height. Of emphasis was ideal placement of cursor as per instructions on height measurements (SMART/IMAM guidelines) ensuring minimal or no movement of the child and maintaining height readings at eye level to the nearest 0.1cm.

MUAC: Mid Upper Arm Circumference was measured on the left arm, at the middle point between the tip of the elbow and the tip shoulder bone while the arm is at right-angle, then followed MUAC measurements of the arm while it is relaxed and hanging by the body's side. MUAC was measured to the nearest mm. In the event of a disability on the left arm or a left-handed child, the right arm was used. Of emphasis during the exercise was correct identification of mid-point and correct tension upon placement of MUAC tape on arm. Maternal MUAC tapes were used to measure MUAC in women of reproductive age.

Bilateral Edema: This was assessed by the application of moderate thumb pressure for at least 3 seconds on both feet. Forming of depression on both feet upon pressure application indicated bilateral pitting edema.

Measles vaccination: The mother and child health booklet was used as a source of verification.
In circumstances where it was not available, the caregiver was probed to determine whether the child had been immunized against measles or not (done subcutaneously on the right upper arm). All children with confirmed immunization (by date) on the vaccination card, the status were recorded as "1" (Card) otherwise as "3" (Not immunized). Oral confirmation from the caregiver without proof of card was recorded as "2" (Recall). Children between 9 to 18 months or greater were used to determine coverage of this in the final analysis**.**

Oral Polio Vaccine (OPV) 1 (1stdose at 6 weeks) **and OPV3** (3rddose at 14 weeks) was calculated for all children aged 6-59 months.
Other relevant information about the eligible child was also gathered as follows:

De-worming: Determined by whether the child had received drugs for intestinal worms in the past one year. This was recorded as "0" for No, "1" for Yes by card, ''2'' for Yes by recall and ''3'' for Do not know.

Vitamin A coverage: This was determined by the number of times the eligible child had received vitamin A in the past year. The response received (number of times) was probed (to determine whether it was given in a health-facility, outreach sites or elsewhere and the number of times recorded in the card).

Morbidity: this information was gathered by asking the caregiver whether the child had been ill in the past two weeks. Those who reported that the child was sick were probed to specify the type of illness.

Other data sets: The household questionnaire was used to gather data on health-**related** variables, HINI Indicators, water availability and accessibility, sanitation and hygiene practices, food sources, dietary diversity, coping strategies and Food fortification.

2.0.7Data Entry, Quality Checks and Analysis

The survey embarked on mobile technology for data collection in which Open Data Kit was used to collect and submit data. The standard SMART questionnaire form was developed on KOBO toolbox and downloaded on ODK collect for Android operating system application software on phone tablets. The teams could send data to the configured servers where it could be retrieved and analyzed. Supervisors manually checked the tablet questionnaires for completeness, consistency and accuracy, and also to provide feedback to the teams to improve data collection as the survey progressed. At the end of each day, the tablets were each synchronized to the server and the data collected was uploaded. The SMART plausibility report was generated daily in order to identify any problems with anthropometric data collection such as flags and digit preference for age, height and weight, to improve the quality of the anthropometric data collected as the survey was on-going. Feedback was given to the teams every morning before the teams left for the field. Anthropometric data was analyzed using ENA for SMART software January 2015 version (Updated on 7th July 2015) while all other data sets were entered and analyzed using Microsoft Excel.

2.0.8Indicators, Guidelines and Formulas used in determining Acute Malnutrition

Weight for height (WFH) index

This was estimated from a combination of the weight for height (WFH) index values (and/or edema) and by sex based on WHO standards 2006. This index was expressed in WFH indices in Z-scores, according to WHO 2006 reference standards. Z-Score:

- Severe acute malnutrition is defined by WFH < -3 SD and/or existing bilateral edema,
- Moderate acute malnutrition is defined by WFH < -2 SD and >-3 SD and no edema,
- Global acute malnutrition is defined by WFH < -2 SD and/or existing bilateral edema.

Mid upper arm circumference (MUAC)

MUAC analysis was also undertaken to determine the nutrition status of sampled children and women of reproductive age (15-49 years). The following MUAC criteria were applied.

Table 2.2: Children 6-59 months and PLWS MUAC Cut-offs

MUAC Guideline	Interpretation
Children 6-59 months	
MUAC <115mm and/or bilateral Edema	Severe acute malnutrition
MUAC >=115mm and <125mm *(no bilateral edema)*	Moderate acute malnutrition
MUAC >=125mm and <135mm (*no bilateral Edema)*	Risk of malnutrition
MUAC > 135mm (no bilateral Edema)	Adequate nutritional status
Women of Reproductive Age (15-49 years)	
MUAC <21-23cm	At Risk of malnutrition
MUAC <21cm	Maternal Acute Malnutrition

2.0.8 Referrals

During the survey, all severe and moderately malnourished children as per MUAC and Weight-for-Height cut offs and pregnant and lactating women with MUAC <21cm were referred to the nearby health facilities or outreach sites offering IMAM services.

3.0 SURVEY FINDINGS

3.1 Household characteristics

The survey involved 3028 persons with an average population of 5.27 persons per household. Proportion of children 6-59 months was 18.8% with proportion of children 0-23 months being 9.2%. The teams were able to visit all the 41 sampled clusters.

PLANNED			**ACHIEVED**		
No. of HHs	No. of Children (Sample Size)	No. of Clusters	No. of HHs	No. of Children (Sample Size)	No. of Clusters
569	516	41	573	569 (18.8%)	41

3.1.1 Mosquito Nets Ownership and Utilization

There was increase in mosquito net ownership 59.9% to 82.4% of the households and utilization among children 0-59 months and PLW's from 60.9% and 64.1% to 82.9% and 83.3% in Isiolo County as indicated in figure 3.1.

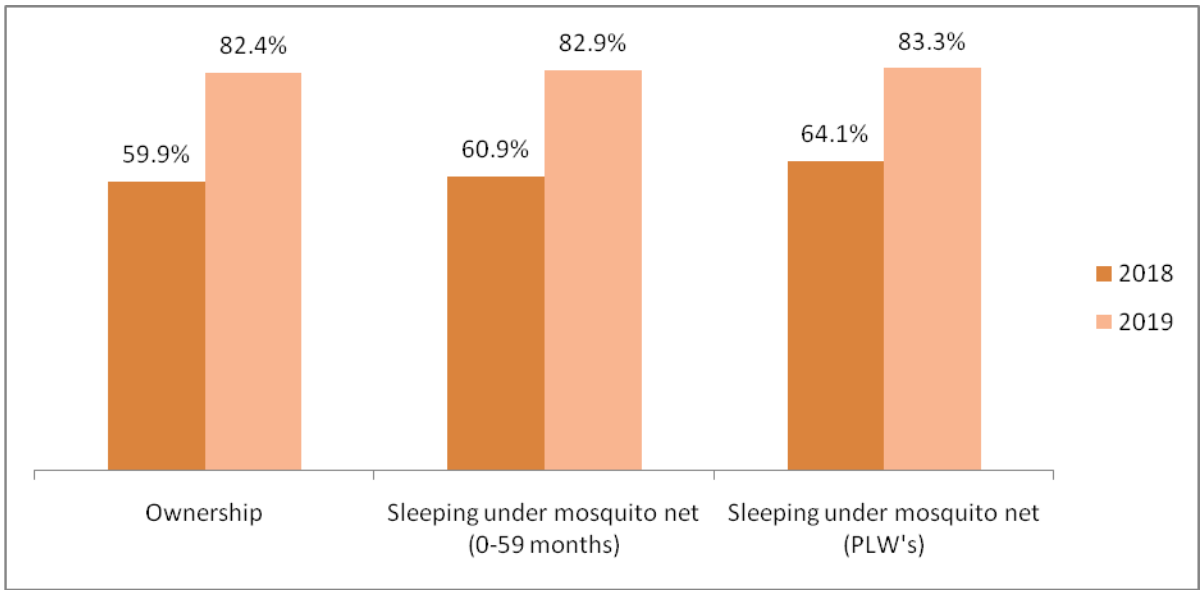


Figure 3.1 Mosquito net ownership and utilization

3.1.2 Residency and Marital Status

Majority (99.7%) of the surveyed respondents were residents whereas 0.3% had refugee status in Isiolo County. Among the respondents surveyed, 85.0 % of them were married while 6.0% were widowed.

3.1.3 Main occupation of the households

Livestock herding remains the main occupation of Isiolo residents with 38 % of the household heads practicing livestock herding. There was a slight decrease on Proportion of household heads relying on charcoal/ firewood as their main occupation. The increase in livestock herding as the main stay can be attributed to the good performance of the long rains and good pasture conditions.

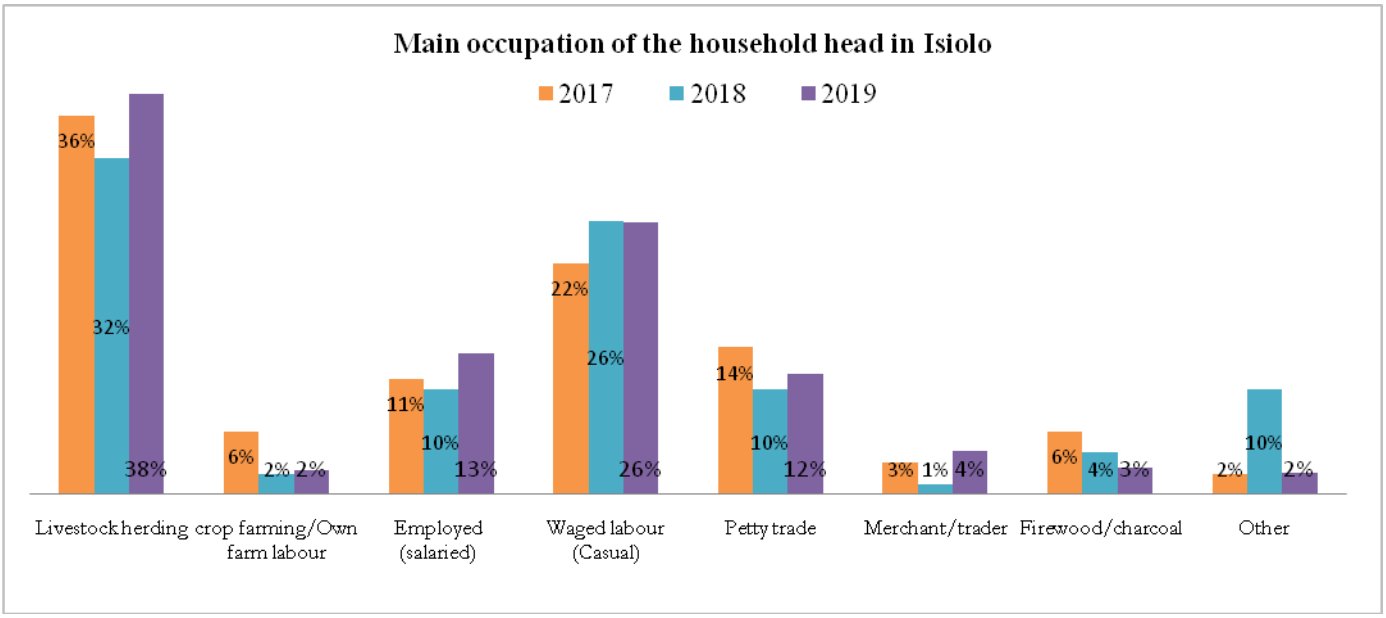


Figure 3.2: Main occupation of the household head.

Sale of livestock as the current main source of income increased from 34% in 2018 to 40% in 2019. This is because of improved livestock body conditions attributed to availability of pastures as result the long rains season that were above average. The current income source also correlates with the main occupation of the household heads.

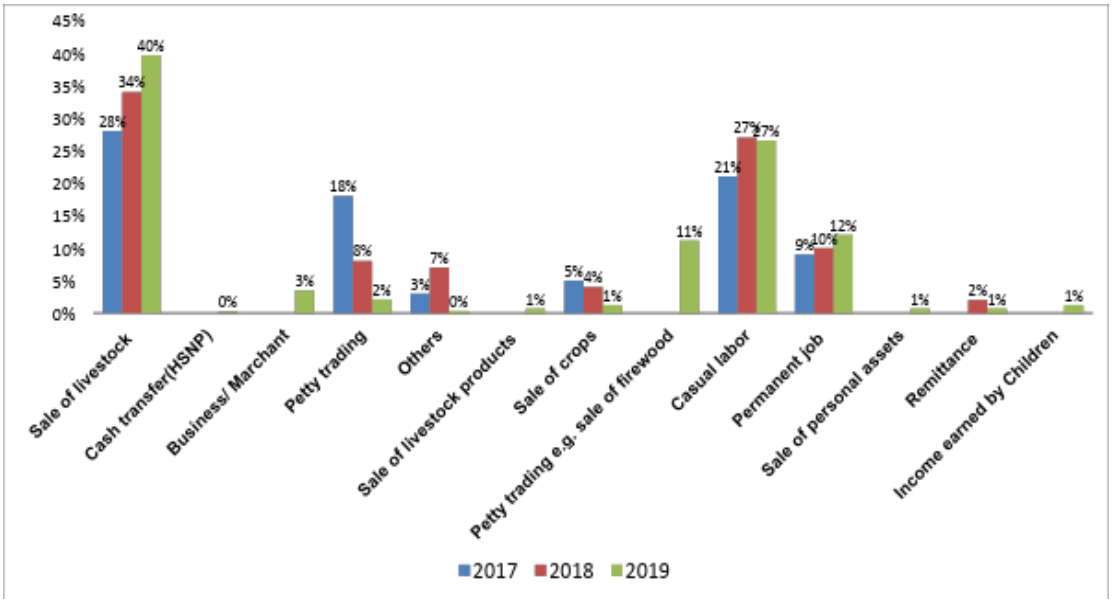


Figure 3.3: Current main source of income for the household

The findings showed that 11.7% of households reported to be living with children from other households. Absence of father and mother was reported to be the leading cause at 40.3% followed by schooling at 22.4% as indicated in *figure 3.4.*

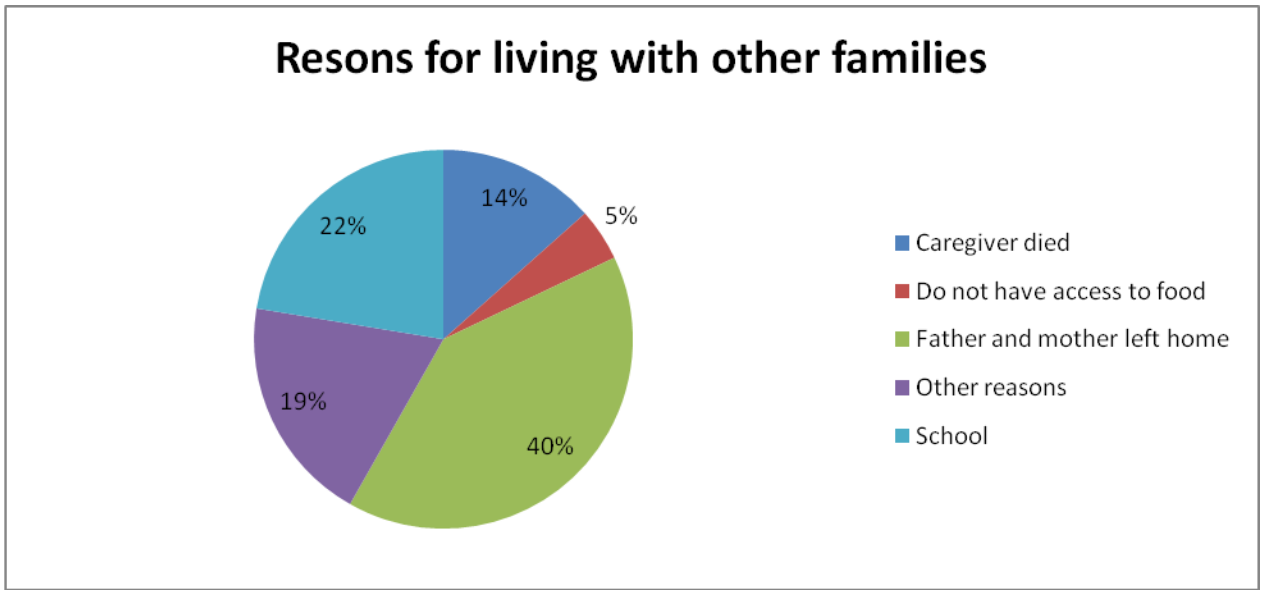


Figure 3.4: Reasons for living with other household members

3.1.4 Literacy levels of the household members

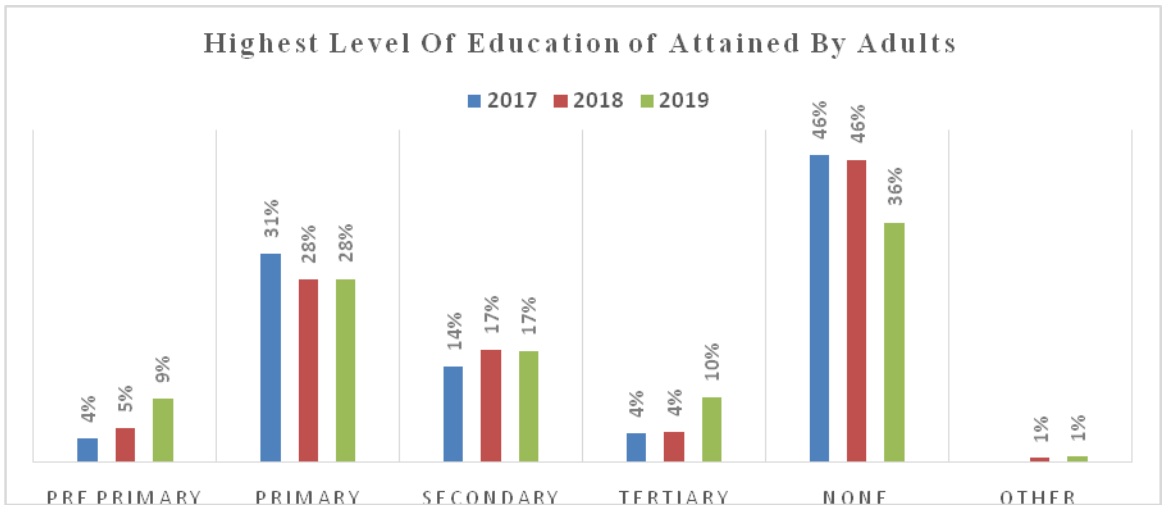


Figure 3.5: highest level of education of attained by adult household members

Adults in Isiolo County without any form of education stands at 36% (n=1072) a slight improvement compared to the previous years. This corresponds with an increase in adults with preprimary education at 9%.

3.1.5School Enrolment for Children 3-18 years

Kenya's Ministry of Education recommends that all children 3 to 18 years should be enrolled in school with children being enrolled in Early childhood development centers at the age of three years.14.5% of children were reported as not attending school, care givers reported low age and family labor responsibilities as the greatest contributors as indicated in the figure below.

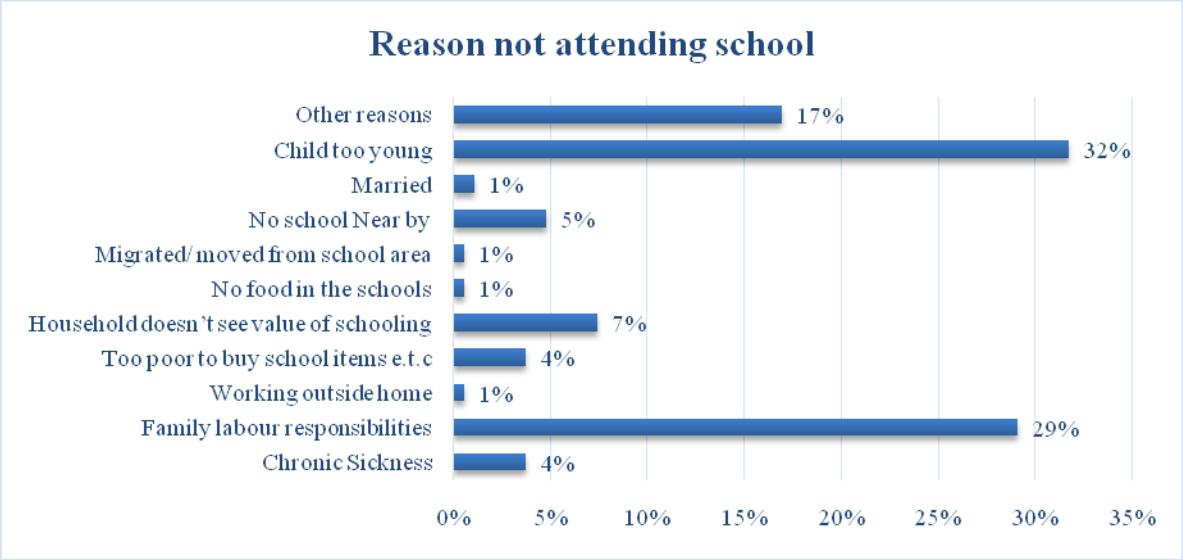


Figure 3.6: School enrollment for children 3-18 years

3.2Child Health and Nutrition

3.2.1 Anthropometry

Anthropometric assessment for 569 children 6-59 months was conducted indicating 18.8% of total population. Out of all sampled children in the County, 82.1% of them had a health card; Birth certificate/notification or baptism card used to verify their age. Age determination for 17.9% of the children was based on recall, hence prone to recall bias. This might have affected indices with age as a variable such as stunting and underweight.

On Age and sex distribution of the sampled children, there were more younger children selected in the sample with the age ratio of 6-29 versus 30-59 months having a significant different (P=0.076), thus affecting equal representation across the age cohorts. The overall sex ratio (boys: girls) was within the acceptable range of 0.8-1.4, depicting an equal representation of both sexes thus less bias.

3.7.1 Overall data quality

The anthropometric data for children 6-59 months was analyzed using ENA for SMART software version 2011 updated on 9th July 2015. The overall score for the survey was 3% indicating an excellent performance. More details on the score were as indicated *Table 3.1*.

Table 3.1: Plausibility check for the survey anthropometric measurements

Criteria	Score	Interpretation
Flagged data	**0** (0.5 %)	Excellent
Overall Sex ratio	**0** (p=0.132)	Excellent
Age ratio(6-29 vs 30-59)	**2** (p=0.076)	Good
Dig Pref score - weight	**0** (4)	Excellent

Dig Pref score - height	**0** (7)	Excellent
Dig Pref score - MUAC	**0** (5)	Excellent
Standard Dev WHZ	**0** (1.03)	Excellent
Skewness WHZ	**1** (0.34)	Good
Kurtosis WHZ	**0** (-0.11)	Excellent
Poisson distribution WHZ-2	**0**	Excellent
OVERALL SCORE WHZ	**3 %**	**Excellent**

3.7.2 Nutritional Status of Children 6-59 Months

Isiolo integrated SMART Survey conducted in January 2019 showed a significant decline in the Global and Severe Acute malnutrition levels at 9.2% (6.6 - 12.6 95% C.I.) and **0.7 %** (0.2 - 2.4 95% C.I.) respectively, classified as **Alert Phase** (AMN Phase classification). There was no edema case identified in the county. However, 1.1% of children (n=6) were considered to be marasmic. The Weight for Height standard deviation of 1.03 was within the acceptable range of 0.8-1.2. The design effect for the county weight-for-height Z-score was 1.45(WHZ), indicating homogeneity. The excluded subjects (z-scores out of range) for WHZ, WAZ and HAZ were 6, 10 and 23 respectively.

Table 3.2: Distribution by age and sex

	Boys		**Girls**		**Total**		**Ratio**
AGE (mo)	**no.**	**%**	**no.**	**%**	**no.**	**%**	**Boy:girl**
6-17	65	46.8	74	53.2	139	24.4	0.9
18-29	61	42.4	83	57.6	144	25.3	0.7
30-41	58	45.0	71	55.0	129	22.6	0.8
42-53	58	52.7	52	47.3	110	19.3	1.1
54-59	25	52.1	23	47.9	48	8.4	1.1
Total	267	46.8	303	53.2	570	100.0	0.9

3.7.2.1 Prevalence of Global and Severe acute malnutrition based on Weight-for -Height Z score and by Sex

The proportion of malnourished boys was higher than girls although with no statistically significant difference.

Table 3.3: Prevalence of GAM and SAM based on WHZ score **(WHO Standards 2006)**

	All n = 565	**Boys** n = 264	**Girls** n = 301
Prevalence of global malnutrition (<-2 z-score and/or oedema)	(52) **9.2 %** (6.6 - 12.6 95% C.I.)	(31) **11.7 %** (7.9 - 17.2 95% C.I.)	(21) **7.0** % (4.4 - 11.0 95% C.I.)

Prevalence of moderate malnutrition (<-2 z-score and >=-3 z-score, no oedema)	(48) 8.5 % (6.1 - 11.7 95% C.I.)	(29) 11.0 % (7.3 - 16.2 95% C.I.)	(19) 6.3 % (4.0 - 9.9 95% C.I.)
Prevalence of severe malnutrition (<-3 z-score and/or oedema)	(4) **0.7 %** (0.2 - 2.4 95% C.I.)	(2) 0.8 % (0.2 - 3.0 95% C.I.)	(2) 0.7 % (0.2 - 2.7 95% C.I.)

The prevalence of edema was 0.0 %.

Table 3.4: Prevalence of **Wasting** by **age** based on Weight-for-Height z-scores

		Severe wasting (<-3 z-score)		Moderate wasting (>= -3 and <-2 z-score)		Normal (> = -2 z score)		Oedema	
Age (mo)	**Total no.**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**
6-17	138	1	0.7	6	4.3	131	94.9	0	0.0
18-29	143	0	0.0	14	9.8	129	90.2	0	0.0
30-41	129	2	1.6	14	10.9	113	87.6	0	0.0
42-53	108	0	0.0	8	7.4	100	92.6	0	0.0
54-59	47	1	2.1	6	12.8	40	85.1	0	0.0
Total	565	4	0.7	48	8.5	513	90.8	0	0.0

Table 3.5: Prevalence of acute malnutrition based on weight-for-height z-scores (and/or oedema) and by sex

	All n = 565	**Boys** n = 264	**Girls** n = 301
Prevalence of global malnutrition (<-2 z-score and/or oedema)	(52) 9.2 % (6.6 - 12.6 95% C.I.)	(31) 11.7 % (7.9 - 17.2 95% C.I.)	(21) 7.0 % (4.4 - 11.0 95% C.I.)
Prevalence of moderate malnutrition (<-2 z-score and >=-3 z-score, no oedema)	(48) 8.5 % (6.1 - 11.7 95% C.I.)	(29) 11.0 % (7.3 - 16.2 95% C.I.)	(19) 6.3 % (4.0 - 9.9 95% C.I.)
Prevalence of severe malnutrition (<-3 z-score and/or oedema)	(4) 0.7 % (0.2 - 2.4 95% C.I.)	(2) 0.8 % (0.2 - 3.0 95% C.I.)	(2) 0.7 % (0.2 - 2.7 95% C.I.)

3.7.2.2Prevalence of acute malnutrition based on MUAC

Compared to weight for height Z-scores, the mid-upper arm circumference (MUAC) is not a very sensitive indicator of acute malnutrition and tends to underestimate acute malnutrition for children below one year of age. However, it is used as a rapid screening tool for admission into nutrition intervention programs.

Generally, MUAC usually tends to indicate lower GAM levels compared to WFH z-scores. The prevalence of malnutrition using MUAC is significantly lower compared to using Weight for Height Z-scores. This could be associated with the physiology of this Samburu, Borana and Turkana populations in Isiolo County, similar to the Somali and South Sudanese, with a high

cormic index[9]. This means, overall significantly lower cases of malnourished children are identified using MUAC when compared to weight for height. The GAM and SAM prevalence of acute malnutrition by MUAC in Isiolo County was 2.5% and 0.2% respectively as shown in *Table 3.5and table 3.6*.

Table 3.6: Prevalence of Acute malnutrition based on MUAC cut-offs and/or oedema by age

		Severe wasting (< 115 mm)		**Moderate wasting (>= 115 mm and < 125 mm)**		**Normal (> = 125 mm)**		**Oedema**	
Age (mo)	**Total no.**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**
6-17	139	1	0.7	10	7.2	128	92.1	0	0.0
18-29	144	0	0.0	2	1.4	142	98.6	0	0.0
30-41	129	0	0.0	1	0.8	128	99.2	0	0.0
42-53	110	0	0.0	0	0.0	110	100.0	0	0.0
54-59	48	0	0.0	0	0.0	48	100.0	0	0.0
Total	570	1	0.2	13	2.3	556	97.5	0	0.0

Table 3.7: Prevalence of Acute malnutrition based on MUAC cut offs (and/or oedema) and by Sex

	All n = 570	**Boys** n = 267	**Girls** n = 303
Prevalence of global malnutrition (< 125 mm and/or edema)	(14) **2.5 %** (1.2 – 4.9 95% C.I.)	(6) 2.2 % (0.9 – 5.6 95% C.I.)	(8) 2.6 % (1.2 – 5.6 95% C.I.)
Prevalence of moderate malnutrition (< 125 mm and >= 115 mm, no oedema)	(13) 2.3 % (1.1 – 4.7 95% C.I.)	(6) 2.2 % (0.9 – 5.6 95% C.I.)	(7) 2.3 % (1.0 – 5.3 95% C.I.)
Prevalence of severe malnutrition (< 115 mm and/or oedema)	(1) **0.2 %** (0.0 – 1.3 95% C.I.)	(0) 0.0 % (0.0 – 0.0 95% C.I.)	(1) 0.3 % (0.0 – 2.5 95% C.I.)

3.7.2.3Trends in GAM prevalence

The levels of malnutrition in Isiolo County have remained below the WHO emergency thresholds of 15% for the past five years except in the year 2017 which had a high GAM rate of 18.2% (Critical Phase for Acute Malnutrition Phase Classification). The current GAM and SAM

[9]The most common bivariate index of shape is the Cormic index, sitting height/ total height (SH/S). It is a measure of the relative length of the trunks or legs and varies between individuals and groups. If sitting height is held constant and leg length varied it produce a range of ratios from 0.48 to 0.55 within and between populations. This demonstrates that variations in SH/S found in or between different population groups may be associated with variations in BMI of some 5kg/m2, with weight and composition being kept constant. The mean SH/S for European and Indo-Mediterranean populations is about 0.52. Africans have proportionally longer legs, in general, with ratios around 0.51 most notable Somali, Sudanese and Turkana populations with even higher ratios. Asian and Far Eastern populations have proportionally shorter legs and means of 0.53-0.54. However, there is considerable variation within populations and within these major groupings

prevalence at **9.2% (6.6 - 12.6 95% C.I.) and 0.7% (0.2 - 2.4 95% C.I.**) shows significant reduction compared to 13.8% (10.9-17.3 95% C.I) and 2.6% (1.6-4.2 95% C.I) GAM and SAM prevalence in 2018 with p values 0.035 and 0.027 respectively. This the first time the county is being classified in the poor phase (IPC Classification) since 2014.This can be attributed to improved drought situation following above average performance of the long rains leading to improved food availability compared to the same time previous year and other health and nutrition interventions including early case finding by CHVs, and integrated medical outreaches in the hard to reach areas.

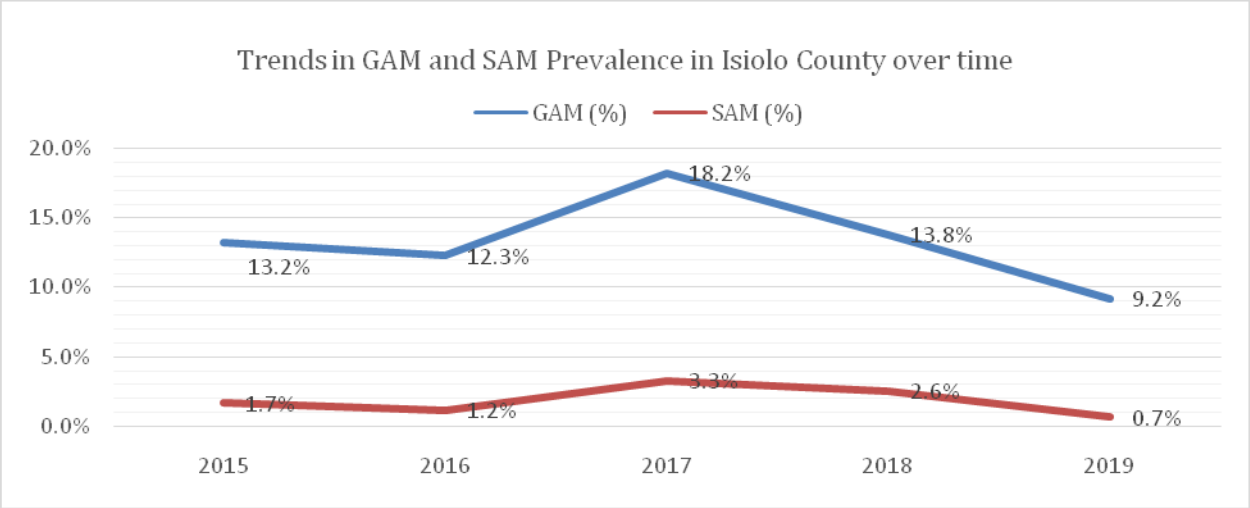


Figure 3.1 Trends in GAM prevalence over time

3.7.2.4Prevalence of underweight based on weight-for-age z-scores by sex

The weight-for-age (WAZ) index, an indicator of both acute and chronic malnutrition, provides a composite measure of wasting and stunting and is commonly used to monitor the growth of individual children in Mother-child booklet since it enables mothers to easily visualize the trend of their children's increase in weight against age. A low WAZ is referred to as underweight. The prevalence of underweight and severe underweight was 13.6% (10.1 - 18.1 95% C.I.) and 1.9 % (0.9 - 4.1 95% C.I.) respectively as shown in *table 3.8*, a significant reduction (P=0.027) compared to the 19.2% (15.7-23.3 95% C.I) and 3.8% (2.3-6.9 95% C.I) underweight and severe underweight respectively realized in 2018.

Table 3.8: Prevalence of underweight

	All **n = 566**	**Boys** **n = 265**	**Girls** **n = 301**
Prevalence of underweight (<-2 z-score)	(77) 13.6 % (10.1 - 18.1 95% C.I.)	(37) 14.0 % (9.3 - 20.4 95% C.I.)	(40) 13.3 % (9.1 - 19.0 95% C.I.)
Prevalence of moderate underweight (<-2 z-score and >=-3 z-score)	(66) 11.7 % (8.3 - 16.2 95% C.I.)	(32) 12.1 % (7.9 - 18.0 95% C.I.)	(34) 11.3 % (7.5 - 16.7 95% C.I.)

Prevalence of severe underweight (<-3 z-score)	(11) 1.9 % (0.9 - 4.1 95% C.I.)	(5) 1.9 % (0.6 - 6.1 95% C.I.)	(6) 2.0 % (0.7 - 5.4 95% C.I.)

Table 3.9: Prevalence of Underweight by age based on Weight-for-age z-scores

		Severe underweight (<-3 z-score)		Moderate underweight (>= -3 and <-2 z-score)		Normal (> = -2 z score)		Oedema	
Age (mo)	**Total no.**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**
6-17	137	5	3.6	4	2.9	128	93.4	0	0.0
18-29	143	3	2.1	23	16.1	117	81.8	0	0.0
30-41	128	2	1.6	20	15.6	106	82.8	0	0.0
42-53	110	0	0.0	13	11.8	97	88.2	0	0.0
54-59	48	1	2.1	6	12.5	41	85.4	0	0.0
Total	566	11	1.9	66	11.7	489	86.4	0	0.0

Table 3.10: Prevalence of underweight by sex based on Weight-for-age z-score

	All n = 566	**Boys** n = 265	**Girls** n = 301
Prevalence of underweight (<-2 z-score)	(77) **13.6 %** (10.1 - 18.1 95% C.I.)	(37) 14.0 % (9.3 - 20.4 95% C.I.)	(40) 13.3 % (9.1 - 19.0 95% C.I.)
Prevalence of moderate underweight (<-2 z-score and >=-3 z-score)	(66) 11.7 % (8.3 - 16.2 95% C.I.)	(32) 12.1 % (7.9 - 18.0 95% C.I.)	(34) 11.3 % (7.5 - 16.7 95% C.I.)
Prevalence of severe underweight (<-3 z-score)	(11) **1.9 %** (0.9 - 4.1 95% C.I.)	(5) 1.9 % (0.6 - 6.1 95% C.I.)	(6) 2.0 % (0.7 - 5.4 95% C.I.)

3.7.2.4 Prevalence of stunting based on height-for-age z-scores

Height for age (stunting) is an indicator of chronic (long-term) malnutrition arising from deprivation related to persistent/chronic food insecurity situation, micronutrient deficiencies, recurrent illnesses and other factors which interrupt normal growth. Unlike wasting, it is not affected by seasonality but is rather related to the long-term effects of socio-economic development and long-standing food insecurity situation. A low height-for-age reflects deficits in linear growth and is referred to as ***stunting.*** From the survey results indicated stunting prevalence and severe stunting of 13.9 %(10.4 - 18.4 95% C.I.)and2.2 %(1.2 - 3.8 95% C.I.)as indicated in *table 3.11*, a decrease with no statistically significant difference (P=0.102) compared to 18.0% (14.4 - 22.4 95% C.I) and 4.8 % (3.1 - 7.2 95% C.I.)Stunting and severe stunting respectively in 2018

Table 3.11: Prevalence of stunting based on height-for-age z-scores and by sex

	All n = 553	**Boys** n = 256	**Girls** n = 297
Prevalence of stunting (<-2 z-score)	(77) **13.9 %** (10.4 - 18.4 95% C.I.)	(40) 15.6 % (11.3 - 21.3 95% C.I.)	(37) 12.5 % (8.5 - 17.9 95% C.I.)
Prevalence of moderate stunting (<-2 z-score and >=-3 z-score)	(65) 11.8 % (8.8 - 15.5 95% C.I.)	(33) 12.9 % (9.3 - 17.7 95% C.I.)	(32) 10.8 % (7.4 - 15.4 95% C.I.)
Prevalence of severe stunting (<-3 z-score)	(12) 2.2 % (1.2 - 3.8 95% C.I.)	(7) 2.7 % (1.4 - 5.4 95% C.I.)	(5) 1.7 % (0.6 - 4.5 95% C.I.)

Table 3.12: Prevalence of stunting by age based on height-for-age z-scores

		Severe stunting (<-3 z-score)		**Moderate stunting (>= -3 and <-2 z-score)**		**Normal (> = -2 z score)**	
Age (mo)	**Total no.**	**No.**	**%**	**No.**	**%**	**No.**	**%**
6-17	134	3	2.2	16	11.9	115	85.8
18-29	140	6	4.3	17	12.1	117	83.6
30-41	126	3	2.4	18	14.3	105	83.3
42-53	106	0	0.0	8	7.5	98	92.5
54-59	47	0	0.0	6	12.8	41	87.2
Total	553	12	2.2	65	11.8	476	86.1

Proxy (Indirect) Coverage of Integrated Management of acute Malnutrition program

All the malnourished children 6-59 months (MUAC<125MM or WFH Z score<-2 SDS) were assessed whether they were enrolled into any nutrition program during the survey. 3 out of 4 (75%) of SAM cases were already enrolled in OTP program while 13 out of 48 (27.1%) of MAM cases were enrolled in SFP program. This indicates a low coverage for SFP program which is below SPHERE standards coverage of 50% for rural setting.

Childhood Immunization, Vitamin A Supplementation and Deworming

3.2.1: Immunization (BCG, OPV1 and OPV 3) Coverage

Kenya aimed to achieve 90% under one immunization coverage by the end of second medium term plan (2013- 2017). In Kenya, the ministry of health through the division of vaccines and immunization supports scales up of immunization through Expanded Programme on Immunization (EPI) vaccination service delivery, supply management, awareness campaigns through mass media and advocacy. The Kenya guideline on immunization defines a fully immunized child as one who has received all the prescribed antigens ***and at least one Vitamin A***

dose under the national immunization schedule before the first birthday. The BCG[10] vaccine has variable efficacy or protection against tuberculosis (TB) ranging from 60-80% for a period ranging from 10-15 years. It is known to be effective in reducing the likelihood and severity of military TB and TB meningitis especially in infants and young children. This is especially important in Kenya where TB is highly prevalent, and the chances of an infant or young child being exposed to an infectious case are high. This survey assessed the coverage of 4 vaccines namely, BCG, OPV1, OPV3, and measles at 9 and 18 months.

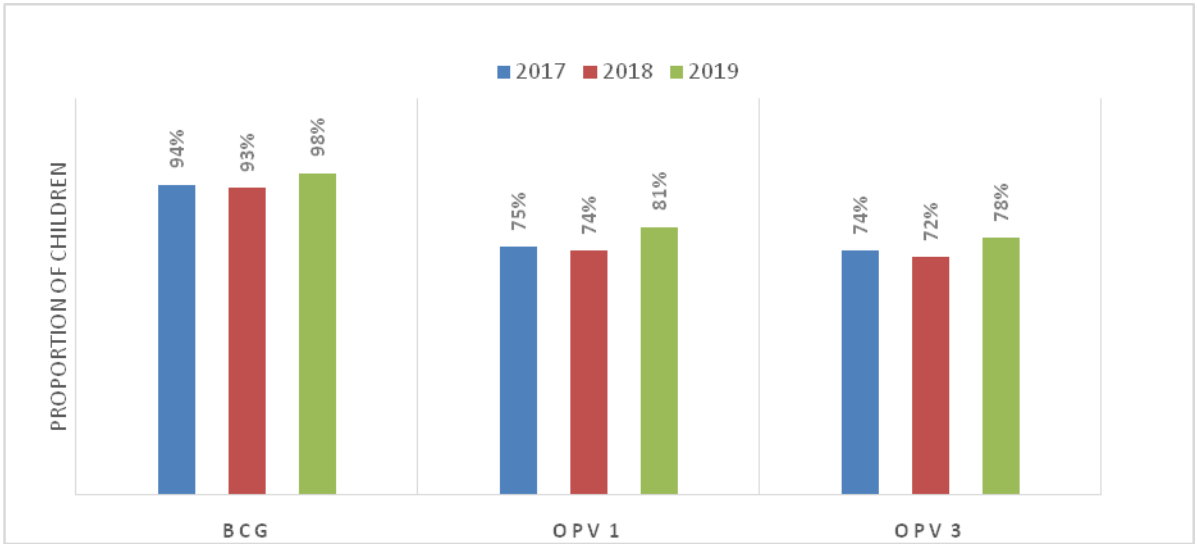


Figure 3.2: Immunization coverage for BCG, OPV1 and OPV 3

BCG coverage remained above the national average of 80% at 98.0%, with improvement of coverage of OPV 1 and OPV 3 at 81.0% and 78% respectively compared to OPV 1 and OPV 3 coverage of74.0% and 72.0% respectively in February 2018 survey as a result of uninterrupted service delivery at the health facilities and ongoing integrated medical outreaches in hard to reach areas support by the MoH and partners.

[10]Ministry of Health Family Division, Department for Communicable Disease

3.2.2: Measles vaccination coverage

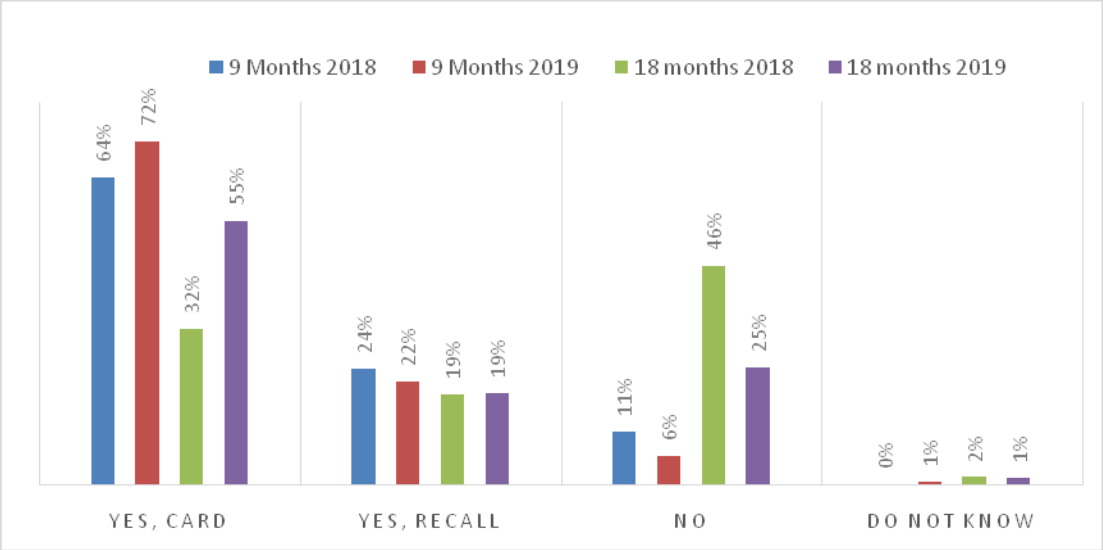


Figure 3.3: Measles vaccination coverage

The coverage of Measles vaccination at 9 and 18 months by card increased from 64.0% and 32.0% respectively in 2018 to 72.0% and 55.0% at 9 and 18 months respectively in 2019. This is attributed to uninterrupted health services delivery at the health facility level, ongoing integrated medical outreaches and improved documentation. The low coverage for measles at 18 months is attributed to children not attending the child welfare clinic after measles vaccination at 9 months.

3.2.3: Vitamin A supplementation

Vitamin A is essential for the functioning of the immune system and the healthy growth and development of children, and is usually acquired through a healthy diet. However, it is estimated that, globally, 190 million children under five years of age are affected by vitamin A deficiency. These children suffer an increased risk of visual impairment (night blindness), illness and death from childhood infections such as measles and those causing diarrhea[11]. Provision of vitamin A supplements every six months is an inexpensive, quick, and effective way to improve vitamin A status and reduce child morbidity and mortality in the long term. Kenya's ministry of health recommends that all children 6-59 months be supplemented with vitamin A after every six months. This can be done at the health facility, at the medical outreach site, community level or at the ECDE centers.

There was increase in vitamin A Supplementation among children 6-59 months for more than ones from 65% in 2018 to 86% in 2019. This is attributed to uninterrupted health services delivery and vitamin A supplementation scale up in ECDE centers and community level during

[11]WHO. Global prevalence of vitamin A deficiency in populations at risk 1995-2005. WHO Global Database on Vitamin A Deficiency. Geneva, World Health Organization, 2009.

Malezi Bora months, May and November. However, Vitamin A supplementation for the recommended two times every year is below the national target of 80% with only 40% of children being supplemented with Vitamin A more than ones.

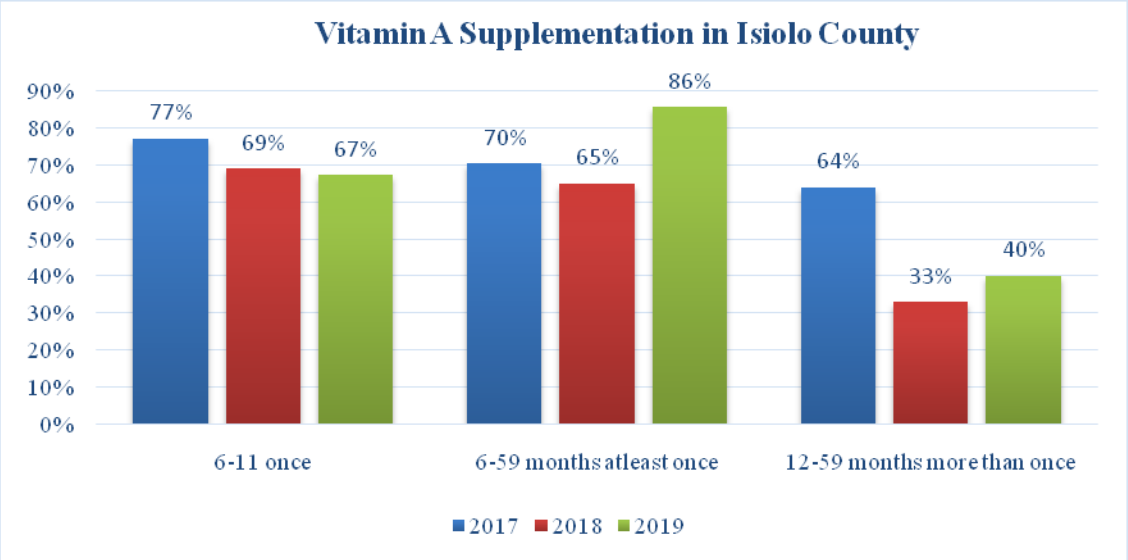


Figure 3.4: Vitamin A supplementation for children 6-59 months

3.2.4: Deworming for children 12-59 months

Soil-transmitted helminths infections are among the most common infections in humans, caused by a group of parasites commonly referred to as worms, including roundworms, whipworms and hookworms[12]. Those living in poverty are most vulnerable to infection which can impair nutritional status by causing: Internal bleeding which can lead to loss of iron and anemia; Intestinal inflammation and obstruction; diarrhea; and Impairment of nutrient intake, digestion and absorption. Deworming is the sixth cost-effective high impact nutrition intervention Proven to reverse malnutrition trends.

Children 12-59 months receiving deworming tablets once in Isiolo County increased from 31% to 49% while those at least once increased from 60% to 70%. However, the children who received the recommended twice in a year remained below the national target of 80% coverage recorded at 21%. (N=569).

[12] https://www.who.int/elena/titles/deworming/en/ Deworming in children

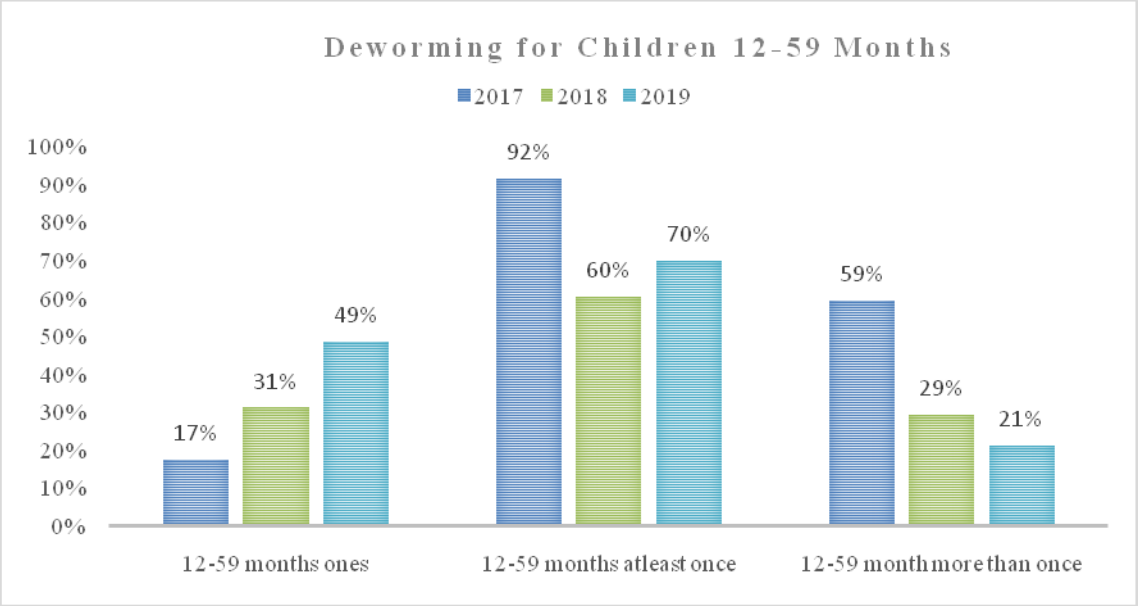


Figure 3.5: deworming in children 12-59 months

3.3 Child Morbidity

Malnutrition can make a person more susceptible to infection, and infection also contributes to malnutrition, which causes a vicious cycle of malnutrition and infections. A sick person's nutrition is further aggravated by diarrhea, mal-absorption, loss of appetite, diversion of nutrients for the immune response, and urinary nitrogen loss, all of which lead to nutrient losses and further damage to defense mechanisms. These, in turn, cause reduced dietary intake[13]. The causes of malnutrition and disease operate at different levels. The factors responsible are household food availability, personal health, health services, and the psychosocial care environment. The existing primary health care infrastructure includes the types of services provided and the accessibility of health care (distance and affordability)[14].It was important therefore to assess morbidity and whether it had some effect on nutrition status of the vulnerable.

To assess child morbidity mothers/caregivers of children aged 6 to 59 months were asked to recall whether their children had been sick in the past 2 weeks prior to the survey. Those who confirmed illness in the past two weeks were further probed on the type illness that affected their children and whether or not they sought any assistance when their child/children were ill and where. Those who indicated that their child/children suffered from watery diarrhea were probed on the kind of treatment that was given to them.

[13]Müller O, Garenne M, Kouyaté B, Becher H. The association between protein-energy malnutrition, malaria morbidity and all-cause mortality in West African children, *Trop Med Int Health*, 2003, vol. 8(pg. 507-11)
[14]Nord M, Andrews M, Carlson S., *Household food security in the United States, 2005 [report ERR-29]. Washington, DC: US Department of Agriculture*, 2006

3.3.1 Incidence of disease among children 6-59 months and health seeking behavior

From the responses, 35.1% of children 6-59 months were reported to have fallen sick within the two weeks recall period a reduction from 46% in 2018. This is as a result of increased community health services e.g. health education in outreaches, CHS etc. Acute respiratory tract infections were the main morbidity at 46% (n=92) which was a reduction from 54% in 2018 followed by fevers and diarrhea. Among those the reported diarrhea cases, 79% (n=22) were reported to have been treated with ORS and Zinc, an increase from 71.2% reported in 2018. This was attributed to availability of stock and On the Job Trainings on ORS and Zinc supplementation during diarrhea.

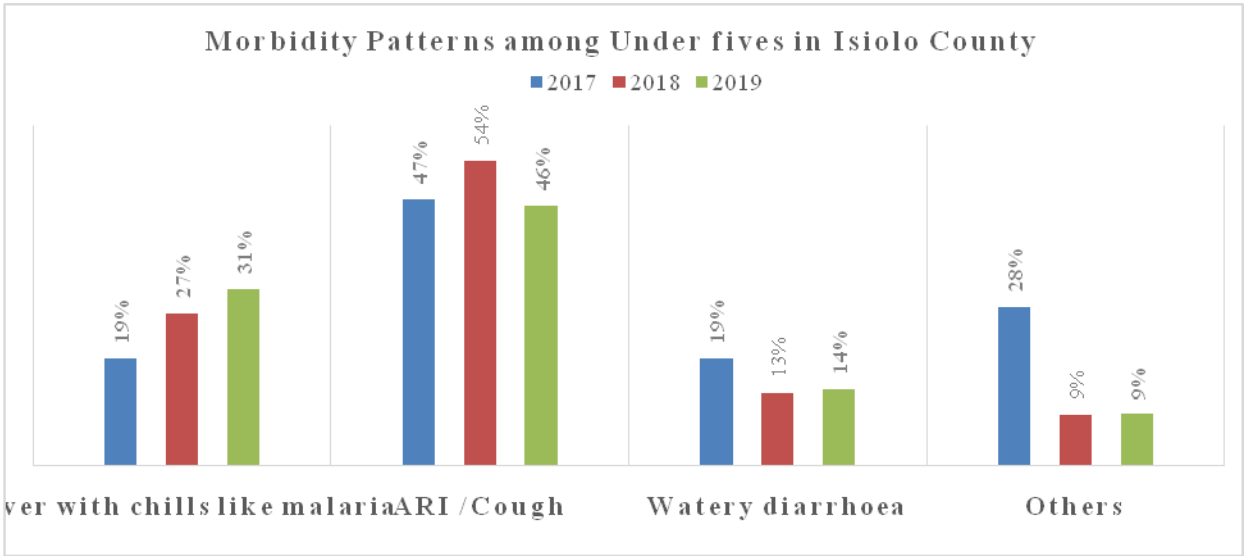


Figure 3.6: Morbidity patterns among children 6-59 month in Isiolo County

3.3.2: Health seeking behavior for caregivers of children 6-59 months

The survey findings showed that 81% of children (n=162) who were reported to have fallen sick in the last two weeks had sort health services from health facilities, with 73% (n=118) visiting public health facilities. (N=200)

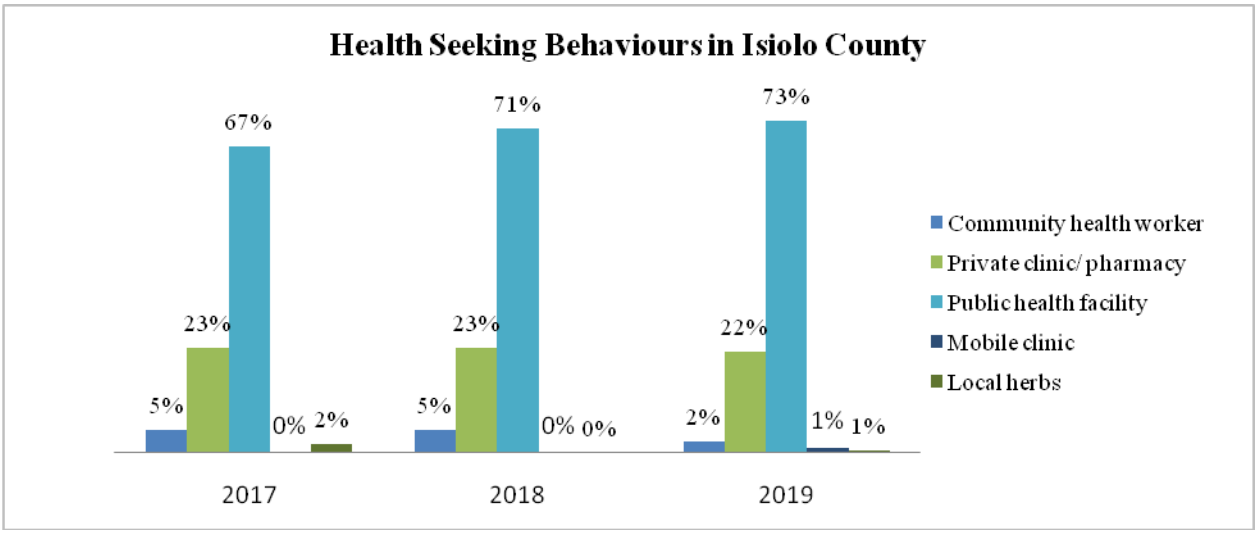


Figure 3.7: Health seeking behavior for caregivers with children 6-59 months

3.4 Maternal Health and Nutrition

Good maternal nutrition is important for a successful pregnancy, child delivery and lactation. Pre-pregnancy nutrition influences a woman's ability to conceive, determines the fetal growth and development and the size of the fetus and its overall health as well as the health of the mother. Malnutrition prior and around pregnancy makes the placenta fail to develop fully therefore it cannot optimally nourish the fetus. Underweight and overweight women experience more complications during pregnancy and delivery than normal women. Anemic women are more likely to deliver low birth weight infants and low folic acid levels are associated with an increased risk of low birth weight and birth defects. Adequate weight gain during pregnancy is essential for foetal growth and desired weight gain is based on pre-pregnancy weight using BMI criteria and pre-conception nutritional status of the woman. Maternal health is defined as the wellbeing of a woman during pregnancy, childbirth and 42 days after delivery.

3.4.1 Women physiological Status

During the survey women were asked their current physiological status on whether pregnant, lactating, pregnant and still lactating or none of them. It was found out that; pregnant, lactating, and pregnant and lactating were 8%, 45% and 1% respectively as shown in *figure 3.8*.

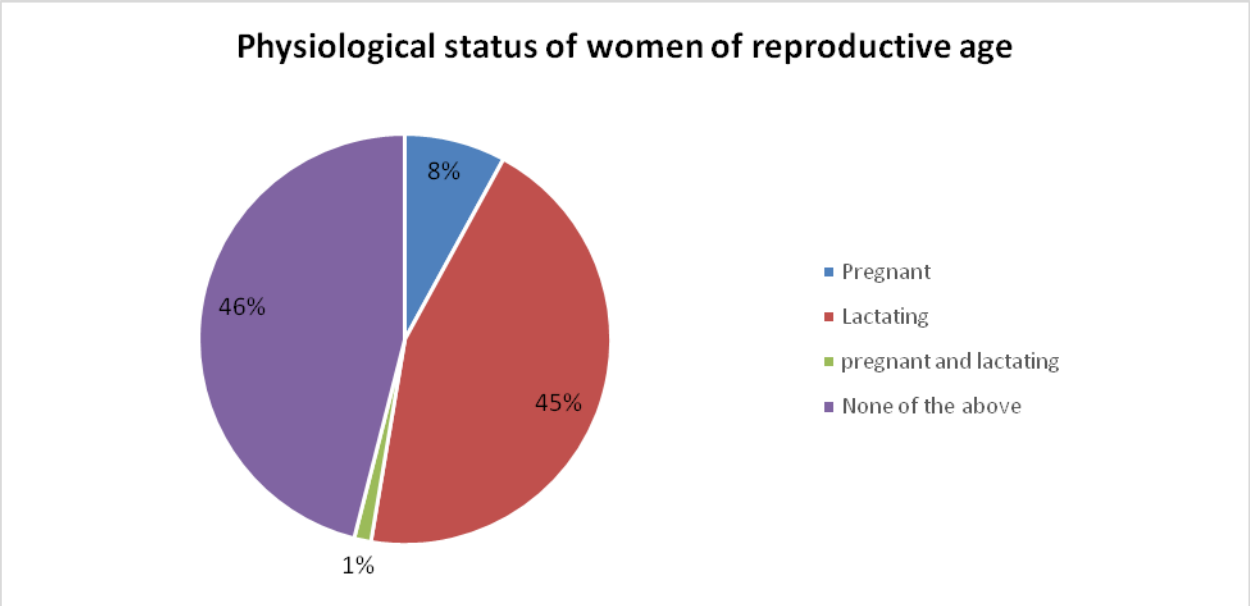


Figure 3.8: Physiological status of women of reproductive age

3.4.2 Maternal Nutrition

Maternal nutrition was assessed for all women of reproductive age (15-49 years) based on MUAC.

The findings showed an improvement with the two categories of all WRA and PLWs having MUAC of <21cm at 5.3% and 4.7% respectively in 2019 an improvement from 6.4% and 7.5% of all WRA and PLWs in 2018 respectively. This improvement can be attributed to good performance of the 2018 long rains that improved livestock and crop production hence improving access and availability of food at the household level in addition to intensified individual counselling, during Antenatal and Post Natal Clinic visits, on dietary diversification during pregnancy and lactation. However, worth noting was the slight increase on the pregnant and lactating women at risk of malnutrition indicating that the situation was likely to deteriorate.

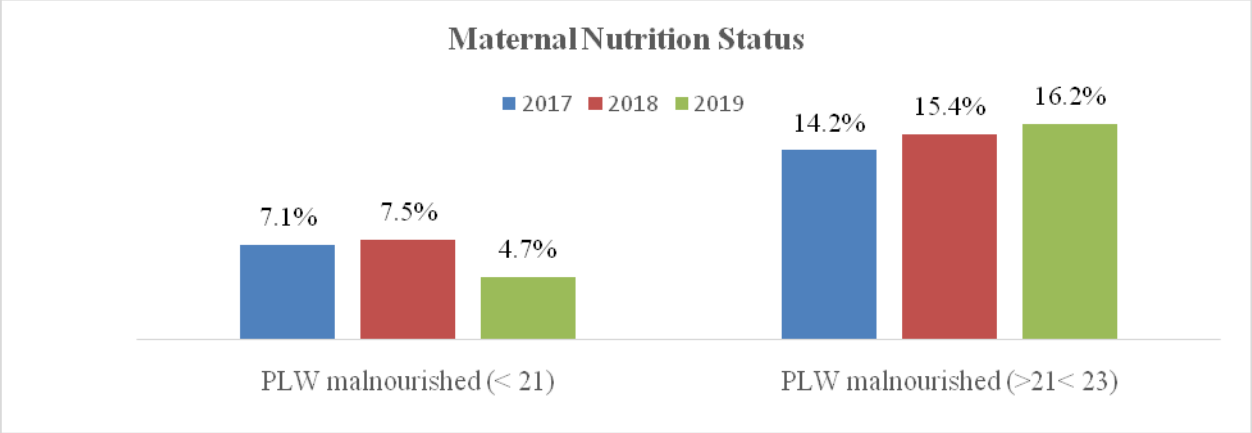


Figure 3.9: Nutrition status of pregnant and lactating women

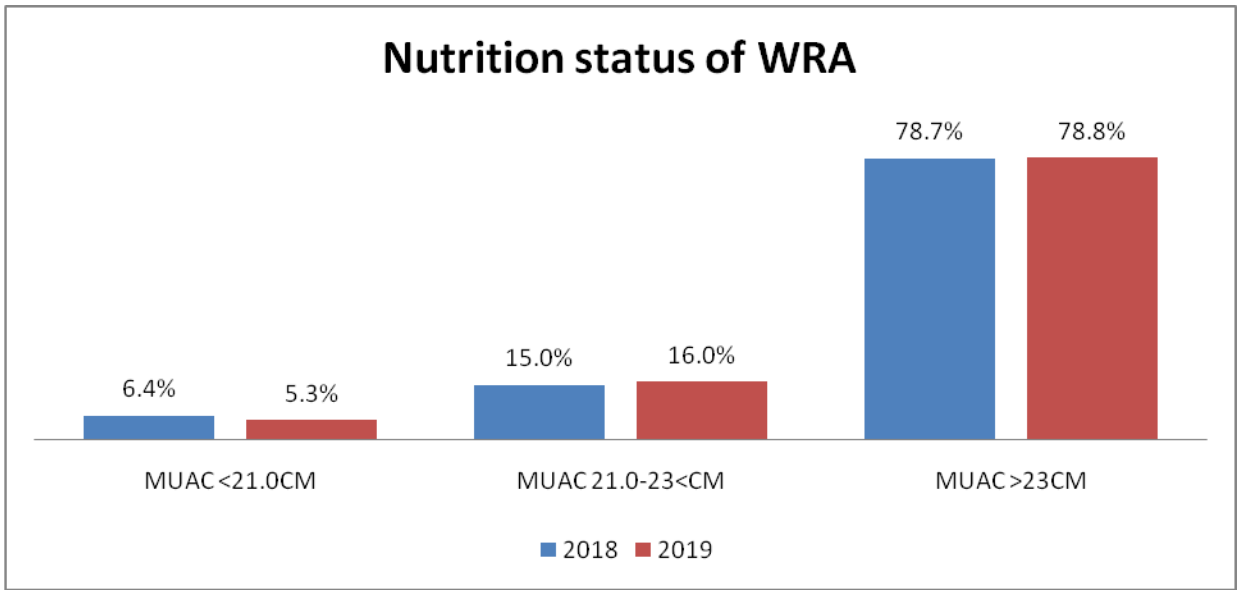
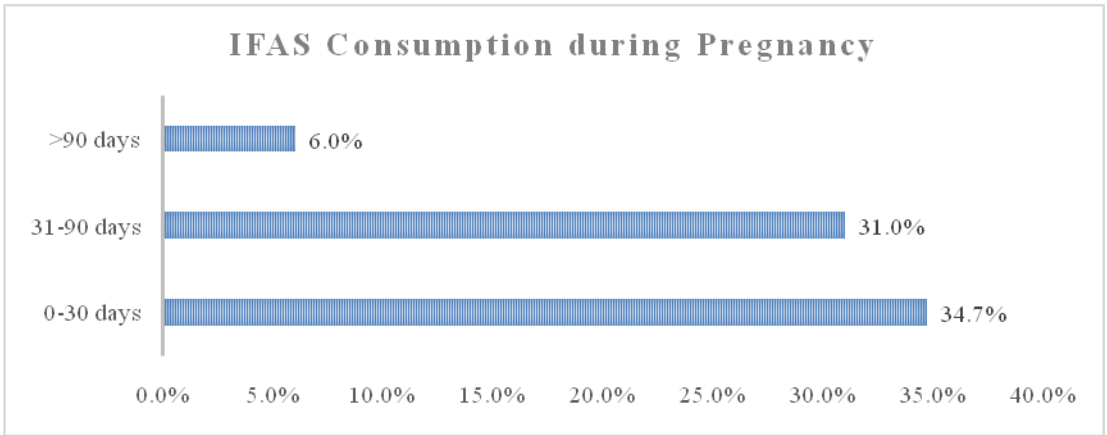


Figure 3.10: Nutrition status of women of all reproductive (WRA) age

3.4.3Iron folate supplementation during pregnancy

Iron folic acid supplementation during pregnancy reduces maternal anemia, risks of low birth weight, and neural tube defects in pregnancy and improve overall pregnancy outcomes. National policy guideline on combined iron and folic acid (IFA)for pregnant mothers in Kenya recommends consumption of one tablet daily of IFAS from conception to delivery[15]. The survey assessed consumption of Iron and folic acid supplements during pregnancy among women with children below 24 months. From the survey, it was found out that although 71.6% mothers of children under two years were supplemented with iron and folic acid during their immediate previous pregnancy, the proportion that consumed iron and folic acid remains quite low. None of them consumed the supplements for the recommended 270 days and only 6.0% consumed the supplements for more than 90 days as shown in *figure 3.11*.



[15]https://www.k4health.org/sites/default/files/2013_kenya_signed_ifa_policy: National policy guideline on combined Iron and Folic Acid (IFA) supplementation for pregnant mothers in Kenya.

Figure 3.11: Consumption period of iron folic acid supplementation

3.5 Water Sanitation and Hygiene (WASH)

3.5.0: Access to water

Per capita water consumption (drinking, cooking and personal hygiene) for Isiolo County was 14.2l/person/day. This is slightly below the SPHERE standards of 15l/person/day. The survey indicated that 65.3% of the population relays on piped water for household consumption, 7.8% on boreholes, 8.2% on dug wells and 12.4% from water kiosks and surface water.

Table 3.13: Main source of household water

Water source	Proportion of households
Piped water system	65.30%
Tube well / borehole	7.80%
Dug well	8.20%
Spring	0.20%
Rainwater	2.40%
Tanker-truck	0.20%
Cart with small tank	3.30%
Water kiosk, Surface water (river, dam, lake, pond, stream, canal, irrigation channel)	12.40%
Other	0.20%

3.5.1: Distance to Main Water source

Maximum distance from any household to main water source should be 500 meters[16].From the survey, 79.76% of households in Isiolo County were taking less than 15 minutes (less than 500m) to reach the closest water point. Generally, distance to water sources reduced in the county compared to the previous years with 79.76% (n=457) of the households taking less than 15 minutes to reach the household water source and increase from 63.4% attributed to recharging of surface water pans, shallow wells and seasonal rivers during the long rains.

[16] SPHERE Standards for humanitarian response

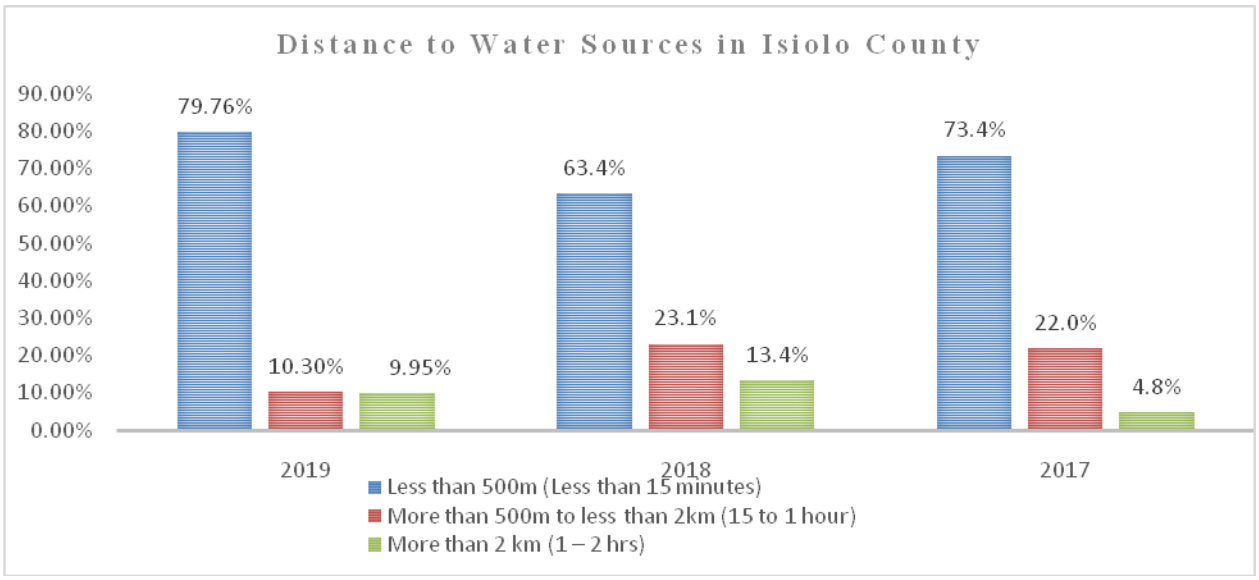


Figure 3.12: Distance to main water source

3.5.2: Queuing Time at Water Points

Time spent queuing for water reduced significantly with 58% (n=332) and 23% (n=132) of respondents queuing for less than 30 minutes and between 30 minutes to less than one hour respectively, an improvement from 50.4% and 31.3% in 2018. This is because most of the surface water sources still had enough water at the time of survey attributed to above average recharge during the previous long rainfall season.

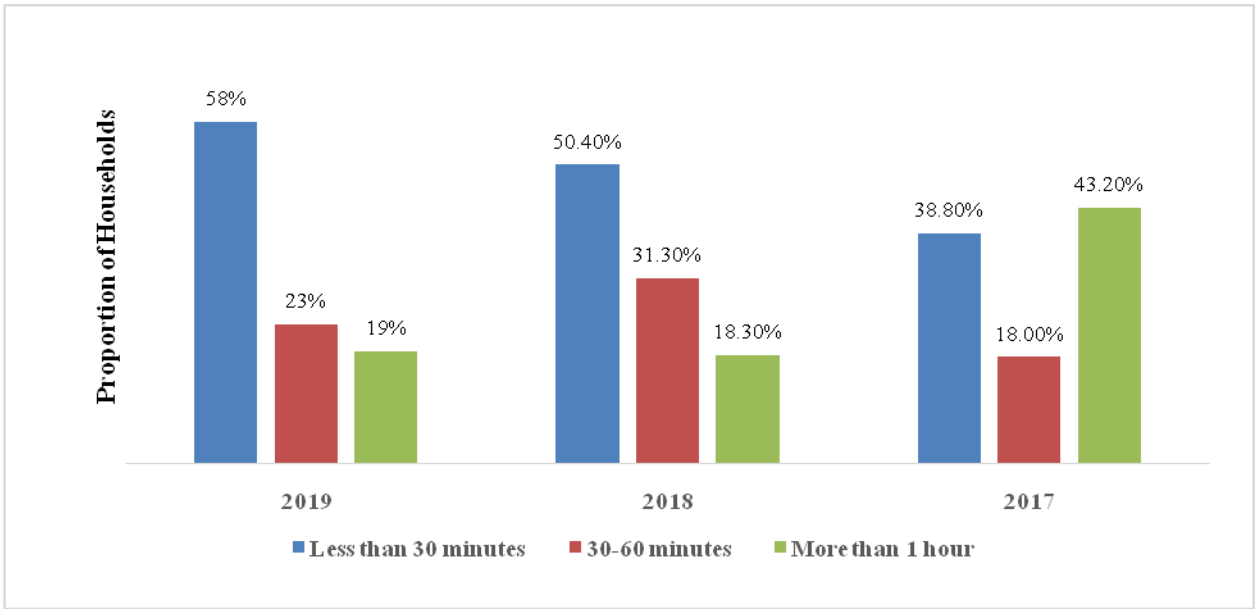


Figure 3.13: Minimum queuing time at water point

3.5.3 Hygiene Practices

Optimal hygiene practices such as safe storage of water, treating water before drinking and hand washing reduce the risk of food and water borne diseases. The consequences for children are severe, as high occurrences of diarrhea, skin disease, respiratory illnesses such as pneumonia, intestinal and other waterborne diseases affects child survival and in many cases, result to death[17]. 71% of households in Isiolo County are using pit latrines for waste disposal. In Isiolo County, 22% of the residents still practice open defecation (*figure 3.14*).

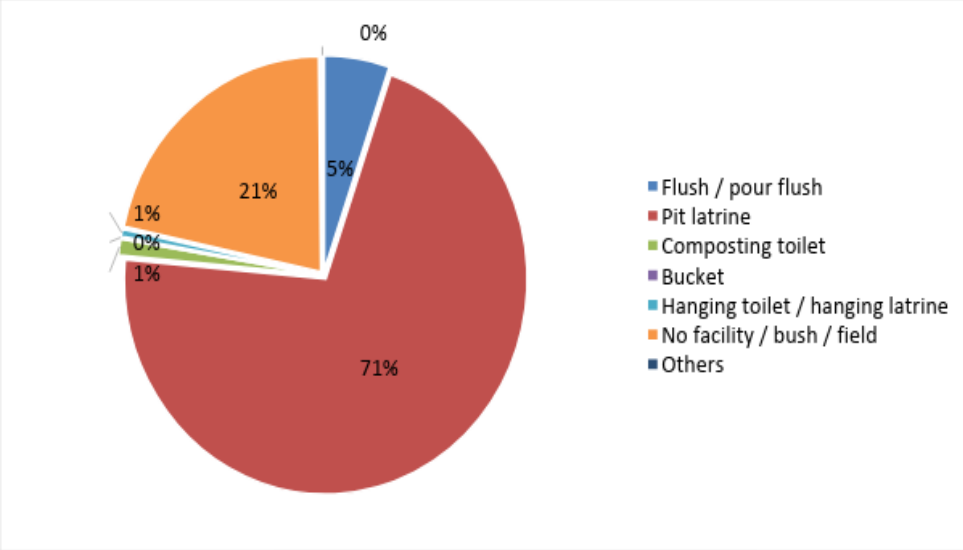


Figure 3.14: Waste disposal in Isiolo County

3.5.4: Handwashing practices

From the findings, 86.3% (n=494) of the respondents were reported to be aware of the hand washing with66% (n=378) reported to be washing hands during four critical times, an increase from 59.6% in 2018. The improvement can be attributed to improved water access and continued health and hygiene promotion and education at the community level.

[17]water , sanitation and hygiene, UNICEF Cambodia

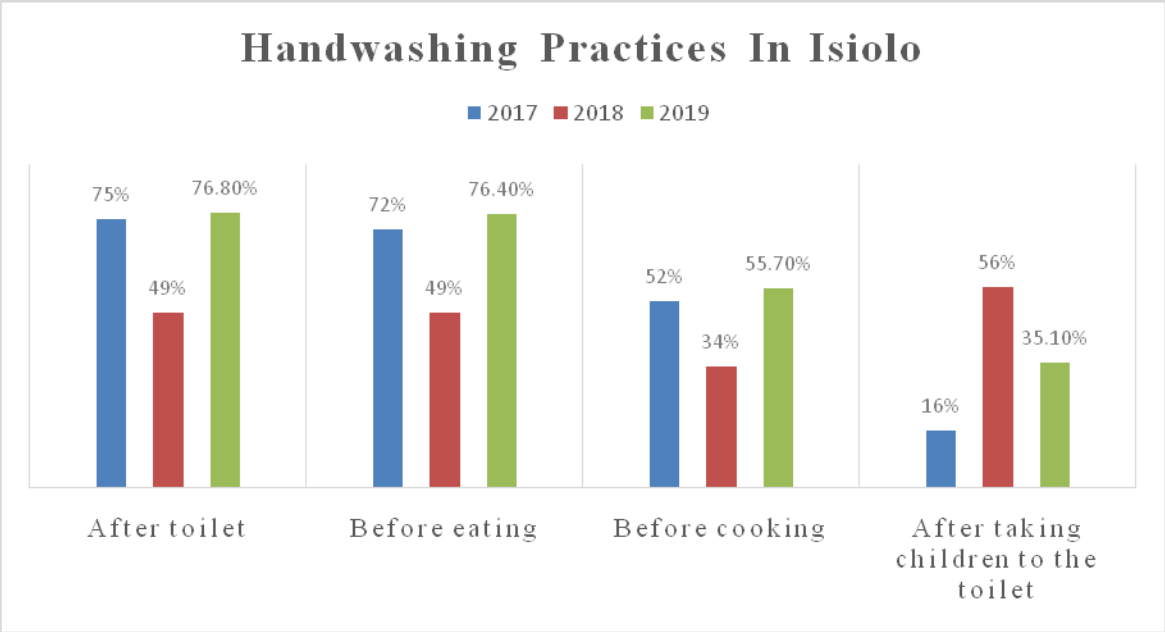


Figure 3.15: Hand washing practices in Isiolo County

In households with children 0-23 months, 83.3% of the respondents reported to be aware of hand washing instances (n=264) but only 26.1% (n=77) reported to be washing hands during four critical times indicating a gap in translation of knowledge into practice.

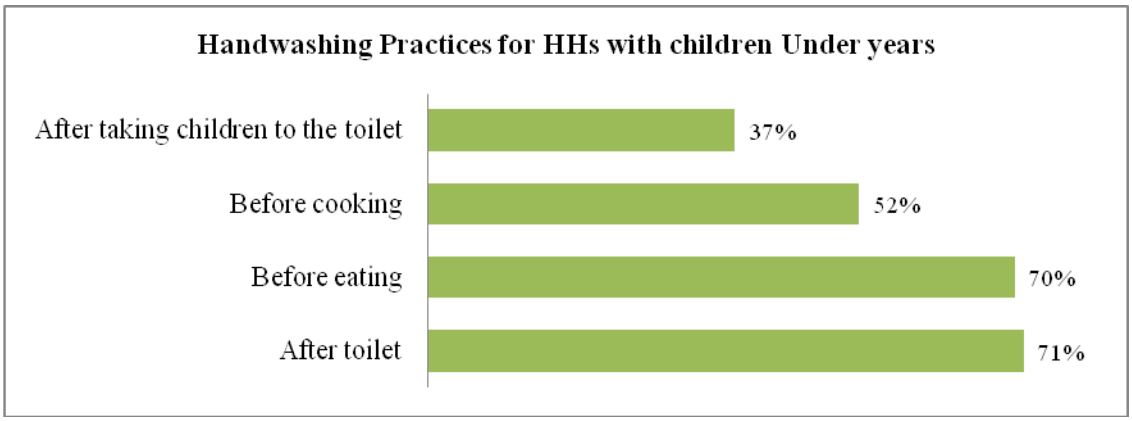


Figure 3.16: Hand washing practices for HH's with children 0-23 months

Hand washing with soap is the single most cost-effective intervention in preventing diarrheal diseases[18].The survey showed that 80% (n=458) of the caregivers were using soap and water for washing their hands a slight decrease from 87.4% reported in 2018.

3.5.5: Water treatment methods

[18]Borghi, J., Guinness, L., Ouedraogo, and J., Curtis, V. (2002): Is hygiene promotion cost-effective? A case study in Burkina Faso. *Tropical Medicine and International Health*, **7(11)**, 960-969

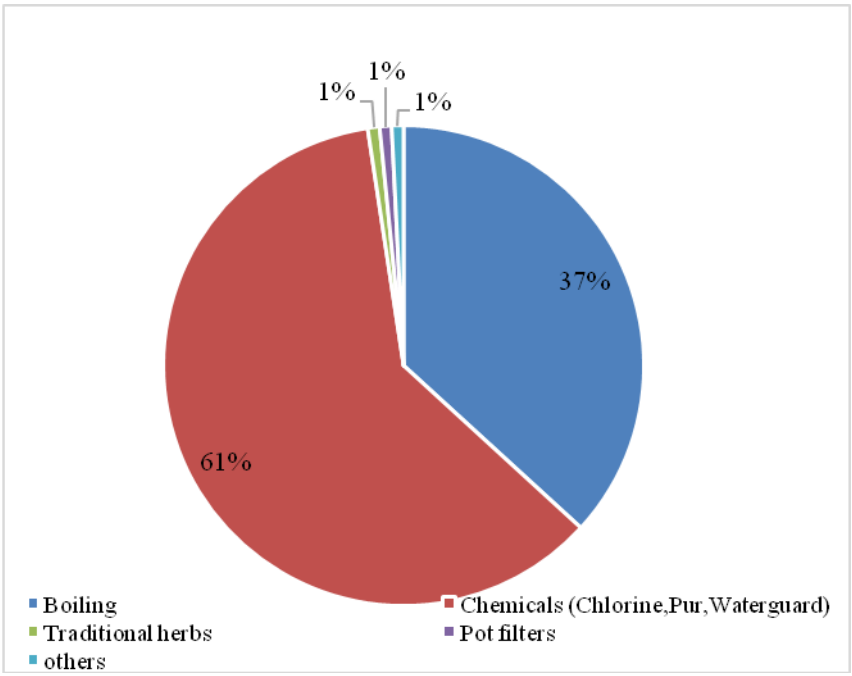


Figure 3.17: Water treatment methods

Drinking of contaminated water is a precursor for diarrheal diseases, which often causes undernutrition. The findings indicated that only 21.8% of the households (n=125) in Isiolo County reported to be treating water before drinking. Use of chemicals was the main method of treating water in the County with 61% of the households treating water using the method.

3.6 Food Security and Livelihoods

3.6.1 Food security Information

Food security exists when all people at all times have physical and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life. A person is considered nutrition secure when she or he has a nutritionally adequate diet and the food consumed is biologically utilized such that adequate performance is maintained in growth, resisting or recovering from disease, pregnancy, lactation and physical work.[19]The indicators used to measure food security in the survey included FCS, CSI, IDDS for WRA and HDDS.

3.6.2 Household dietary diversity

Household dietary diversity is defined as the number of unique foods consumed by household members over a given period. The household dietary diversity was assessed based on 24-hour recall. Household dietary diversity increased with household consuming more than 5 food groups increasing from 35.9% in 2018 to 59.3% (n=340) in 2019. The increase is attributed to good performance of livestock sector and access to variety of foods in the market.

[19]http://www.fao.org/fileadmin/user_upload/food-security-capacity-building/docs/Nutrition/NairobiWorkshop/5.WFP_IndicatorsFSandNutIntegration.pdf Food security indicators

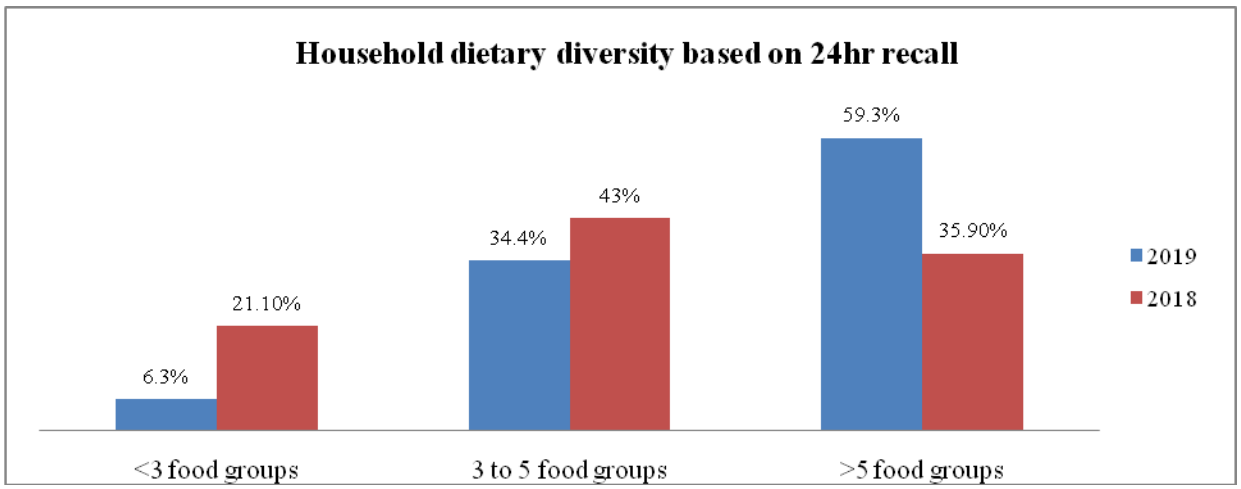


Figure 3.18: Household dietary diversity based on 24hr recall

The most frequently consumed source of micronutrients is Staples 6.3 while vitamin A and Iron reach foods are the list consumed as indicated in *figure 3.19*.

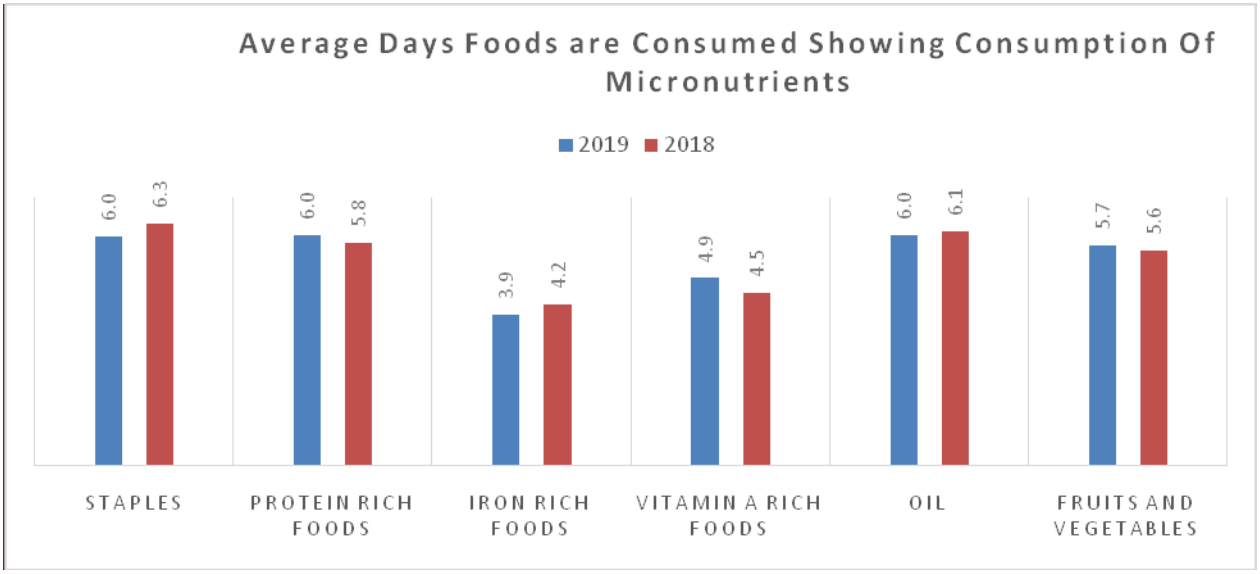


Figure 3.19: Micronutrient food grouping

3.6.3 Micronutrient consumption for household dietary diversity

Only 35.4% (n=203) of the households reported to have consumed iron rich foods with 59.3% (n=340) of the households consuming Vitamin A rich foods.

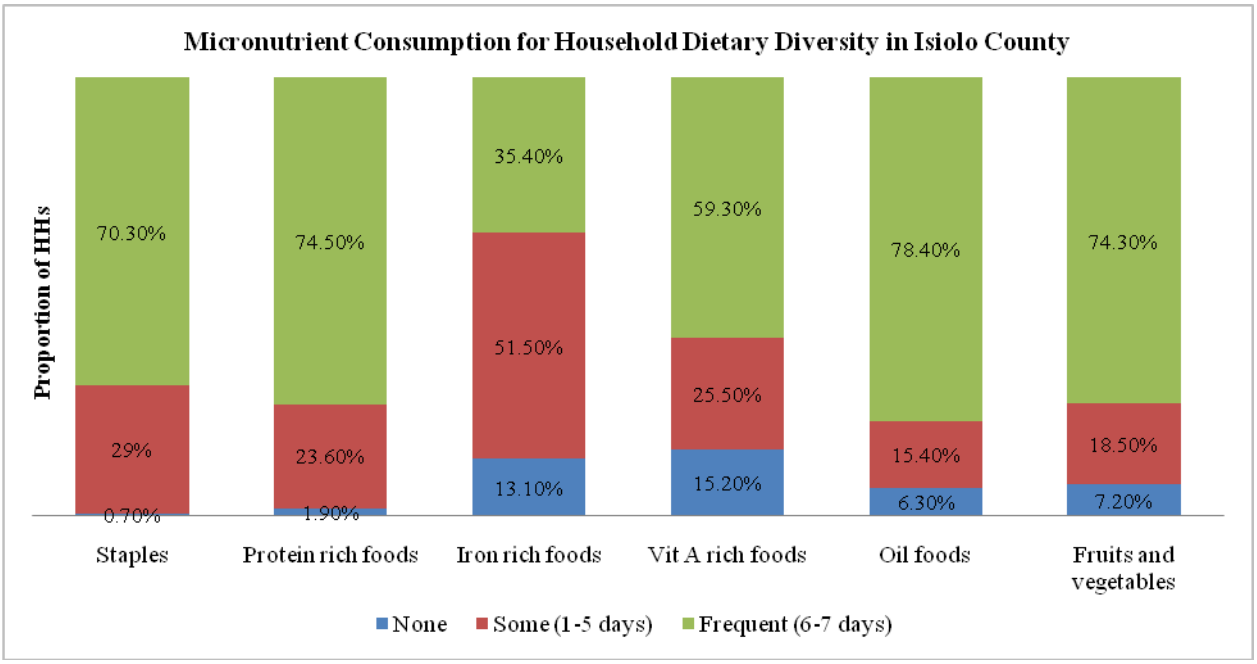


Figure 3.20: Micronutrient consumption for household dietary diversity

3.6.5 Food Consumption Score

The Isiolo FCS, which combines frequency of food intake and relative importance of each food indicated that a majority of the Households (86.7%) were within good food consumption. This has not changed compared to the previous year.

Table 3.14: Food Consumption Score

Main threshold	Nomenclature	2017 findings	2018 findings	2019 Findings
0-21	Poor food consumption score	3.8%	2.7%	2.3%
21.5-35	Borderline food consumption score	9.3%	9.4%	11.0%
>35	Good food consumption score	87.3%	87.9%	86.7%

3.6.6 Coping Strategy Index

The coping strategy index assesses how a household responds to food shortage or lack of money to buy food. Household were assessed based on five coping strategies which were then weighted based on their severity. The total weighted coping strategy score was 18.7 which was higher than the score for 2018 at 17.8.

Table 3.15: Coping strategy index

Coping Strategy	Proportion of HHs (N=219)	Mean	Severity score	Weighted score		
				2017	2018	2019
Rely on less preferred and less expensive foods?	24%	2.82	1	3	3.09	2.8

Borrow food, or rely on help from a friend or relative?	18.0%	1.91	2	3.94	3.16	3.8
Limit portion size at mealtimes?	20.5%	2.34	1	1.82	2.77	2.3
Restrict consumption by adults in order for small children to eat?	17.1%	2.2	3	5.64	5.73	6.6
Reduce number of meals eaten in a day?	20.4%	3.09	1	3	3.02	3.1
Total Weighting Coping Strategy Score				17.4	17.8	18.7

3.6.7 Food fortification

Food fortification is addition of vitamins and minerals in commonly consumed staple foods to make the food a superior source of these micronutrients. Compared to other interventions, food fortification is assumed to be more cost-effective. It is also considered a more sustainable intervention because it can reach wider populations without changes in existing consumption patterns. If fortified foods are regularly consumed in sufficient quantities, it has the advantage of maintaining steady body stores of the micronutrients.[20]28.3% (n=162) of the respondents reported to be aware of food fortification in the County. The main source of information about fortification n was reported to be health talks as indicated in the *figure 3.21*.

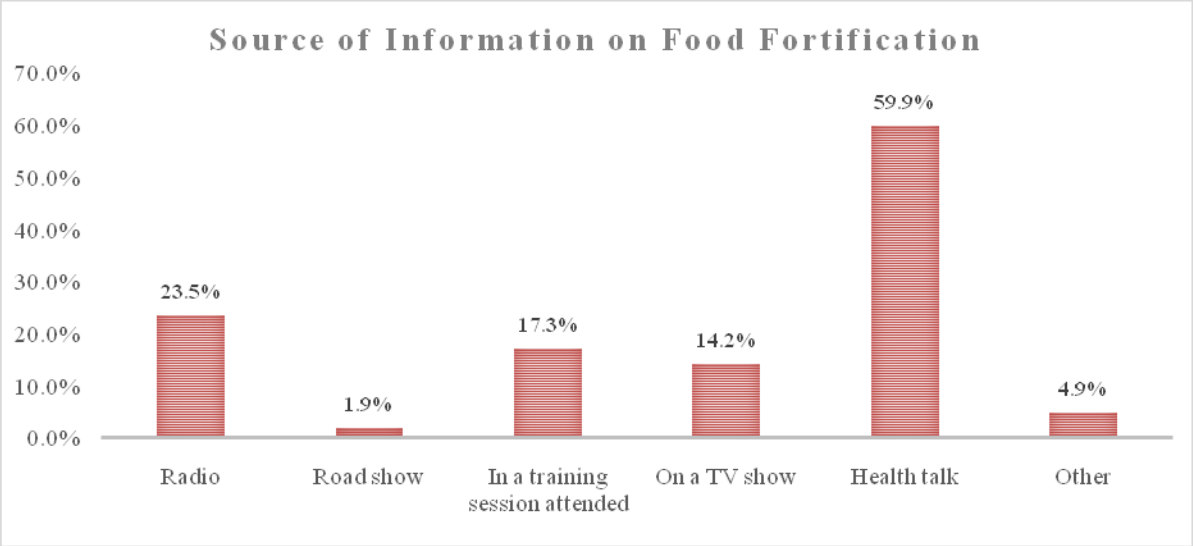


Figure 3.21 Source of information on food fortification

[20]http://www.nutritionhealth.or.ke/programmes/micronutrient-deficiency-control/food-fortification/ Overview of food fortification program

4.0 CONCLUSION

Overall the nutrition Status of children in Isiolo County improved compared to the outcome of a SMART survey conducted in the same season in 2018. The current nutrition status of children in the County is in Alert phase (IPC Phase 2) with a global and severe acute malnutrition prevalence of 9.2 and 0.7 percent respectively a significant difference with p value 0.035 (GAM) and 0.027 (SAM) compared global and severe acute malnutrition prevalence of 13.8 and 2.6 percent respectively in 2018. The same significant improvement (p=0.027) where the percentage of children with underweight reduced from 19.2 in 2018 to 13.6 in 2019. The stunting levels were also noted to improve although with no statistical ssignificant difference.

There was a reduction in the number of children under five reported to have fallen sick within two weeks recall period from 46.5 percent in 2018 to 35.1 percent in 2019. A Slightly higher number of children sought help from public health facilities in 2019 at 73 percent compared to 71 percent in 2018. Acute respiratory tract infections and fevers with chills like Malaria were the main morbidity at 46% and 31% respectively with a slight upsurge malaria in 2019 compared to 27% in 2018. Among the diarrhea cases reported 79 percent were reported to have been treated with ORS and Zinc an increase from 71.2 percent in 2018. Reduction in Acute respiratory tract infections and other diseases can be attributed to an improvement in immunization coverage at 98.0%, 81.0%, 78.0%, 72% and 55% for BCG, OPV1, OPV3, Measles at 9 and Measles at 18 months respectively compared to 93.0%, 74.0%, 72.0%, 64% and 32% in 2018. There was also a notable improvement in Vitamin A Supplementation among children 6-59 months and deworming among children 12 to 59 months at least once from 65% and 60% in 2018 to 86% and 70% in 2019 respectively. The improved health service delivery and reduced morbidity coupled with appropriate health seeking behaviour can be linked with reduced wasting in Isiolo County. The unchanged number of diarrhea cases can be attributed to poor performance in WASH indicators with 22.0% of the households practising open defecation, and only 26.1% caregivers with children below 23 months washing hands at four critical times and only 21.8% of the households treating their drinking water.

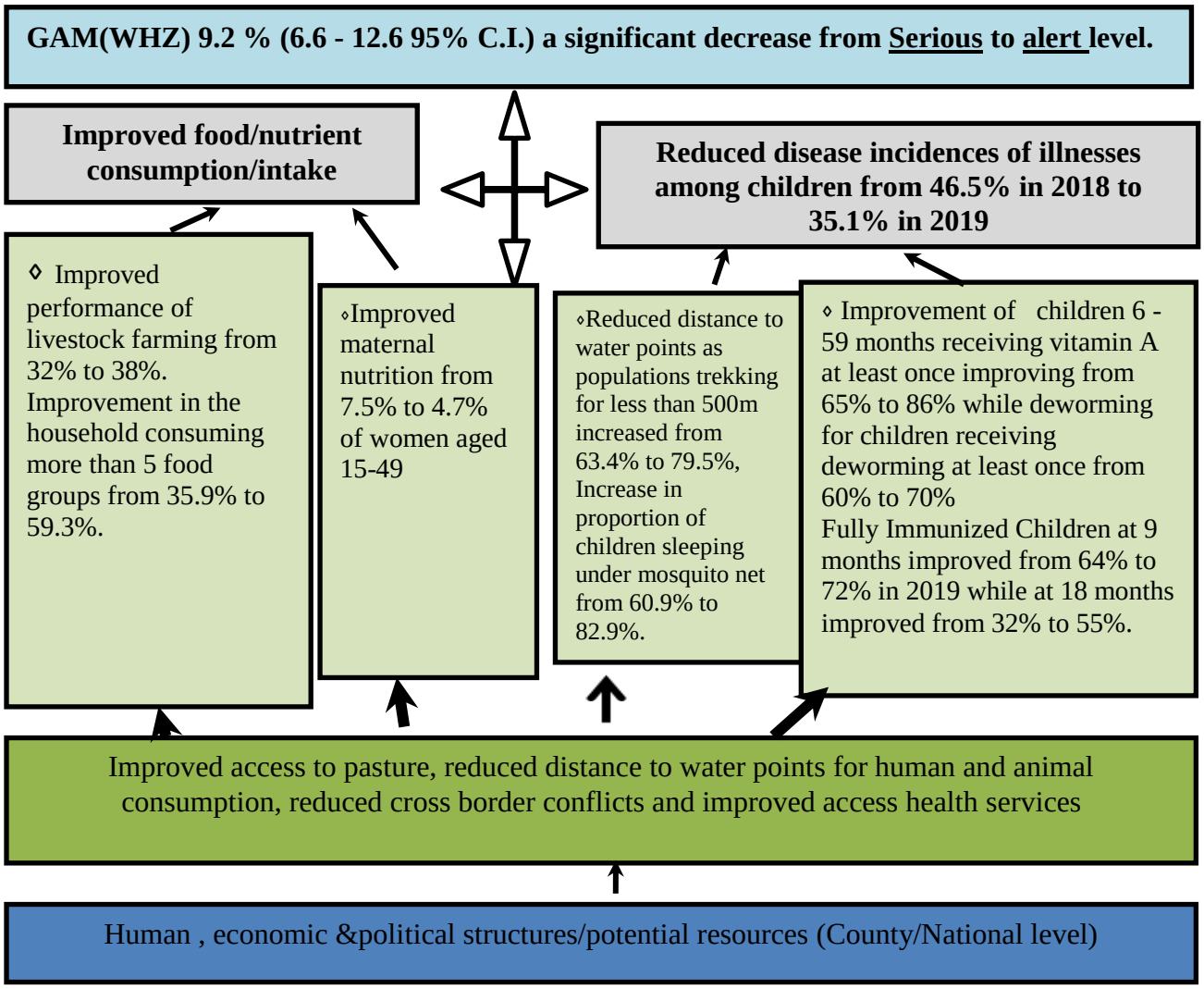
Maternal nutrition status based on MUAC measurement among all women of reproductive age and pregnant and lactating women only showed an improvement with the two categories having MUAC of <21cm at 5.3% and 4.7% respectively in 2019 an improvement from 6.4% and 7.5% in 2018 respectively. Although 71.6% mothers of children under two years were supplemented with iron and folic acid during their immediate previous pregnancy, the proportion that consumed iron and folic acid remains quite low. None of them consumed the supplements for the recommended 270 days and only 6.0% consumed the supplements for more than 90 days.

There was a notable improvement in food security indicator in the County compared to the same period 2018. The household dietary diversity increased with the proportion of households consuming more than 5 food groups increasing from 35.9% in 2018 to 59.3% in 2019. The major foods being consumed included cereals, legumes/pulses, sugars, oils and fats, milk and milk products. The situation improvement is attributed to the heavy rains experienced during the long rains season. The county Food Consumption Score, which combines frequency of food intake and relative importance of each food, indicated 86.7% of the Households remaining at acceptable levels. However, Consumption of Iron rich and Vitamin A rich foods remained quite low with

38.5% of households at poor food consumption level not consuming iron rich foods and 69.2% not consuming vitamin A rich foods.

In conclusion it can be noted that the key drivers of poor nutrition status in Isiolo County include; Chronic food insecurity, High prevalence of childhood illness, Inadequate dietary diversity, Poor access to safe water, Poor hygiene and sanitation practices, and Inadequate basic structures (incomes and assets for the households).

Below are the conclusions based on UNICEF's conceptual framework for malnutrition.



5.0 RECOMMENDATIONS

Table 5.0: recommendations

Survey Findings	Short Term Recommendations	Medium to Long Term	Responsible
GAM rates at 9.2%	• Capacity development of staff through On Job Training and Continues Medical Educations (CMEs) • Active case findings at the community • MIYCN activities (BFCI and BFHI) • IMAM activities • Nutrition surveillance and scale up of IMAM surge activities at health facilities.	• Sensitizing the political class and other county departments e.g. water and livestock on health and nutrition issues • Formation of Multi-sectoral platform for coordination of implementation of nutrition (sensitive and specific) activities. • Advocate for employment of nutritionist in the county.	MoH and partners MSP task force SUN CSA and MSP.
Low vitamin A coverage of 40% (more than once), Low deworming of 21% more than twice	• Health education to the community on the importance of vitamin A supplementation and de-worming to the children under five years • Routine Vitamin A Supplementation and deworming at health facilities and integrated outreach activities • Taking advantage of mass screening, Malezi Bora etc for vitamin A and de-worming supplementation • Continued OJT's on documentation of the VAS in the MCH Booklet for monitoring	• Health education on importance of VAS • Continued Vitamin A supplementation interventions in schools and ECDE and schools.	MoH and partners supporting outreach activities

Prevalence of stunting at 13.9%	• Re introduction of MNP program targeting children 6-23 months for food fortification at household level.	• Health education on fortified foods at the markets and the importance of household food fortification • Continue engaging and building the capacity of community members on Agri nutrition. • Scaling up BFCI. • Strengthen integrated coordination (Sensitive/specific) ministries at sub County level	MoH, MoA
Open defecation remained high in Isiolo County with 22%	• Continuous engagement with the community on CLTs • Continuous health education on critical times for hand washing	• Advocating for positive behavior change on use of latrines	MoH
Low IFAS utilization for >90 days which is at 6%	• Health education at the health facilities and outreach sites on consumption of iron folate during pregnancy.	• Foster male involvement as means of reaching women for iron folate consumption. • Develop social behavior messages targeting the community on the need for pregnant to consume iron folate. • Reach women in women groups with key IFAS messaging	MOH and partners
Low Hand washing for caregivers with children 0-23 months at 26%	• Targeted health education at the community level • Community dialogues. • Promoting use of hand washing stations.	• Increased coverage of CHS. • Scaling of baby WASH and BFCI and CLTS.	MOH and partners
Low consumption of Iron rich and vitamin A rich foods with 38.5% and 69.2% of households within poor food consumption score not consuming iron rich and vitamin A rich foods.	• Promote integrated kitchen gardening at household level. • Promote production consumption of Vitamin A rich fruits and vegetables.	• Promote small scale irrigated farming at household level for vegetables and fruits. • Establishing junior farmer field schools that promote consumption of diversified foods.	MOH, MoA and partners

6.0 ANNEXES

6.0.1 Sampled Clusters

Table 6.2: List of Sampled clusters

Sub-county	Ward	Sub-Location	Cluster	Cluster number
MERTI	Cherab	Bisan Biliqo	Bisika	1
MERTI	Cherab	Goda	Goda 'A'	2
MERTI	Cherab	Korbesa	Rigga	3
MERTI	Cherab	Malkagalla	Malkagalla Town B	4
MERTI	Cherab	Merti North	Shauriyako 2	5
MERTI	Chari	Merti South	Manyatta Ganna	6
MERTI	Chari	Merti South	Manyatta Funan	7
GARBATULLA	Garbatulla	GAFARSA	M.Gabra	8
GARBATULLA	Garbatulla	GAFARSA	M.Dathey	9
GARBATULLA	Garbatulla	GARBA TULLA NORTH	Matagari A	10
GARBATULLA	Garbatulla	GARBA TULLA NORTH	Town	11
GARBATULLA	Kinna	KINNA	Cherab Dicha	12
GARBATULLA	Kinna	KULAMAWE	Yaq-Barasadi	13
GARBATULLA	Kinna	MADO YAKA	Barambate/Bulla Wara	14
GARBATULLA	Sericho	SERICHO	Sericho North	15
GARBATULLA	Sericho	SERICHO	Adele	16
ISIOLO	Bula pesa	Bulla Pesa	Bulla Safi	17
ISIOLO	Bula pesa	Bulla Pesa	Bulla Zamani	18
ISIOLO	Bula pesa	Bulla Pesa	Marille	19
ISIOLO	Bula pesa	Bulla Pesa	Kulamawe A	20
ISIOLO	Bula pesa	Bulla Pesa	Kulamawe B	21
ISIOLO	Bula pesa	Bulla Pesa	Kampi Ya Juu A	22
ISIOLO	Bula pesa	Bulla Pesa	Kampi Ya Juu B	23
ISIOLO	Burat	Odha	Kampi Bulle	24
ISIOLO	Burat	Odha	Odha	25
ISIOLO	Burat	Burat	Game	26
ISIOLO	Burat	Burat	Leparua	27
ISIOLO	Oldonyiro	Oldonyiro	Loruko	28
ISIOLO	Wabera	Kiwanjani	KiwanjaNdege	29
ISIOLO	Wabera	Wabera	Chechelesi 'A'	30
ISIOLO	Wabera	Wabera	Tuluroba A	31
ISIOLO	Wabera	Wabera	Tuluroba B	32
ISIOLO	Wabera	Wabera	Acacia	33
ISIOLO	Wabera	Wabera	Wabera	34
ISIOLO	Ngaremara	Ngaremara	Akunoit	35
ISIOLO	Ngaremara	Ngaremara	Loangila	36
ISIOLO	Oldonyiro	Oldonyiro	Namelok	37
ISIOLO	Oldonyiro	Oldonyiro	Rumate	38
ISIOLO	Oldonyiro	Lonkopito	Nantundu	39
ISIOLO	Oldonyiro	Kipsing	Kawalash	40
ISIOLO	Oldonyiro	Lenguruma	Lemorijo	41

6.0.2 Plausibility report

Standard/Reference used for z-score calculation: WHO standards 2006
(If it is not mentioned, flagged data is included in the evaluation. Some parts of this plausibility report are more for advanced users and can be skipped for a standard evaluation)

Overall data quality

Criteria	Flags*	Unit	Excel.	Good	Accept	Problematic	**Score**
Flagged data	Incl	%	0-2.5	>2.5-5.0	>5.0-7.5	>7.5	
(% of out of range subjects)			0	5	10	20	**0** (0.5 %)
Overall Sex ratio	Incl	p	>0.1	>0.05	>0.001	<=0.001	
(Significant chi square)			0	2	4	10	**0** (p=0.132)
Age ratio(6-29 vs 30-59)	Incl	p	>0.1	>0.05	>0.001	<=0.001	
(Significant chi square)			0	2	4	10	**2** (p=0.076)
Dig pref score - weight	Incl	#	0-7	8-12	13-20	> 20	
			0	2	4	10	**0** (4)
Dig pref score - height	Incl	#	0-7	8-12	13-20	> 20	
			0	2	4	10	**0** (7)
Dig pref score - MUAC	Incl	#	0-7	8-12	13-20	> 20	
			0	2	4	10	**0** (5)
Standard Dev WHZ	Excl	SD	<1.1	<1.15	<1.20	>=1.20	
.			and	and	and	or	
.	Excl	SD	>0.9	>0.85	>0.80	<=0.80	
			0	5	10	20	**0** (1.03)
Skewness WHZExcl	#		<±0.2	<±0.4	<±0.6	>=±0.6	
			0	1	3	5	**1** (0.34)
Kurtosis WHZExcl	#		<±0.2	<±0.4	<±0.6	>=±0.6	
			0	1	3	5	**0** (-0.11)
Poisson dist WHZ-2	Excl	p	>0.05	>0.01	>0.001	<=0.001	
			0	1	3	5	**0** (p=0.073)
OVERALL SCORE WHZ =			0-9	10-14	15-24	>25	**3** %

The overall score of this survey is 3 %, this is excellent.

There were no duplicate entries detected.

Percentage of children with no exact birthday: 0 %

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

Age cat.	mo.	boys	girls	total	ratio boys/girls
6 to 17	12	65/61.9 (1.0)	74/70.3 (1.1)	139/132.3 (1.1)	0.88
18 to 29	12	61/60.4 (1.0)	83/68.5 (1.2)	144/128.9 (1.1)	0.73
30 to 41	12	58/58.5 (1.0)	71/66.4 (1.1)	129/125.0 (1.0)	0.82
42 to 53	12	58/57.6 (1.0)	52/65.4 (0.8)	110/123.0 (0.9)	1.12
54 to 59	6	25/28.5 (0.9)	23/32.3 (0.7)	48/60.8 (0.8)	1.09

6 to 59	54	267/285.0 (0.9)	303/285.0 (1.1)	0.88

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

Overall sex ratio: p-value = 0.132 (boys and girls equally represented)
Overall age distribution: p-value = 0.177 (as expected)
Overall age distribution for boys: p-value = 0.964 (as expected)
Overall age distribution for girls: p-value = 0.061 (as expected)
Overall sex/age distribution: p-value = 0.015 (significant difference)

Digit preference Weight:
Digit preference score: **4** (0-7 excellent, 8-12 good, 13-20 acceptable and > 20 problematic)
p-value for chi2: 0.426
Digit preference Height:
Digit preference score: **7** (0-7 excellent, 8-12 good, 13-20 acceptable and > 20 problematic)
p-value for chi2: 0.001 (significant difference)
Digit preference MUAC:
Digit preference score: **5** (0-7 excellent, 8-12 good, 13-20 acceptable and > 20 problematic)
p-value for chi2: 0.157

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:	1.06	1.06	1.03
(The SD should be between 0.8 and 1.2)			
Prevalence (< -2)			
Observed:	9.5%	9.5%	9.2%
Calculated with current SD:	10.9%	10.9%	10.2%
Calculated with a SD of 1:	9.7%	9.7%	9.5%
HAZ			
Standard Deviation SD:	1.28	1.24	1.05
(The SD should be between 0.8 and 1.2)			
Prevalence (< -2)			
Observed:	14.6%	14.6%	13.9%
Calculated with current SD:	16.6%	16.2%	12.9%
Calculated with a SD of 1:	10.8%	11.0%	11.7%
WAZ			
Standard Deviation SD:	1.05	1.05	1.01
(The SD should be between 0.8 and 1.2)			
Prevalence (< -2)			
Observed:	13.9%	13.9%	13.6%
Calculated with current SD:	14.7%	14.7%	13.7%
Calculated with a SD of 1:	13.5%	13.5%	13.4%
Results for Shapiro-Wilk test for normally (Gaussian) distributed data:			
WHZ	p= 0.001	p= 0.001	p= 0.000
HAZ	p= 0.000	p= 0.000	p= 0.393
WAZ	p= 0.125	p= 0.125	p= 0.396

(If p < 0.05, then the data are not normally distributed. If p > 0.05 you can consider

the data normally distributed)

Skewness

WHZ	0.23	0.23	0.34
HAZ	0.64	0.42	0.01
WAZ	-0.02	-0.02	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	0.29	0.29	-0.11
HAZ	3.46	2.48	-0.23
WAZ	0.53	0.53	-0.13

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=1.34 (p=0.073)
WHZ < -3: ID=1.44 (p=0.036)
GAM: ID=1.34 (p=0.073)
SAM: ID=1.44 (p=0.036)
HAZ < -2: ID=1.76 (p=0.002)
HAZ < -3: ID=0.90 (p=0.658)
WAZ < -2: ID=1.74 (p=0.003)
WAZ < -3: ID=1.50 (p=0.023)

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.