October 2009

INTEGRATED SMART-SURVEY

(Nutrition, WASH and Food Security & Livelihoods)

In

KITUI DISTRICT, KENYA

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TABLE OF CONTENTS

1. EXECUTIVE SUMMARY 4
2. INTRODUCTION 7
3. METHODOLOGY 9
3.1. Sampling 9
3.2. Training and organization of survey teams 9
3.3. Data Quality Assurance Processes 10
3.4. Data Collection 10
3.5. Data Entry and Analysis 11
4. RESULT AND DISCUSSION 13
4.1. Child Nutrition Status 13
4.1.1. Distribution by age and sex 13
4.1.2. Anthropometric analysis 13
4.1.3. Measles immunization and vitamin A coverage 18
4.1.4. Children treated in an OTP/SFP Program 19
4.1.5. Breastfeeding and Complementary Feeding Practices 19
4.1.6. Child Morbidity and Treatment Seeking 20
4.2. Mosquito Net Use 20
4.3. Mortality 21
4.4. Households' Background Characteristics 21
4.5. Water and Sanitation 23
4.5.1. Water Source and Use 23
4.5.2. Hand washing practices 25
4.5.3. Latrine use and garbage disposal 25
4.6. Food Security and Livelihoods 26
4.6.1. Crop Production 26
4.6.2. Livestock Holding 27
4.6.3. Sources of Food 28
4.6.4. Dietary Diversity 28
4.6.5. Coping Strategies 29
4.6.6. Income and Expenditure 30
5. CONCLUSION AND RECOMMENDATIONS 33

ANNEXES
Annex I: Assignment of Clusters
Annex II: Anthropometric Survey Data Form
Annex III: Local Event Calendar
Annex IV: Household Mortality Questionnaire
Annex V: WASH and Food Security and Livelihoods Questionnaire
Annex VI: Anthropometrics Data Plausibility Check (WHO)

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1. EXECUTIVE SUMMARY

In October 2009, to assess and determine the extent of acute malnutrition in the area, ACF-USA and the Ministry of Health (MOH)-Kitui conducted an integrated nutrition survey in selected areas within the Larger Kitui District, Eastern Province of Kenya. The nutrition survey was implemented using the SMART methodology[1]. The survey covered rural villages in twelve locations within four divisions (Ikutha, Mutomo, Mutonguni and Yatta) of the larger Kitui Districtand was implemented in collaboration with the Ministry of Health, Arid Lands Resources Management Project (ALMP) and the Kitui District Kenya National Bureau of Statistics (KNBS) Office. The survey was preceded by training of staff from local partners on the SMART methodology from the 5th to the 10th of October 2009. The survey was then conducted from 12th to 23rd October 2009. Its main objective was to determine the level of acute malnutrition among children aged 6-59 months and to analyze the possible factors contributing to acute malnutrition such as illnesses, care practices, water, sanitation & hygiene (WASH) factors and food security situation.

A total of 808 children (411 boys and 397 girls) aged 6-59 months were surveyed for measuring the rates of acute malnutrition and 4,175 people from 651 households were surveyed for retrospective mortality and household data. The mean household size and number of under five per household was 6.4 persons and 1.3 children respectively. In the final analysis for the nutrition 806 children (410 boys and 396 girls) were included (2 data sets were excluded as data showed aberrant). The global acute malnutrition (GAM, expressed by weight for height <-2 Z score and / or oedema) based on the WHO Growth Standards 2005 was 8.9% [95% CI: 7.0-10.9] and severe acute malnutrition (SAM, expressed by weight for height <-3 and / or oedema) was 1.5% [95% CI: 0.7-3.0] including 4 (0.5%) oedema cases. These rates of acute malnutrition range between poor and serious according to the WHO thresholds.

The Crude Death Rate (CDR) finding was 0.03 [0.00-0.15] per 10,000 persons per day, which is below the emergency threshold of 1/10,000/day. The survey also revealed a high level of morbidity in the area where 53.6% of the surveyed children had some form of sickness in the two weeks prior to the survey. The three most reported illnesses were “fever with difficulty breathing” (29.9%), “diarrhea” (12%) and “fever with chills like malaria” (11%). The percentage of children reporting “fever with chills like malaria” was low possibly due to the dry season and relatively good use of mosquito net (66% of households). Illness has a direct relationship with acute malnutrition, as leading to poor nutritional outcomes through poor utilization of the nutrients in the body. Analysis of the nutritional data shows association between acute malnutrition and illness in diarrhea. Children who had had diarrhea within two weeks prior to the assessment were more likely to be acutely malnourished (p value= 0.052). Measles vaccination coverage for eligible children (9-59 months old) was fair (72% by card) as was coverage for vitamin A supplementation (94%) at least once in the past one year in the surveyed areas.

In Kitui, 55% of the population accesses water from safe sources in the rainy season but only 29% in the dry season (see narrative for definitions) with about 61% reporting some kind of water treatment. The per capita water consumption in liters for drinking, cooking, washing and cleaning at the time of the survey was 11.0 (10.6-11.4, 95% CI), which is comparable to similar areas in Kenya and the national standard for “low potential areas” of 10 L/p/d, but lower than international standards. Close to three in four households (72%) used a family latrine in their compound, and this is considered as good coverage.

[1] Standardized Monitoring and Assessment of Relief and Transitions

Resulting from poor rains in the past few years, households experienced repeated crop failures. Finding reveals that more than 98% of the households reported to have been engaged in crop farming; however, only about 24% reported to have harvested any crop in the last harvesting season.

Remittances, sale of bush products (charcoal & firewood), loan/credit and sale of livestock and livestock products were income sources for 29, 28.3, 26.1 and 24% of households, respectively. The daily labor is very significant as an income source and contributing about 63% of the households' income. Expenditures are mainly on food purchase but a significant amount of income has been spent on medical and school fees. Farm inputs, transportation and debt repayment are also important expenditure for the households.

The common sources of food in the 30 days before the survey were purchase, food aid, gift and own production, respectively for 99 , 87, 73 and 60% of the households. The average number of food groups consumed based on the 12 food groups and 24 hour recall period was 4.4 with 41% of the households consuming three or less food groups.

The common adopted coping strategies are among others reducing the size of the meals, purchasing food on credit/borrowing from local vendors or relatives and skipping meals.

The results of the Kitui October 2009 survey on anthropometrics, mortality, WASH and key food security indicators are summarized in the Table 1 below.

Table 1: Summary of Key Findings

INDEX	INDICATOR		RESULTS[2]
WHO (N=806)	***Z- scores***	***Global Acute Malnutrition*** W/H < -2 z and/or oedema	**8.9%** [7.0-10.9]
		Severe Acute Malnutrition W/H < -3 z and/or oedema	**1.5%** [0.7-3.0]
NCHS (N= 806)	***Z-scores***	***Global Acute Malnutrition*** W/H < -2 z and/or oedema	**7.8%** [6.0-9.7]
		Severe Acute Malnutrition W/H < -3 z and/or oedema	**0.6%** [0.08-1.2]
	% Median	***Global Acute Malnutrition*** W/H < 80% and/or oedema	**4.0%** [2.5-5.4]
		Severe Acute Malnutrition W/H < 70% and/or oedema	**0.5 %** [0.1-0.9]
MUAC (N=806)	***Height> 65 cm***	***Global Acute Malnutrition*** MUAC <12.5cm	**2.8 %** [2.0-4.4]
		Severe Acute Malnutrition MUAC <11.5 cm	**0.1%** [0.0-0.8]
Total crude retrospective mortality (last 3 months) /10,000/day			**0.03** [0.00-0.15]
Under five crude retrospective mortality /10,000/day			**0.0** [0.00-0.00]

[2] Results in brackets are at 95% confidence intervals

Measles immunization coverage by Card (N=557 children 9-59 months old)	**71.7%** [68.5-74.9]
Children who received vitamin A supplementation in last one year (N=806)	**94.3%** [92.7-95.9]
Proportion of children 6-59 months of age with diarrhea in 2 weeks prior to the survey (N=806)	**11.2%** [9.0-13.3]
Proportion of children 6-59 months of age with chills like malaria in 2 weeks prior to the survey (N=806)	**22.0%** [19.1-24.8]
Proportion of children 6-59 months of age with fever & difficult breathing in 2 weeks prior to the survey (N=806)	**29.9%** [26.7-33.1]
Proportion of households with a family latrine within a compound	**72%** [68.6-75.5]
Proportion of households at least one member using a mosquito net the night before the survey date (N=651)	**26.7%** [23.2-30.1]
Proportion of households who access a safe water source in the dry season (N=630)	**42.1%** [38.3-46.0]
Proportion of households who access a safe water source in the rainy season (N=624)	**57.8%** [54.0-61.7]
Average daily per person water consumption at the time of the survey (liters) (N=651)	**11.0** [10.6-11.4]
Proportion of households engaged in crop farming who harvested in the last cropping season (N=651)	**24.4%** [21.1-27.7]
Mean Household Dietary Diversity (N=651)	**4.4** [4.3-4.6]
Proportion of households who consumed ≤3 food groups (N=651)	**41.0%** [37.2-44.8]

2. INTRODUCTION

Kitui district is located in the Southern part of Eastern Province, bordering the districts of Mwingi to the North, Taita Taveta to the South, Tana River to the East, Makueni to the West and Machakos to the North West. The district is approximately 20,402 sq km with a population of 628,615. In terms of livelihood zone, the district population is classified as marginal mixed farming (57.2%), mixed farming (38.5%) and formal employment/casual labor[3] (4.3%). There are ten administrative divisions within the larger district, namely: Central, Chuluni, Ikanga, Ikutha, Mutomo, Yatta, Mwitika, Muthonguni, Mutha and Mutitu[4]. The survey covered the rural villages in the twelve locations within the four divisions of Ikutha, Mutomo, Mutonguni and Yatta (see map below).

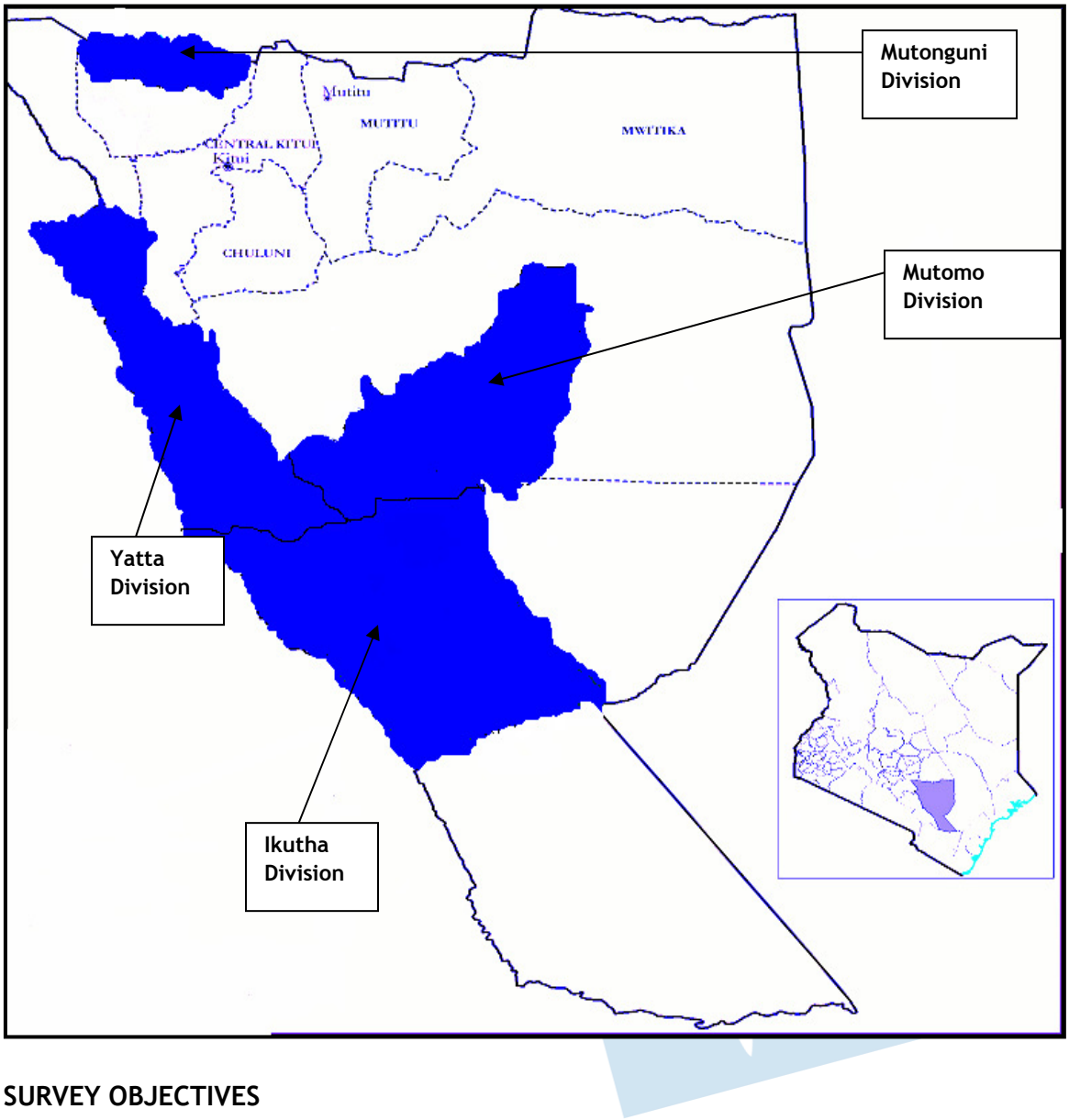
Following prolonged drought resulting in successive crop failures, food aid distributions started in 2004 in the larger Kitui District. Since then, the food aid recipients have been steadily increasing and according to the district Arid Lands Resource Management Project (ALRMP) currently about 42% of the population are recipients of food aid rations including food for asset programs. In response to the Long Rain Assessment (LRA) recommendation, ACF-USA started building the capacity of the district health system in TFP/SFP programs in July 2009, to ensure that severely and moderately malnourished children have access to treatment service. Thus far, the number of children admitted as of end of September 2009 was 55 severe cases in 12 dispensaries[5].

The survey areas were selected based on the 2009 long rain assessment ranking as well as from recommendations of the local authorities and implementing partners (the most vulnerable areas were selected for being surveyed). The surveyed locations accounted for about 37% of the larger Kitui District population[6] and predominantly fall within the marginal mixed farming zone. This zone mainly relies on crop farming and supplements with keeping livestock. Crops grown include maize, beans, millets, sorghum, and green grams, while livestock kept include cattle, goats, sheep and donkeys. The altitude of the larger district ranges from 400m to 1800 m above sea level and the district receives a bimodal rainfall pattern, the long rains between March and April and the short rains between October and December. The rainfall is highly unreliable and the annual precipitation ranges between 500-1050mm. Water scarcity is a major problem in the area.

According to the KFSSG Long Rain Assessment in the marginal mixed farming, due to successive crop failures the general food security trend in the district is unstable which led to depletion of household assets and coping capacity and purchasing power. The majority of the households still rely on market purchases and food aid.

[3] ALRMP
[4] KFSSG Kitui District Long Rain Assessment (2009)
[5] These figures are calculated from June to September 2009
[6] KFSSG Kitui District Long Rain Assessment report (2009)

Figure 1: **Survey Divisions**



SURVEY OBJECTIVES

The main objective of the survey was to determine the level of acute malnutrition among children aged 6-59 months, as well as to analyze the possible factors contributing to malnutrition such as illnesses and care practices, water and sanitation and the food security situation. The specific objectives of the nutritional survey, in addition to providing capacity building training on SMART, included assessing or estimating:

- Prevalence of acute malnutrition in children aged 6-59 months
- Crude and under five mortality rates
- Coverage of measles vaccination and vitamin A distribution among targeted children
- Exclusive breastfeeding and child feeding practices
- Illnesses in children aged 6-59 months
- Water, sanitation and hygiene (WASH) coverage, knowledge and practice

- Food security situation and livelihood sources

The report is organized in to five sections. Section two provides the survey methodology including sampling, training and organization of survey teams and analytical approach. The survey results and discussion are presented under section three. The final section provides conclusions and recommendations.

3. METHODOLOGY

3.1. Sampling

A two-stage cluster sampling with probability proportional to size (PPS) design was employed for the integrated nutritional survey. The Emergency Nutrition Assessment (ENA) for SMART software was used to determine the sample size required using village level population data obtained from location and sub-location chiefs and sub-chiefs[7]. Since no nutritional surveys were conducted in the recent past that could provide information on the prevalence of GAM, the sample size was determined using the survey conducted by ACF in the adjacent Tana River District in November 2008 which showed rates of global acute malnutrition of 14.7% (the upper limit with 95% CI). Using a precision of 4%, a design effect of 2.0 and a 3% non response rate, 602 children (621 households) were planned for the survey. For the mortality, taking the prevalence of 0.37 per 10,000/day for the same Tana River survey, precision of 0.3 and design effect 1.5, the sample size was determined at 594 households. The anthropometric survey was the one that determined the maximum number of households (621) included in the sample. This was translated to 50x13 cluster design with an overall sample size of 650 households, as 13 households was estimated to be the maximum number of households a team could survey in one day.

At the second stage, for selecting the households and children in each cluster, a systematic random sampling was used from a household list provided by village elders. The total number of households in each village or cluster was divided by the required sample size per cluster (13) to determine the sampling interval. Then a random number was chosen to select the first household and the sampling interval repeatedly added to determine the remaining sample households. Respondents were primarily heads of households and spouses.

3.2. Training and organization of survey teams

Capacity building of the local partners on SMART was one of the objectives of the survey and accordingly a three-day training (October 5th to 7th, 2009) was organized in Kitui town on the SMART methodology for ten participants, five from Kitui and five from Mwingi district. The ten participants were drawn from the Ministry of Health, ALRMP and KNBS and later served as team leaders during the actual survey implementation in their respective district.
The SMART training for the team leaders was followed by another three-day intensive training session from October 8th to 10th, 2009 in Kitui town for the anthropometrics measurers (10), data collectors (5) and team leaders (5). The training was conducted focusing on the survey implementation including the objectives, sample household selection and interviewing and anthropometrics measurement techniques.

[7] The population estimate obtained from Kitui Kenya National Bureau of Statistics (KNBS) Office was later revised for the sampling purpose based on the village level data provided by Chiefs and Assistant Chiefs.

The five team leaders in Kitui were from the Ministry of Health (3), ALRMP (1) and KNBS (1). Five survey teams each comprising of a team leader, one data collector and two measurers were organized based on the number of clusters to be completed and households/children to be interviewed or measured per cluster. Each team completed a cluster in a day.

3.3. Data Quality Assurance Processes

To ensure accurate and reliable measurements, survey teams were subjected to a standardization test on the second day of the training. In addition, field testing of the survey instruments and survey teams in a non surveyed village adjacent to Kitui town was conducted on the last day of the training where each survey team member had a practical test and evaluation. The precision and the accuracy of the data collected as part of the pre-test were evaluated and feedback provided to the teams. To improve the accuracy in determining dates of childbirth, a local events calendar was used when mothers or caretakers showed unable to provide a child card with birth date clearly indicated. At the end of each day during the data collection all the anthropometrics data were entered, plausibility check performed and feedback provided to each team for improvement of performance and of quality of data.

3.4. Data Collection

The field data collection was conducted from October 12th to 23rd, 2009. While the anthropometric and mortality questionnaires were adopted from the SMART methodology, the survey questionnaire for the WASH and Food Security and Livelihoods was developed specifically for this survey and pre-tested as part of the training of enumerators and team leaders. The following categories of data were collected:

- **Anthropometrics:**

Children aged 6-59 months were measured using the standard survey form (see annex) that captures the following key variables:

- **Age** in months-determined from child card or with the help of a local calendar of events
- **Sex**- recorded as 'm' for male and 'f' for female
- **Weight**- Children were weighed to the nearest 100 g with a Salter Hanging Scale of 25 kg. All scales were checked daily by using a standard weight of 5 kg and adjusted to "0" with an empty weighing pant before each measurement. After the mothers consent, children were measured either undressed or using the child's own clothes to adjust the scale to zero.
- **Height**- Children were measured on a measuring board (precision of 0.1cm). Children less than 85cm were measured lying down, while those greater than or equal to 85cm were measured standing up.
- **Mid-Upper Arm Circumference (MUAC)** - measured in centimeters at mid-point of left upper arm to the nearest 0.1 cm with a MUAC tape.
- **Bilateral oedema** - assessed by the application of moderate thumb pressure for at least three seconds to both feet (upper side) simultaneously. Only children with bilateral oedema were recorded as having nutritional oedema.
- **Measles vaccination**- recorded for children aged 9-59 months from their vaccination cards. If no card was available at the time of the survey, the caretaker was asked if the child had been immunized against measles or not.
- **Vitamin A coverage**- assessed by first describing what a Vitamin A capsule looked like, then asking the mother if the child received the content of that capsule in the past. The answer was then recorded depending on how many times the child had received it in the last one year.

- **Illness**- assessed by asking each caretaker whether the child selected aged 6-59 months data was sick in the two weeks prior to the date of the survey. If the response was positive then the caretaker was further asked regarding the type of illnesses and the responses recorded.

➢ **Mortality:**

The data required for estimating the death rate were collected using the SMART mortality survey form and 90 days recall period. The start of the cold season which was around mid July (17^{th}) was used as the start of the recall period. Each surveyed household, regardless of having children 6-59 months of age, was asked to enumerate current household members, indicate sex and age, members present at the time of the survey and at the beginning of the recall period, people joined or left during the recall period, and whether there was any birth or death in the recall period.

➢ **WASH and Food Security and Livelihoods:**

From the same households the mortality data were collected, the water & sanitation and food security & livelihoods questionnaires were administered to the head of the household and/or the spouse regardless of whether the selected household had a child 6-59 months of age. The questionnaire used to gather data on health related variables from mothers with children under five, water availability and accessibility, sanitation practices, crop and livestock production, food sources, dietary diversity, income and expenditure and coping strategies.

3.5. Data Entry and Analysis

The anthropometric and mortality data were entered and analyzed using the ENA Software, November 2008 version. The Food Security & Livelihoods and WASH data entry was done in EpiInfo version 3.5.1 and later exported to SPSS version 12 for further analysis. In assessing the nutritional status of children 6-59 months old, data on immediate and underlying causes of malnutrition such as disease, health seeking behavior, water and sanitation and food security and livelihood indicators were analyzed. Nutrition status is improved when individuals are healthy, have secure access to food and access to resources and livelihood options. This analytical approach provided the framework in identifying possible casual factors leading to the final outcome of malnutrition.

Analysis of Acute Malnutrition: Acute malnutrition rates are estimated from the weight for height (WFH) index values combined with the presence of nutritional oedema. The WFH indices are expressed in both Z-scores and percentage of the median, according to WHO and NCHS reference standards.

➢ **Z-Score**

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

➢ **Percentage of median**

- Severe malnutrition is defined by WFH < 70 % and/or existing bilateral oedema.
- Moderate malnutrition is defined by WFH < 80 % and ≥ 70 % and no edema.
- Global acute malnutrition is defined by WFH <80% and/or existing bilateral edema.

Mortality

The Crude Death Rate is defined as the number of people in the total population who died between the start of the recall period and the time of the survey. It is calculated using the following formula.

Crude Mortality Rate (CMR) = 10,000/a*f/ (b+f/2-e/2+d/2-c/2), Where:

a = Number of recall days
b= Number of current household residents
c = Number of people who joined household
d = Number of people who left household
e = Number of births during recall
f = Number of deaths during recall period

Crude Mortality Rate (CMR):
Alert level: 1/10,000 people/day
Emergency level: 2/10,000 people/day

Under Five Mortality Rate (U5MR):
Alert level: 2/10,000 people/day
Emergency level: 4/10,000 people/day

Illnesses of Children < 5 years and Health Seeking Behavior

- Children 5 morbidity: illnesses and treatment seeking behavior and sources of health services.
- Exclusive breastfeeding and child feeding practices.
- Immunization (measles) and vitamin A coverage.
- Mosquito nets utilization.

WASH

- Sources of water and distance to the nearest sources, safety and quantity of water use for household consumption and its relation to nutritional outcomes.
- Water treatment and hand washing practices.
- Access to and utilization of latrines.

Food Security and Livelihoods:
In order to better understand the food security and livelihoods dynamics, the data collected and the analytical approaches include:

- Analysis of crop and livestock production practices and ownership structure and contribution to food security and livelihoods.
- Income and expenditure patterns- amount and sources for the 30 day before the survey.
- Dietary diversity score based on 12 food groups.
- Ranking of food sources and use of coping strategies for the 30 days.

4. RESULT AND DISCUSSION

This section presents the results and discussions based on the data on nutrition status of 6-59 months old children, mortality with 90 days recall period and the immediate and underlying causes of malnutrition including morbidity, water & sanitation and food security & livelihoods related indicators. Quantitative results are presented in tables, graphs or charts.

4.1. Child Nutrition Status

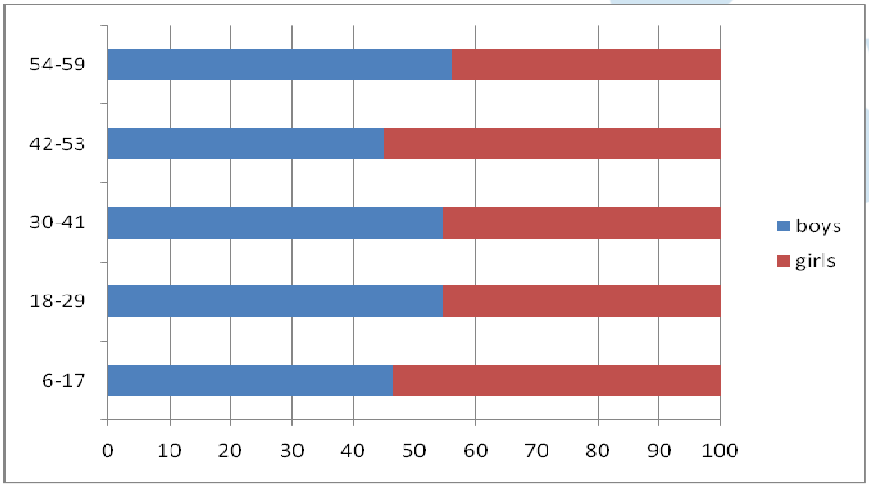
4.1.1. Distribution by age and sex

A total of 808 children, 411 boys and 397 girls aged 6-59 months were assessed in the survey. Two children were flagged out of range and excluded leaving 806 children, 50.9% boys and 49.1% girls, in the final analysis. The overall sex ratio was 1.0, within the acceptable range.

Table 2: Distribution of age and sex of children

Age Group (months)	Boys		Girls		Total		Ratio
	N	%	N	%	N	%	Boy : girl
6-17	85	46.4	98	53.6	183	22.7	0.9
18-29	104	54.7	86	45.3	190	23.6	1.2
30-41	111	54.7	92	45.3	203	25.2	1.2
42-53	78	45.1	95	54.9	173	21.5	0.8
54-59	32	56.1	25	43.9	57	7.1	1.3
Total	**410**	**50.9**	**396**	**49.1**	**806**	**100.0**	**1.0**

Figure 2: distribution by age and sex



4.1.2. Anthropometric analysis

The rate of Global Acute Malnutrition (GAM, weight for height <-2 Z score and/or oedema) based on the WHO Growth Standards 2006 was 8.9% [95% CI: 7.0 - 10.9] and Severe Acute

Malnutrition (SAM, weight for height <-3 and/or oedema) was 1.5% [95% CI: 0.7-3.0] including four (0.5%) oedema cases. These rates, when considered with 95% confidence (as expressed through confidence intervals) range from poor to serious according to the WHO thresholds. When estimated using the NCHS Reference from 1977, slightly lower GAM and SAM rates were calculated, respectively 7.8% [95% CI: 6.0-9.7] and 0.6% [95% CI: 0.2-1.7].

The distributions of the weight-for-height scores expressed in both WHO 2006 and NCHS 1977 reference standards were skewed towards the left of the reference curves indicating a poor nutritional status of the assessed population (Figure 3 and 4).

The mean Z-scores of the sample was -0.62 and the Standard Deviations (SD) 1.03. The SD is within the acceptable range of 0.80-1.20, which shows that the samples were representative of the population. A summary of the ENA plausibility check for the anthropometrics data is provided in Annex VI.

- **Distribution of Acute Malnutrition in Z-Scores WHO**

Table 3: Prevalence of acute malnutrition based on weight-for-height z-scores (and/or oedema) and by sex

	All n = 806	**Boys** n = 410	**Girls** n = 396
Prevalence of global malnutrition (<-2 z-score and/or oedema)	(72) 8.9 % (6.8 - 11.7)	(42) 10.2 % (7.3 - 14.1)	(30) 7.6 % (5.0 - 11.2)
Prevalence of moderate malnutrition (<-2 z-score and >=-3 z-score, no oedema)	(60) 7.4 % (5.8 - 9.6)	(36) 8.8 % (6.1 - 12.5)	(24) 6.1 % (4.0 - 9.1)
Prevalence of severe malnutrition (<-3 z-score and/or oedema)	(12) 1.5 % (0.7 - 3.0)	(6) 1.5 % (0.7 - 3.1)	(6) 1.5 % (0.6 - 3.7)

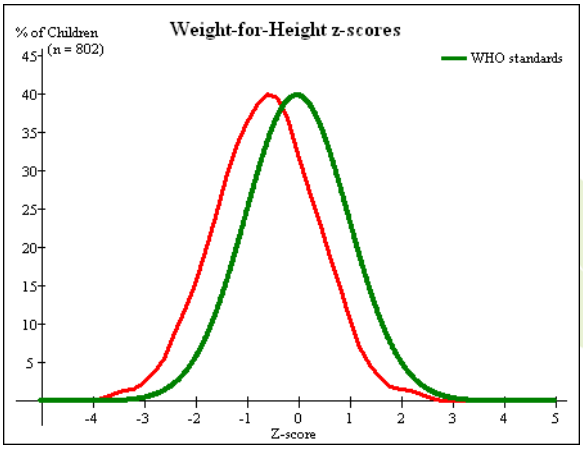
Table 4: Prevalence of acute malnutrition by age based on weight-for-height z-scores and/or oedema

		Severe wasting (<-3 z-score)		**Moderate wasting (>= -3 and <-2 z-score)**		**Normal (> = -2 z score)**		**Oedema**	
Age (mths)	**Total no.**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**
6-17	183	0	0.0	11	6.0	170	92.9	2	1.1
18-29	190	1	0.5	21	11.1	167	87.9	1	0.5
30-41	203	4	2.0	8	3.9	190	93.6	1	0.5
42-53	173	2	1.2	16	9.2	155	89.6	0	0.0
54-59	57	1	1.8	4	7.0	52	91.2	0	0.0
Total	806	8	1.0	60	7.4	734	91.1	4	0.5

Table 5: Distribution of acute malnutrition and oedema based on weight-for-height z-scores

	<-3 z-score	>=-3 z-score
Oedema present	Marasmic kwashiorkor No. 1 (0.1 %)	Kwashiorkor No. 3 (0.4 %)
Oedema absent	Marasmic No. 9 (1.1 %)	Not severely malnourished No. 795 (98.4 %)

Figure 3: ***Z-scores distribution Weight-for-Height, WHO 2006***



➢ **Distribution of Acute Malnutrition in Z-Scores NCHS**

Table 6: Prevalence of acute malnutrition based on weight-for-height z-scores (and/or oedema) and by sex

	All n = 806	**Boys** n = 410	**Girls** n = 396
Prevalence of global malnutrition (<-2 z-score and/or oedema)	(64) 7.9 % (6.0 - 10.4)	(37) 9.0 % (6.5 - 12.4)	(27) 6.8 % (4.4 - 10.5)
Prevalence of moderate malnutrition (<-2 z-score and >=-3 z-score, no oedema)	(59) 7.3 % (5.7 - 9.4)	(37) 9.0 % (6.5 - 12.4)	(22) 5.6 % (3.5 - 8.8)
Prevalence of severe malnutrition (<-3 z-score and/or oedema)	(5) 0.6 % (0.2 - 1.7)	(0) 0.0 % (0.0 - 0.0)	(5) 1.3 % (0.5 - 3.5)

Results between brackets are expressed with 95% confidence

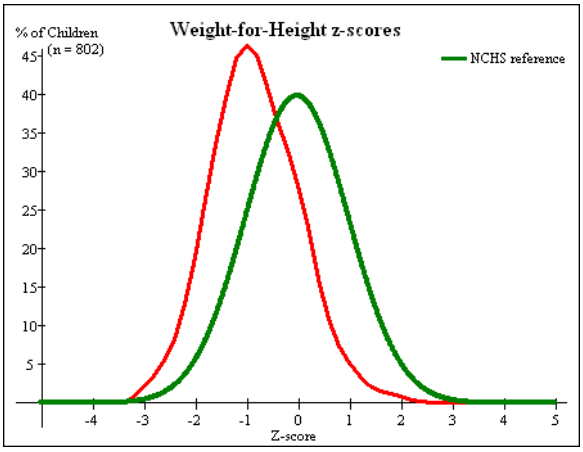
Table 7: Prevalence of acute malnutrition by age based on weight-for-height z-scores and/or oedema

		Severe wasting (<-3 z-score)		Moderate wasting (>= -3 and <-2 z-score)		Normal (> = -2 z score)		Oedema	
Age (mths)	Total no.	No.	%	No.	%	No.	%	No.	%
6-17	183	0	0.0	8	4.4	173	94.5	2	1.1
18-29	190	0	0.0	22	11.6	167	87.9	1	0.5
30-41	203	0	0.0	12	5.9	190	93.6	1	0.5
42-53	173	1	0.6	14	8.1	158	91.3	0	0.0
54-59	57	0	0.0	3	5.3	54	94.7	0	0.0
Total	806	1	0.1	59	7.3	742	92.1	4	0.5

Table 8: Distribution of acute malnutrition and oedema based on weight-for-height z-scores

	<-3 z-score	>=-3 z-score
Oedema present	Marasmic kwashiorkor No. 0 (0.0 %)	Kwashiorkor No. 4 (0.5 %)
Oedema absent	Marasmic No. 1 (0.1 %)	Not severely malnourished No. 803 (99.4 %)

Figure 4: ***Z-scores distribution Weight-for-Height, NCHS 1977***



- **Distribution of acute malnutrition by MUAC**

Table 9: Prevalence of acute malnutrition according to MUAC

MUAC (mm)	>= 65 cm to < 75 cm height		>=75 to < 90 cm height		>= 90 cm height		Total	
MUAC < 115	1	0.6%	0	0.0%	0	0.0%	1	0.1%
115 < = MUAC < 125	8	4.5%	13	3.7%	0	0.0%	21	2.7%
125 < = MUAC < 135	42	23.6%	63	18.1%	18	6.8%	123	15.5%
MUAC > = 135	127	71.3%	273	78.2%	246	93.2%	646	81.7%
Total	**178**	**100%**	**349**	**100%**	**264**	**100%**	**791**	**100%**

When considering MUAC results, GAM rates reached 2.8% while SAM reached 0.1%

- **Distribution of underweight and stunting in Z-Scores WHO 2006**

Table 10: Prevalence of underweight based on weight-for-age z-scores by sex

	All n = 800	Boys n = 409	Girls n = 391
Prevalence of underweight (<-2 z-score)	(249) 31.1 % (27.1 - 35.4)	(138) 33.7 % (28.8 - 39.0)	(111) 28.4 % (23.2 - 34.2)
Prevalence of moderate underweight (<-2 z-score and >=-3 z-score)	(179) 22.4 % (19.1 - 26.0)	(102) 24.9 % (20.5 - 30.0)	(77) 19.7 % (15.9 - 24.2)
Prevalence of severe underweight (<-3 z-score)	(70) 8.8 % (6.7 - 11.3)	(36) 8.8 % (6.4 - 12.0)	(34) 8.7 % (5.9 - 12.6)

Results between brackets are expressed with 95% confidence

Table 11: Prevalence of underweight by age based on weight-for-height z-scores and oedema

		Severe underweight (<-3 z-score)		Moderate underweight (>= -3 and <-2 z-score)		Normal (> = -2 z score)		Oedema	
Age (mths)	**Total no.**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**
6-17	180	9	5.0	30	16.7	141	78.3	2	1.1
18-29	188	22	11.7	35	18.6	131	69.7	1	0.5
30-41	202	15	7.4	53	26.2	134	66.3	1	0.5
42-53	173	19	11.0	48	27.7	106	61.3	0	0.0
54-59	57	5	8.8	13	22.8	39	68.4	0	0.0
Total	800	70	8.8	179	22.4	551	68.9	4	0.5

Table 12: Prevalence of stunting based on height-for-age z-scores and by sex

	All n = 794	Boys n = 409	Girls n = 385
Prevalence of stunting (<-2 z-score)	(398) 50.1 % (45.5 - 54.7)	(208) 50.9 % (45.9 - 55.8)	(190) 49.4 % (42.8 - 55.9)
Prevalence of moderate stunting (<-2 z-score and >=-3 z-score)	(251) 31.6 % (28.3 - 35.2)	(124) 30.3 % (26.2 - 34.7)	(127) 33.0 % (28.2 - 38.2)
Prevalence of severe stunting (<-3 z-score)	(147) 18.5 % (15.6 - 21.8)	(84) 20.5 % (16.3 - 25.5)	(63) 16.4 % (12.9 - 20.6)

Results between brackets are expressed with 95% confidence

Table 13: 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 (mths)	**Total no.**	**No.**	**%**	**No.**	**%**	**No.**	**%**
6-17	179	26	14.5	50	27.9	103	57.5
18-29	187	38	20.3	71	38.0	78	41.7
30-41	201	43	21.4	64	31.8	94	46.8
42-53	171	28	16.4	54	31.6	89	52.0
54-59	56	12	21.4	12	21.4	32	57.1
Total	794	147	18.5	251	31.6	396	49.9

Table 14: Mean z-scores, Design Effects and excluded subjects

Indicator	n	Mean z-scores ± SD	Design Effect (z-score < -2)	z-scores not available*	z-scores out of range
Weight-for-Height	802	-0.62±0.99	1.29	4	2
Weight-for-Age	800	-1.51±1.03	1.59	4	4
Height-for-Age	794	-1.97±1.15	1.69	0	14

* contains for WHZ and WAZ the children with edema.

4.1.3. Measles immunization and vitamin A coverage

The data on measles immunization and vitamin A coverage were assessed based on verification of immunization card and caretakers' confirmation. The measles immunization coverage was quite satisfactory where close to 72% of eligible children were immunized which was confirmed by verification of immunization cards and a further 23.7% based on caretakers' verbal confirmation. In terms of vitamin A coverage, over one half of the children (55%) had received a Vitamin A capsule two or more times in the last one year indicating good coverage.

Table 15: Measles Immunization and Vitamin A Coverage

Measles (Children 9-59 months)	N	%
Not Immunized	36	4.6
Immunized (by Card)	557	71.7
Immunized (Mother's Confirmation)	184	23.7
Total	**777**	**100**
Vitamin A in the last one year (Children 6-59 months)		
Not received	46	5.7
Once	316	39.2
Twice or more	444	55.1
Total	**806**	**100**

4.1.4. Children treated in an OTP/SFP Program

In order to assess access to OTP/SFP services, data on whether a child measured had been treated in an OTP/SFP was collected. The result indicates that only 2.4% of the sample children had participated in OTP or SFP programs.

4.1.5. Breastfeeding and Complementary Feeding Practices

To assess exclusive breastfeeding and timing of complementary food introduction, questions were included for mothers with children under two years old. The responses to the questions "when did you begin breastfeeding the child after birth?" and “at what age in months did your child start receiving food other than breast milk?” are presented in Table 9. A high proportion of the respondents (68%) reported "Immediately after birth" , followed by “Within a day but more than an hour” accounting to 29%. The result for the introduction of complementary food indicates that a considerable proportion (38%) of mothers introduced food before four months of age and 45.5% within 4-6 months. Only about 16% of mothers introduced complementary feeding after six months.
This data shows, in general, good practices for initiation of breastfeeding (though could use strengthening), but inadequate exclusive breastfeeding and weaning practices.

Table 16: Initiation of breastfeeding and introduction of complementary food (mothers with child <2 Years)

Initiation of Breastfeeding	N*	%
Immediately (within 1 hour)	253	68.0
More than 1 hour/within a day	109	29.3
More than a day	10	2.7
Total	**372**	**100.0**
Introduction of Complementary Feeding		
Less than 4 months	139	38.1
4-6 months	166	45.5
After 6 months	60	16.4
Total	**365**	**100.0**

*Due to missing data, N is not same for both

4.1.6. Child Morbidity and Treatment Seeking

To assess the morbidity status of children from whom anthropometrics measurements were taken (6-59 months old), caretakers were asked whether their children had any sickness in the two weeks prior to the survey date. About 48% of the children have had some type of sickness in the reference period. Mothers with sick children were further asked on the type of sickness. The result indicates that fever with difficult in breathing was the most prevalent among the assessed children (29.9%). This was followed by fever with chills like malaria (22%) and diarrhea (11.2%).

Table 17: Percentage children 6-59 Months old by type of sickness reported (N=806)

Type of Illness	N	%
Diarrhea	90	11.2
Fever with chills like Malaria	177	22.0
Fever with difficulty in breathing	241	29.9
Others	55	6.8

Disease is an important immediate contributing factor to malnutrition and a chi square test was performed to analyze whether morbidity was associated with malnutrition. The survey result indicates that there was an association between diarrhea and nutritional status of children. Children with diarrhea in the reference period tend to be more malnourished/wasted (p=0.052) than others. However, there was no association at all between malnutrition and chills like malaria or fever with difficult in breathing.

Mothers with sick children were further asked whether they sought any treatment service and 84.8% reported that they had sought assistance. The distribution of respondents by the type of assistance sought is indicated in Table 11. The single most important source of assistance was a public clinic accounting to about 53%. This was as expected as Kitui ranks second nationally in terms availability of health facilities.

Table 18: Mothers with sick children <5 by type of Assistance Sought (N=342)

Assistance Sought from	N	%
Public clinic	181	52.9
Private clinic/ pharmacy	55	16.1
Shop/kiosk	50	14.6
Others	11	3.3

4.2. Mosquito Net Use

The survey result on mosquito nets coverage indicates that the proportion of households with a mosquito net was 79.6%. Households with a mosquito net were further asked to indicate whether any family members slept under the mosquito net the night before the survey date. Of those that owned a net, 66.4% of households used the net to sleep under the night before the survey, although in only 36% of these households did everyone sleep under a net. Households who didn't have a net and those who had, but nobody was using, accounted to 33.6% of the sample households.

Table 19: Distribution of households by use of mosquito nets (N=651)

Response	N	%
Households owning	518	79.6
Households used net the night before the survey	432	66.4
Households with no use of net	129	33.6

To assess if there was a correlation between a child with "fever and chills like malaria" and "absence mosquito net use" in the household, a chi square test was performed. No association between the two variables was detected. This could be due to the fact that the chills like malaria sickness reported might not be true malaria, since no clinical test was performed. In addition, the survey time was dry season when malaria incidence was expected to be low.

4.3. Mortality

The retrospective death rate was calculated based on the data collected using a 90 day recall period. Data were collected from 651 households with or without children under 5 years. The results are summarized in the following table.

Table 20: Mortality Result

Demographic Data	Result
Current resident	4175
Current resident < 5 years old	848 (20.3%)
People who joined the household	170
< 5 years who joined household	15
People who left the household	251
< 5 years who left household	11
Birth	22
Death	1
Death < 5 years old	0
Recall Period (days)	90
CMR (deaths /10,000 people/day)	0.03 [0.00-0.15]
U5MR (deaths in children<5/ 10000 / day)	0 [0.00-0.00]

4.4. Households' Background Characteristics

The household level background demographic related data collected include sex of household head, household size, educational status and major occupation of the household heads. A household was defined as a person or group of persons related or unrelated by blood, residing in the same compound, having one household head and eating from the same pot. According to the sample survey finding, the average household size was 6.4 persons (SD=2.75). The data on household heads disaggregated by gender show that males account for 59% and females 41%.

The high proportion of female headed households is explained by the fact that males migrate to big cities and commercial centers in search of employment, a common practice in the area. The survey result on main occupation indicates that the majority of household heads were engaged in crop farming (43.3%). Daily labor is the second most reported occupation accounting for about 29%. The main occupation by sex of household head reveals quite contrasting results. The majority of males tend to be daily laborers (40.8%) while females tend to be crop farmers (75.9%). This could be due to migration of males in search of employment elsewhere leaving their spouses behind (see Table 2).

Table 21: Main occupation of household heads

	Male		Female		Total	
Main Occupation	N	%	N	%	N	%
Crop farming	80	20.8	202	75.9	282	43.3
Livestock farming	3	0.8	0	0	3	0.5
Small business/petty trade	34	8.8	14	5.3	48	7.4
Salary Employment	78	20.3	9	3.4	87	13.4
Daily Labor	157	40.8	34	12.8	191	29.3
Firewood/charcoal making	31	8.1	7	2.6	38	5.8
Other	2	0.5	0	0	2	0.3
Total	**385**	**100**	**266**	**100**	**651**	**100**

The survey results on the educational status of household heads indicate that a significant proportion of the household heads, 70 per cent, had primary level education. A further look at the data on educational status disaggregated by sex of household heads reveals no noticeable difference between male and female (Table 3).

Table 22: Educational status of household heads

	Male		Female		Total	
Educational status	N	%	N	%	N	%
None	21	5.5	35	13.0	56	8.6
Non formal	18	4.7	9	3.4	27	4.1
Primary Level	256	67.0	197	74.0	453	70.0
Secondary Level	64	17.0	21	7.9	85	13.0
Above Secondary	21	5.5	2	0.8	23	3.5
Other	5	1.3	2	0.8	7	1.1
Total	**385**	**100**	**266**	**100**	**651**	**100**

4.5. Water and Sanitation

4.5.1. Water Source and Use

With the aim of assessing water availability, accessibility, safety and seasonality, households were asked to indicate their main source of water by season and the one-way travel time to fetch water as well as water treatment practices.

In the rainy season majority (55%) access safe water sources, due to the fact that about 47% use household roof catchments. During the dry season, many households (71%) use unsafe water sources, most of which are scooping water out of the dry river beds (47%) as well as some earth pan and river usage (10% and 17%, respectively). This could indicate that households prioritize close water sources over clean ones.

Table 23: Households by Main Source of Drinking Water

Proxy classification	Sources of Water	Dry Season[8]		Rainy Season	
		N	%	N	%
Safe	Piped water system (water kiosk, taps)	5	0.8	5	0.8
Safe	Water trucking to public tank	10	1.5	20	3.1
Safe	Hand pumped well (shallow well or borehole)	77	11.8	0	0
Safe	Motor pumped well (borehole)	24	3.7	22	3.4
Safe	Household roof rain catchments	51	7.8	309	47.8
Safe	Public roof rain catchments (school, health center etc.)	1	0.2	1	0.2
	Summary of safe sources	**168**	**25.8**	**357**	**55.3**
unsafe	Dry River bed (scooping into the sand, temporary)	307	47.2	77	11.9
unsafe	Water seller (ex. Using a cart, or tank, or donkey)	8	1.2	3	0.5
unsafe	Shallow well (with no pump, bucket to take water)	42	6.5	6	0.9
unsafe	Earth pan	65	10	66	10.2
unsafe	River (that is flowing, not dry)	40	6.1	111	17.2
	Summary of unsafe sources	**462**	**71**	**263**	**40.7**
	Others	21	3.2	27	4.2
	Total	**651**	**100**	**647**	**100**

Access to adequate and safe water is an important determinant of nutritional outcome. Accordingly, sample households were required to indicate the daily water consumption at the time of the survey. Taking a household size of 6.4 persons, the average daily water use per person in liters for drinking, cooking and washing at the time of the survey, which was considered dry season, was 11.0 [95% CI: 10.6- 11.4]; this is comparable to other arid areas in Kenya as well as the national standard for "low potential areas" of 10 L/p/d less than the 15

[8] Though the survey was conducted in the dry season rain had just started on the fourth day of the survey and the data on source of water from household roof rain catchment (51 households), which is normally source of water in the rainy season, could have been influenced by the rain.

L/p/d recommended by the SPHERE project.

In terms of one way travel time or distance to water point, about 40% of households travel 15 minutes or less. Close to 60% travel 15 minutes or more, specifically 26.7% walk for over an hour (the SPHERE standard for distance is 15 minutes or less/less than 500 meters). The response to the waiting time at water points at the time of the survey indicates that about 46% waited for 15 minutes and 30% over an hour (Table 15). In the dry season households had to wait longer due to poor recharging capacity of dry season water sources mainly river beds and wells.

Table 24: Households survey results by one way distance to and queuing time at water source

One way Distance	N	%
It takes 15 minutes or less to walk there (less than 500m)	262	40.2
It takes between 15 minutes and 1 hour (more than 500m – 2 km)	215	33.0
It takes more than one hour (more than 2 km)	174	26.7
Total	**651**	**100.0**
Waiting Time		
15 minutes or less	301	46.2
15 to 30 minutes	67	10.3
30 min to 1 hour	83	12.7
More than 1 hour	200	30.7
Total	**651**	**100.0**
Daily Water consumption (Liters/Person)	11.0 (10.6-11.4, 95% CI)	

Safety of water depends on handling at home including treatment practices used at household level. Sample households were required to indicate if any water treatment practices were employed. About 61% reported practicing some type of water treatment with the bulk of the households reporting boiling and chlorination while the remaining about 39% practicing no water treatment. Compared to similar areas of Kenya, this is a relatively high reported use of water treatment and could be influenced by a high general awareness at the time of the survey due to a localized cholera outbreak in the district (but not the sampled villages).

Treatment of water is necessary for reducing the prevalence of water borne diseases such as diarrhea. Though the proportion of households using boiling or chlorination before drinking water was high, still a considerable proportion of households (39%) didn't practice any water treatment.

Table 25: Water Treatment Practice

Response	N	%
Nothing	253	38.9
Boiling	239	36.7
Chlorination	190	29.2
Other	20	3.1

Note: Multiple responses being possible, percentages don't add up to 100

Considering the fact that a considerable proportion of households accessing water from unsafe sources a Chi Square test was performed if diarrhea prevalence with children 6-59 months old was associated to the water sources (safe versus unsafe) or treatment practices employed (those who practiced versus those who didn't) at household level. However, no significant association was detected between diarrhea and sources of water or water treatment practices employed.

4.5.2. Hand washing practices

In order to assess households' hygiene practices, the survey also looked at hand washing practices before and after events. Hand washing before eating and after toilet use were the two most reported events, respectively by 92.6% and 85.1% of households, showing very good knowledge of when to wash hands. When asked about use of soap 51.7% of caretakers reported using soap for hand washing. In order to assess if there was risk of diarrhea for children from households using soap for hand washing versus households who don't use soap a Chi Square was conducted and the result indicates significant association ($p < 0.05$). Children from households not using soap were more likely to have diarrhea sickness. Promotion of use of soap as an integral component of hygiene promotion would contribute to improved hygiene and nutritional outcomes.

Table 26: Distribution of households by hand washing practice (%)

Response	N	%
Does not wash hands	95	14.6
Does not wash hands at any special time, when they look dirty.	159	24.4
Before latrine	21	3.2
After toilet / latrines	**554**	**85.1**
Before cooking	353	54.2
Before eating	**603**	**92.6**
Before breastfeeding	142	21.8
After taking children to the toilet	273	41.9
After handling animals	286	43.9
After working in the Shamba/Farm	329	50.5
Others	57	8.7

Note: Multiple responses being possible, percentages don't add up to 100

4.5.3. Latrine use and garbage disposal

Lack of basic sanitary facilities such as latrines and poor garbage management or disposal pose serious threats to health and ultimately contribute to poor nutritional outcomes. Accordingly the survey collected data on the two indicators. Close to three in four households (73.4%) reported that members of their households relieve themselves using a family latrine (either within the homestead or a neighbor's), while 26.1% use open defecation. In terms of garbage disposal, the majority of the households (46.7%) disposed of their household garbage into a farm followed by disposing through burning (35.5%).

Table 27: Households by defecation and garbage disposal (N=651)

Defecation	N	%
In the bushes, open defecation	170	26.1
A family latrine in this compound	469	72
Neighbors latrine	9	1.4
Other	3	0.5
Total	**651**	**100**
Garbage Disposal	**N**	**%**
Give food waste to animals	83	12.7
Put food waste into the Shamba/farm	304	46.7
Put into a pit and bury	172	26.4
Burn it	231	35.5
Nothing, or throw it into nature	143	22.0

Note: Multiple responses for garbage disposal being possible, percentages don't add up to 100

To establish if there was any risk of diarrhea based on type of defection used between children from households with and without latrine analysis was performed. However, latrine use and reported cases of diarrhea showed no association probably due to fewer observed cases of diarrhea.

4.6. Food Security and Livelihoods

The survey areas are normally net importers of food where access mostly determined through purchase from the local markets. According to the KFSSG 2009 Long Rain Assessment, successive crop failures in the last two years caused depletion of household assets, further weakening coping capacities and affecting household purchasing power. With the objective of assessing the households food security situation, data were collected on key food security related indicators that contribute to child malnutrition such as crop and livestock production, food sources, dietary diversity, coping strategies, income and expenditure patterns. The results are presented in the following sections.

4.6.1. Crop Production

Crop farming was an important economic activity for over 98% reported in the assessed areas and about 43% of the households identified as the main occupation of the household heads (see Table 2). The major crops planted include maize, beans, sorghum, pigeon peas and cow peas primarily using rain-fed production system. Irrigation is constrained by water scarcity and limited to around the Athi river bank. Poor rain performances in the past few years leading to crop failures and increasing prices of food have deteriorated food security. For instance, despite the fact that over 98% of the sample households reporting that they were engaged in farming, when asked if they had harvested any crop in the last harvesting season the overwhelming majority (76%) reported that they didn't harvest leaving only about 24% harvesting some crop, depicting the extent of crop failure farmers experienced (Table 19).

Table 28: Households Engaged in Crop Production and Mean Production in the last harvesting season (KG)

Crop (N=639)	N	%	Production (Mean KG)
Maize	122	19.1	237.5
Beans	60	9.4	66.8
Pigeon pea	26	4.1	51.5
Cow peas	67	10.6	39.2
Green gram	34	5.5	45.8
Sorghum	17	2.7	52.4
Millet	1	0.3	90.0

Mean is calculated from N for the respective crops

4.6.2. Livestock Holding

Livestock keeping is important economic activity and has vital role in the livelihoods of the population as a source of food, draft power and much needed cash income. In order to assess the ownership structure, sample households were asked to indicate the type and number of animals owned at the time of the survey. Table 20 indicates the proportion of households owning and average ownership per household for the different types of livestock. The data indicate that most households own goats, poultry and donkeys, respectively by 71.7, 64.5 and 46.4% of the households. The fact that goats and poultry were kept by most households indicates the importance households attach to these two small animals as sources of cash income. Donkeys play important role as draft power as well as transport of goods especially water.

Overall livestock ownership was low for households. The maximum holding per household reported was for goats (35) and poultry (30). The mean livestock holding per household and the standard deviations (S.D) are indicated in the following Table.

Table 29: Households Owning Livestock and Mean Livestock Ownership (N=651)

Livestock	N	%	Mean (S.D)
Cattle	231	35.5	0.9 (1.6)
Goats	467	71.7	4.8 (5.6)
Sheep	52	8.0	0.3 (1.4)
Poultry	420	64.5	3.4 (4.4)
Donkeys	302	46.4	0.6 (0.8)

Note: Multiple responses, percentages don't add up to 100

In order to understand the milk production at household level, sample households were required to indicate if they had milked any animal the day before the interview and the amount of milk produced. The result indicates that only 22% of the households reported producing milk and the average production per household was a bare minimum of 0.12 liters. Households with children under five years who were not breastfed at the time of the survey were asked if the child was provided with milk in the 24 hours before the survey. About 85% of the children weren't provided any milk. Consumption of milk, as reported in the household dietary diversity, also confirms this where only about 28% had consumed milk or milk products,

possibly complemented through purchase from the local market. The low production of milk, when taken within the context of limited households purchasing capacity, illustrates why milk consumption was limited.

4.6.3. Sources of Food

Sample households were required to identify, among the four common food sources that include purchase, production, food aid and gift, which sources of food were used in the last 30 day before the survey and if used to rank them from first important to fourth (least) important, based on the importance to individual households. The common sources of food in the 30 days before the survey measured by the proportion of households using as a source of food, regardless of the ranking, were purchase, food aid, gift and own production, respectively used by 99 , 87, 73 & 60% of the households. Purchase from the market was identified as source of food by most households and at the same time ranked as the first important source by most households (65.7%) who identified it as sources of food in the reference period. Food aid, though used as source of food by quite significant proportion of households (87%), few households (17.9%) ranked it as first important. The reason is because there were no food aid distribution the month before the assessment and most of the households were purchasing food from the market. It should be noted that in the area a good number of the population are engaged in voucher for asset activities. The voucher is exchanged in the vendor or traders and assumed by household as purchasing.

The poor rains which led to crop failure in the past recessive seasons have made households to depend on food aid. At the time of the survey about 40% of the Larger Kitui District population was food aid recipient. It is alarming indicator that compared to other sources the proportion of households identified own production as a source of food was the least, a sign of increasing dependence on food aid or purchase. With increasing prices of food, dependence on market could adversely affect households' ability to access adequate food.

Table 30: Proportion of Households by Ranking of Food Sources (N=651)

Source of Food	N	Ranking (%)			
		1st	2nd	3rd	4th
Purchase	647	65.7	31.8	2.3	0.2
Production	389	34.2	1.3	8.2	56.3
Food Aid	565	17.9	45.5	16.1	20.5
Gift	474	2.7	20.9	60.5	15.8

4.6.4. Dietary Diversity

The survey looked at diet diversity using the 12 food groups and 24 hour recall period and the results by type and number of food groups consumed are summarized in Table 22. The single most important food group consumed by most households (over 97%) was cereals, and followed by vegetables (65.7%), pulses & nuts (63.7%) and fat/oil (61.3%). The consumption of fish was non-existent while the consumption of fruits, eggs or meat was extremely limited. The average number of food groups consumed based on the 12 food groups and 24 hour recall period was 4.4 with 41% of the households consuming three or less food groups.

Table 31: Households by Type and Number of Food Groups Consumed

Type of Food Groups	N	%	# Food Groups	N	%
Cereals	633	97.2	One Food Group	37	5.7
Roots or tubers	102	15.7	Two Food Groups	86	13.2
Any vegetables	428	65.7	Three Food Groups	144	22.1
Fruits	25	3.8	Four Food Groups	78	12.0
Eggs	22	3.4	Five Food Groups	100	15.4
Meat	68	10.4	Six Food Groups	94	14.4
Fish	0	0	Seven Food Groups	62	9.5
Beans, peas, lentils, or nuts	415	63.7	Eight Food Groups	34	5.2
Milk or milk product	184	28.3	Nine Food Groups	14	2.2
Fat or oil	399	61.3	Ten Food Groups	2	0.3
Sugar or honey	302	46.4	Eleven Food Groups	0	0
Other condiments (e.g.coffee, tea)	291	44.7	Twelve Food Groups	0	0
Total	**-**	**-**	**Total**	**651**	**100.0**
Mean HDDS	**4.4**				

Note: Multiple responses, percentages don't add up to 100

In order to assess the risk of malnutrition based on dietary diversity chi square test was performed between those children from households who consumed three or less food groups versus those who consumed above three food groups but no risk of malnutrition was detected for children from households consuming three or less food groups.

4.6.5. Coping Strategies

The sample households were asked if any coping strategies among the list indicated in Table 22 if used during the 30 days before the survey date. The households reported using a range of coping strategies amongst which reducing the size of the meals, purchase food on credit/borrow from local vendors/relatives and skipping meals were the common coping strategies used. When asked the frequency of use, most households reported frequently, 3-4 times in a week (Table). The use of coping mechanisms indicates vulnerability of the households to food insecurity.

Table 32: Proportion of Households by use of coping strategies during 30 day before the survey

Coping Strategy	Never used	Rarely (1-4/month)	Frequent (3-4/ week)	Always (≥5/week)	Total
Skip meals (excluding Ramadan if Muslim)	37	16	36.7	10.3	**100**
Reduce the size of meals	14.9	28.3	41.5	15.4	**100**
Eat less preferred foods (e.g. foods not normally eaten, wild foods etc.)	47.3	12.4	20.9	19.4	**100**
Purchase food on credit/borrow from local vendors/relatives	16.4	15.5	51.2	16.9	**100**
Withdrawing children from school	85.6	6.8	5.1	2.6	**100**
Sell off productive assets (breeding livestock, ox, farming tools, household assets etc.)	74.2	16.4	6.8	2.6	**100**
Engaged in charcoal making, fire wood, etc.	76.5	8.1	8.6	6.8	**100**
Other	99.8	0.2	0	0	**100**

4.6.6. Income and Expenditure

During the survey, respondents were required to indicate the income and expenditure sources and amount earned/expended in the last 30 days preceding the survey date. Income and expenditure data are unreliable due to the common reporting problem. The data presented have to be treated cautiously and provide only an estimate and the relative importance of the different sources. In order to give a better picture, the data were analyzed and presented in terms of proportion of households reporting the different sources, average income and expenditure during the reference period (30 days) and the relative importance of the different sources to the overall household income and expenditure. Since the reference period was limited to the 30 days proceeding the survey date, seasonal fluctuations weren't captured. To arrive at a more reliable income and expenditure data all sources and seasonality have to be taken in to account which was beyond the objective of this survey.

Income Sources

The major income source for the majority of households was daily labor, a source to about 63% of the households. Remittances, sale of bush products (charcoal & firewood), loan/credit and sale of livestock and livestock products were income sources for 29, 28.3, 26.1 and 24% of households, respectively. Considering widespread charcoal production and sale in the areas, the true proportion of households reporting income from this source believed to be much higher, since the activity was considered illegal. It should be noted that some NGOs are supporting the inhabitants through cash for work, so as to do some agricultural work in their farm like terracing.

The household mean income for the reference period was KSH 6,115 [95%CI: 5,488-7,461] and median income of KSH 4,000. Since high income reported by few households earning from salary employment skewed average income, analysis excluding the households with salary income results to a mean income less by about KSH 1,000, KSH 5,039 [95%CI: 4,517-5,561]

which better reflects the income of surveyed communities. The income data disaggregated by gender of household head reveals quite a disparity between female and male household heads. The mean monthly income for male heads was KSH 7,206 [95% CI: 6,227- 8,184] and for females KSH 4,535 [3,992-5,077], significant difference. This could be explained partly by the main occupation of the households (Table 2) where male heads tend to be more salary employed (better paid relative to others) or daily laborers while female heads tend to be crop farmers (high risk crop failure and reduced income).

Taking an average household size of 6.4 persons the monthly per capita income for the reference period was only KSH 955 or KSH 787 when households earning from salary were excluded. However, real income is expected to be higher than the reported level as the households were rural due to seasonal fluctuations.

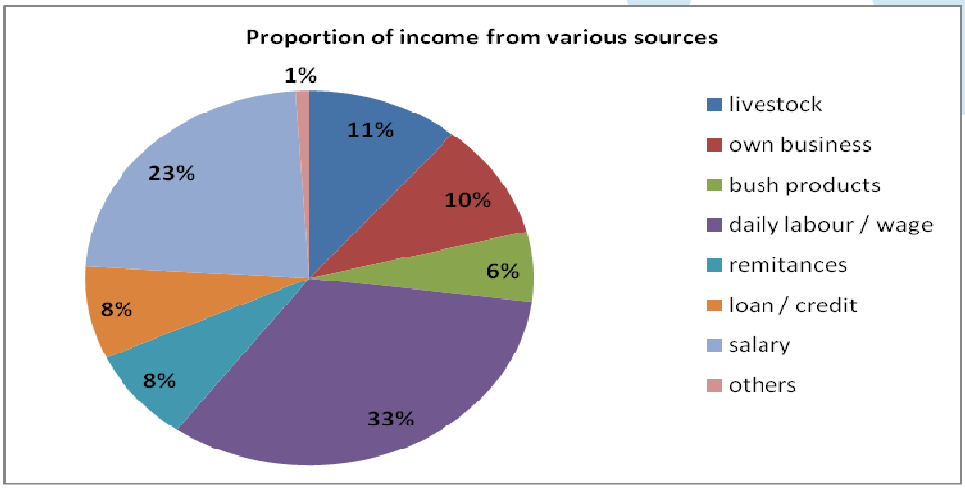
Table 33: Average Household Income from different sources (last 30 Days) KSH

Income Source	N	%	Mean (KSH)
Livestock and livestock products sale (including milk & honey)	156	24.0	2916
Earning from own business (petty/small scale trading)	101	15.5	3815
Sale of bush products (charcoal, firewood, etc.)	184	28.3	1359
Daily labor/wage	412	63.3	3141
Remittances from family/relatives	189	29.0	1582
Loans /credit	170	26.1	1897
Salary	111	17.1	8264
Others	21	3.2	2718
All	**651**	**100**	**6,115**

Note: Multiple responses, N doesn't add up to the totals

The relative importance of the different income sources measured by the volume of income reported was highest for daily labor accounting to 33% of the total income reported. Salary and own business, respectively, accounted to 23 and 10% of the total income (Figure 3).

Figure 5: Proportion of income from different sources



Expenditures

The most frequently reported line of expenditure for the 30 days period prior to the survey was food, cited by 98.3% of the households, which covers 65% of the total household expenditure. School fees and medical expenses were the second most frequently reported lines of expenditure, covering 13% and 3% of the household expenditure value. It should be noted that while farm inputs and debt repayment were cited less frequently, they consume a relatively high percentage of total average expenditure, 7% and 4% respectively.

The mean monthly expenditure per household was KSH 4,537 [95% CI: 4,185-4,888]. Comparing the mean monthly income with the mean monthly expenditure, it appears that there was a net income in excess of expenditure. However, since the data on income and expenditure covered the 30 days prior to the survey, the surplus could be, among other factors, the result of seasonal fluctuations in income and expenditure.

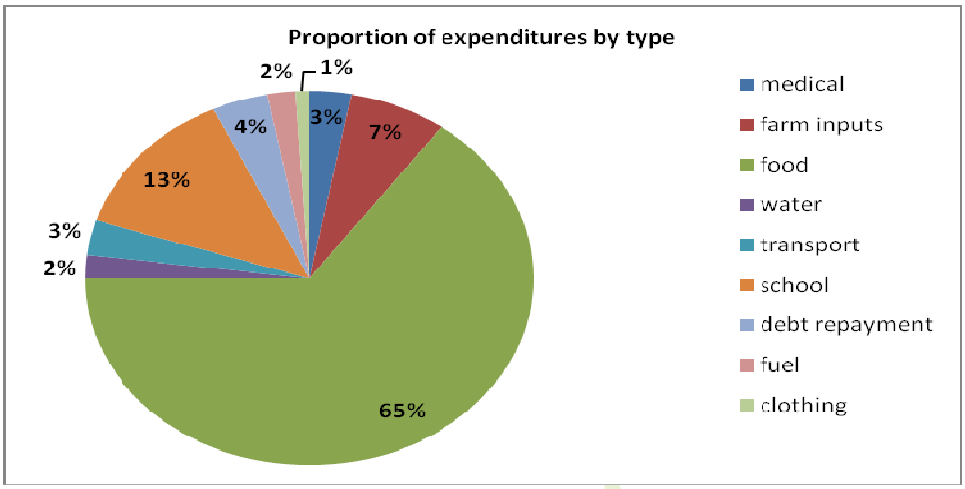
Table 34: Average monthly household expenditure the last 30 days (KSH)

Expenditure	N	% HH citing (frequency)	Mean (KSH)
Medical and health (service fees, medicine, etc.)	347	53.3	157
Farm inputs (seeds, fertilizers, livestock medication, etc)	215	33	308
Food	640	98.3	2936
Water	123	18.9	99
Transportation	172	26.4	113
School (fees, books, uniform, etc.)	372	57.1	572
Debt repayments	148	22.7	200
Fuel	280	43	99
Clothing	48	7.4	50
Others	3	0.5	0
Total	**651**	**-**	**4,537**

Note: Multiple responses, N doesn't add up to the totals

Breakdown by types of expenditure reveals that food expenditure accounted to 65%, followed by school fees (13%).

Figure 6: Proportion of expenditures by type



5. CONCLUSION AND RECOMMENDATIONS

The nutritional assessment provided information on nutritional status specifically on the prevalence of acute malnutrition and on the immediate underlying contributing factors to acute malnutrition. With WHO Growth Standards 2005, the GAM rate was 8.9% [CI 95%: 7.0-10.9]. Although this rate is below the 15% WHO emergency threshold, the prevalence remains between poor and serious, requiring adequate attention. The situation requires a look into the prevention, identification, referral and treatment of acutely malnourished children in order to ensure that the nutrition situation in the district be addressed in an adequate manner. Interventions in child feeding and weaning practices, WASH and diversification of livelihood options should be an integral component of addressing the problem on the long-term basis. Following are recommendations based on the survey findings.

Health and Nutrition

- Access to prevention, detection, referral and treatment of acute malnutrition should be effective throughout the district for acutely malnourished children at all levels of the health system (communities, health facilities, hospitals, central ministries offices)
- Caretakers should have access to promotion campaigns for infant and young child feeding practices and management of childhood illnesses.
- There was limited diversity in terms of diets taken, the majority consuming cereals. Consumption of fish was nonexistent and fruits and meat was extremely limited. Promotion of nutritional education and more diversified foods contributes to reduce the risk of malnutrition.

Water and Sanitation

- Water is most scarce resource. Household rainwater harvesting is a common, positive practice which should be further promoted.
- Promotion activities and campaigns focusing on improved and simple water treatment practices and on hygienic practices should be accessible to all households.

Food Security/Livelihoods

- Households were dependent on market to access food using income mainly from daily labor and sale of livestock. Expenditure on food accounts a significant proportion of expenditure, about 65%. An increase in the price of cereals will have serious implication on the food security of the population. Supporting income-generating activities in alternative livelihoods like gum and resin, bee keeping and processing of products as a way of diversifying income sources with special focus on female headed households would

be one potential area of intervention. Further detailed analysis is required to identify the specific needs and come up with feasible strategies.

- Crop farming is highly rainfall dependent. On the other hand, rainfall is very unreliable and farmers are prone to risk of crop failures. There is a need to diversify cropping away from solely staple crops such as maize towards more drought tolerant crops. The potential for water harvesting should also be explored in areas where it is feasible.
- Diversify the consumption of vegetables supporting households who have access to the river side to plant vegetables. Such intervention ensures not only food security but also good nutritional status
- Continue targeted general food distribution in the short-term while promoting mid and long term alternative livelihood strategies to reduce dependency on food aid with focus on innovative and appropriate social safety net programs, supporting the most vulnerable to exit the cycle of seasonal hunger and malnutrition.

Annex I: Assignment of Clusters

GU	PS	Cluster	G.U.	PS	Cluster	G.U.	PS	Cluster
Kivulu	624	1	Kyasioni	286		Makuuni	176	
Kutha Proper	637	2	Kaluni	284		Iuulya Muu	213	
Kuthan Nzau	420		Kaumoni	176		Kaliku	220	
Kakuswi	545		Ngomano	131		Kasolelo	168	
Kangii	429	3	Kitune	194		Kangungi	305	
Ndovoini	519	4	Naolo	250		Kaanzoni	225	
Kahidndangongo	493		Mangelu	252		Muthula	142	
Nyuani	833		Kwa-Ndoi	232		Musuu	195	
Ilani	459		Katheka	190		Mathinga B	175	
Kyuthini	774		Kaumbulu	199		Mathata	296	
Mhambani	473		Kwa-Nguu	194		Kasue	299	
Sokoni	401		Makutano	191		Katakani	276	
Kukuni	585	5	Kathiani	202	8	Kivumbuni	252	
Mangelu	418		Muniyiiki	170		Mathoka	181	
Kitundumo	551		Kambui	159		Kwa Kimwele	321	11
Nginyai	505		Makngo	164		Kavete	228	
Kivanga	407		Kwa-Nethia	154		Wayani	231	
Misyini	494		Kiseveni	252		Pawani	342	
Kakeani	666		Miwongoni	250		Isamalu	568	
Kwa-nyingi	125	6	Kashangathini	260	9	Nguuni	229	
KitoteB	174		Kwa-kyondo	262		Uiini	567	12
Kasue B	184		Kiukuni	200		Kawaluini	229	
Kasue A	132		Kwa-ngnzu	240		Malatani	468	
Ngunga Synthi	212		Mathunzini	241		Kavilani	213	
Nzemeli	200		Syonghra	250		Kakunuku	228	
Katitika	213		Katiani	220		Nidithini	224	RC
Katelekeni	238		Kalinati A	200		Kallyongo	220	
Mavalini A	163		Kalinati B	220		Itungu	322	13
Mavalini B	158		Mututa	244		Kamuluni	495	
Nzewani	136		Masimbaka	225	10	Kwa Ngindu	520	
Ithekethe	285		Ithuka	215		Kisesini	597	
Kiteeti	195		Kalinai	242		Nzalamilo	572	14
Kamukuyuni	439	7	Mutomo	230		Ngingni	425	
Kwa Kitulu	219		Mathinga	230		Baraka	485	
Kitulu	248		Yangani	200		Kwa Mbali	872	
Kalla	226		Mulakitete	227		Kassala	328	
Kitote A	259		Kivani A	268		Memboo	567	15
Kyani	281		Kivani B	227		Kiluya	591	16
Kiaveti	276		Kikunguu	101		Kivuti	562	
Kalimba	200		Kavoo	183		Mandinoi	423	
Kyondoniiukuni	137		Muthi	113		Kyambusya	338	
Kiukuni	188		Muimi	227		Tiva	241	17
Kiluiya	224		Komu	290		Makali	343	
Kavuata	234		Kangeli	277		Katokolo	611	

GU	PS	Cluster	G.U.	PS	Cluster	G.U.	PS	Cluster
Ngwate	594		Thome	156		Muana Umwe	166	
Makili	473		Kyasio	212		Kaangna	150	
Ndulikye	384		Kakumi	228		Lolo	143	
Imiwa center	221		Kyome	309		Musingsuni	223	
Ngani yani	227		Ngomeni	295		Kibwea	214	
Kivwauni	213	18	Kaluasi	294		Kisayani	213	
Kisou	567	19	Kawelu	158		Kivuti	238	
Kilambaasye	321		Uweni	168		Kyambusya	197	
Syangwa	410		Kyesuni	142		Kaiyu A	194	
Syamatani	408		Syoumbniheke	168		Kaliani	248	
Ukaatuni	235		Kyelengona	199		Matulani	240	
Ndili	556		Yamutava	307		Kaiyu B	210	
Ilaani	706		Ndianitu	192		Muamba	223	
Kasula	371	20	Matulani	163		Kiviu	207	
Imale	410		Kalimbani	176		Syomithumo	245	
Matikoni	310		Katitika	205		Nugethi	239	
Ngaw'uni	534	21	Muvonde	205		Maluma	299	
Nasoma	391		Miambani	216		Uae	235	
Wiitu	452		Imale	299		Kasundi	230	
Tiani	478		Imuu	207		Nguluuni	233	
Ndandi	239		Kilisa	257		Kaita	224	
Mwimbi	397	22	Ndovoini	266		Kaleani	304	
Muuna	387		Kyanika	213		Mwangeni	200	
Nzeveni	523		Kyambui	257		Kyanguli	258	
Kwe kala	327	23, 24	Kavate	245		Nzouni	205	
Tiva	122		Malili	274		Yongela	303	
Kwa Mbuu	528		Kiange	136		Kiseuni	195	
Nigitini	365		Maiyuni	293	26	Mwanyani	233	
Mutuni	346		Kavyuvaa	285		Kanzokea	245	
Ndukuma	331		Yakyuma	265		Maimu	255	
Yanzati	263		Kandwale	246		Katiliku	283	
Mululu	430		Yanna	293		Kamunyuni	245	
Kiangu	521	25	Ndui	213		Kyetumo	219	
Yaana	453		Ilili	138		Syomutanga	204	
Kyakavi	336		Kyongoni	261	27	Ngiluni	201	
Livila	350		Kithae	228		Ikuku	193	
Wiitu	403		Winduku	209		Kamangalu	201	
Kyuasisni	133		Ilika	176		Katukaa	231	
Kengesa	243		Muthungitho	157		Kavuuni	309	
Yumbu	436		Kangma A	196		Twone Mbee	302	
Yaua	462		Kangma B	282		Ngiluni	178	
Kathini	300		Kyambiti	206		Kathungu	306	
Ngasani	255		Kyandula	299	28	Kyambusya	208	
Natikoni	130		Imuwange	198		Tutaane	247	

GU	PS	Cluster	G.U.	PS	Cluster	G.U.	PS	Cluster
Kithini	209		Mweletu	186		Kivwauni	189	
Power	242		Yumbo	197		Mukooni	189	
Mungaluni	207		Kyeni	168		Kaukuni	237	
Ikuki	307		Kayangombe	188		Kisongeni	159	
Kitoo	335		Kyangombe B	168		Kaseve	171	RC
Kimwelwa A	154		Syomuthungu	264		Mukelenzuni	183	
Kimwelwa B	154	29	Kauwandei	184		Kitandaa	178	
Kakunio A	152	30	Mutini	211		Kamumbu	230	
Kakunio B	153		Mathilini A	180		Kanyunyi	195	
Mutyane A	233		Mathilini B	187		Imale	215	
Mutyane B	130		Museeni	207		Kyuluni	202	37
Ndulini A	174		Kasyelia	223		Muvyani	208	
Ndulini B	200		Katooni	177		Muvitha	162	
Muvuko Original	305		Kanzoa	154		Kamboo	224	
Muvuko Centre	282		Ndunguni	288		Nthongoni A	220	
Tuisya	300		Kambiti	199		Nthongoni B	210	RC
Kitambaa A	280		Imuvia	225	33	Kituini	135	
Kitambaa B	203		Computor	167		Matulani	165	
Mathembe	259	31	Nzalani	239		Yaituni	170	
Nduni	226		Nduundune	194		Mulukya	110	
Kyuthani A	123		Imuvia B	212		Kanguu	91	
Kyuthani B	123		Ndaisi	140		kyamuungi	312	38, 39
Maliembwa	137		Kata	180		Kyambuna	97	
Syunguni B	210		Ikivango	231		Umu	151	
Kanzi	202		Ikivuthi	175		Kawongo	129	
Muvuyuni A	200		Kandae	202		Nthilani	169	
Muvuyuni B	192	32	Makngoni	130		Itomya	196	
Vonde	284		Ngilungu	172	34	Kithangathini	180	
Muungano	212		Ngomano	208		Nzevea	246	
Kasyelia	108		Matheveve	190		Nzevemasaani	126	
Kenze A	187		Utui Wa	130		Nzeveiviani	249	
Kenze B	135		Mbene	138		Nzeve West	203	
Kathema	237		Veta Kimena	140		Kamanyi A	329	
Mbelenzu	226		Kivanga	132		Kamanyi B	290	
Mwanianguli	204		Waemwa	137		Kamanyi	341	
Muumba	196		Mateso	130		Ngamu	121	
Syanduini	220		Musosia	180		Tiva	180	
Imuuku	205		Itumbini	163		Kawongo	177	
Mutini	181		Kavuku	219	35	Ndumbuni	168	
Syomukuu	189		Kingatani	216		Ikunyi B	160	
Kilingile	226		Kimuuni	197		Ikunyi A	212	40
Syonyaa	169		Miangeni	251	36	Ndumukini	215	
Mathendu	201		Kyemulea	154		Nthamboni	153	
Mwele tu	174		Kathemboni	216		Kiunguni	167	

GU	PS	Cluster	G.U.	PS	Cluster	G.U.	PS	Cluster
Kyosini	458		Ngakaani	390		Ndokeani	221	
Nunga	444		Ndumukini	350		Kanyoleni	196	
Menzoka	304		Nguuni	246		Kavonge	864	49
Kaseve	340		Tiva	240		Itithini	423	
Kanthenge	450		Kiseuni A	162		Mandongoi	721	
Waivumbu	250		Kiseuni B	180	43	Itooma A	444	
Nguu nziu	243		Winguli	198		Masimba A	297	
Munyiiki	440		Makondo	108		Malatani	270	
Nguuni	233		Kaondu	240		Itulu	263	
Kakusini	364		Kangala	288	RC	Likoni	370	
Kathamani	373		Matu	186		Kisayani A	404	
Muselele	300		Ndivuni	204		Muliluni	278	
Ndunguni	546		Ukaakaani	114		Masimba B	425	
Muambani	564	41	Kyoani	180		Makukani	212	
Mawungu	492		Kithiani	180		Kinyau	230	
Ndatani	540		Kivila	144		Ndovoini	254	50
Kyaithani	468	42	Kavate	204		Ikongo	157	
Ndandini	384		Syomakanda	417		Kithuni	361	
Kiunduani	396	RC	Mbetwaani	489		Katitika	185	
Kang'ulya	462		Kateiko A	408	44	Nzambia	179	
Miangeni	480		Kinyaau	140		Athi	209	
Kangundo	234		Kateiko B	418		Usai	232	
Konza	285		Mukameni	526		Yamunyu	288	
Kalawa	255		Ithangathi	464		Musoloni	564	
Malimboni	233		Kitungulu A	624		Kangaatu	284	
Kalima	347		Mandalwa	266		Malimbani A	329	
Mandu	534		Mwaani	517		Kiundwani	340	
Utumoni	402		Kithyambyu	361		Ndithini	482	
Kalivini	320		Kitungulu B	650		Thusi	284	
Masaini	354		Kilisa	272		Yienge	288	
Mukambu	372		Kimwele	456	45	Muambani	249	
Kiukuni	250		Itulani	760	46	Kilumya	283	
Ngulilu	455		Nzuki Imwe	519		Makusu	317	
Ngungani	430		Ngomoni	396	47	Malimbani B	285	
Ngovu	385		Kyungamisyo B	521		Miangeni	377	
Mamole	475		Kyatune	288		New Mwaani	268	
Syomisulu	490		Kyambiti	393		Uvaini	335	
Nthilani	440		Kalawa	386				
Kwakilya	360		Kavumbuni	309				
Nthunthini	340		Kitooni	319				
MamoleMwaani	370		Itooma B	248				
Kwa Kilui	400		Kavoo	449	48			
Kinakoni	217							
Mukelenzuni	380							

Annex II: Anthropometric Survey Data Form

1. Identification		Data Collector_____			Team Leader_____	
1.1 Larger District	1.2 Division	1.3 Location	1.4 Sub-location	1.5 Cluster No	1.6 Team Number	1.7 Date

Child no.	HH no.	Sex (F/M)	Age in Months	Weight ##.# kg	Height ###.# cm	Weigh-for-height %	Oedema (Y/N)	MUAC ##.# cm	Measles Vaccination 0= Not immunized 1= Card 2= Mothers verification	In the last one year how many times received Vitamin A	Child in any Nutrition center? 0= No 1= OTP 2= SFP	In the past two weeks did the child suffer from any sickness? 0=No 1= Yes	If yes, which sicknesses			
													Diarrhea 0= No 1= Yes	Fever with chills like malaria 0= No 1= Yes	Fever, cough, difficult breathing 0= No 1= Yes	Other (specify) 0= No 1= Yes
1																
2																
3																
4																
5																
6																
7																
8																
9																
10																
11																
12																
13																
14																
15																

Minimum number of children (6-59 months) required per cluster: 13 children

Annex III: Local Event Calendar

MONTH	SEASONS	MAIN ACTIVITIES	2004	2005	2006	2007	2008	2009
JANUARY (Mwai wa Mbee)	NGETHA (HARVEST)	Eat greens from shambas, harvest mangoes. Schools open.		57	45	33 Somali-Kenya border closes	21 Post election Skirmishes	10
FEBRUARY (Mwai wa Keli)		Preparation for harvesting.		56	44	32	20	9
MARCH (Mwai wa Katatu)		Peak harvesting exercise. Preparation of farm lands for short rains.		55	43 AFLOTOXIN (MBEMBA MBUUNDU)	31	19 Grand Coalition	8
APRIL (Mwai wa Kana)	MBUA YA W'UUA (SHORT RAINS)	Planting of farms in short rains. Schools close, most wedding take place, Pass-over ceremony		54 Pass-over (Sikuku ya Kwambwa ka Yesu)	42 Pass-over (Sikuku ya Kwambwa ka Yesu)	30 End of drought, Pass-over (Sikuku ya Kwambwa ka Yesu)	18 Cholera outbreak Dadaab refugee camps, Pass-over (Sikuku ya Kwambwa ka Yesu)	7 Pass-over (Sikuku ya Kwambwa ka Yesu)
MAY (Mwai wa Katano)		Schools open, weeding for cowpeas		53	41	29	17	6 KATULU (FOOD FOR WORK)
JUNE (Mwai wa Thanthatu	NGETHA (HARVEST)	Harvesing cowpeas		52	40	28	16	5
JULY (Mwai wa Muonza)	NGETHA YA NZUU (HARVEST COW-PEAS)MBEVO(COLD SEASON)			51	39	27 RIFTVALLEY FEVER	15	4
AUGUST (Mwai wa Nyanya)		Circumcisions take place, schools closs, tuitions, more wedding ceremonies take lace		50	38	26	14 Ramathan	3

MONTH	SEASONS	MAIN ACTIVITIES	2004	2005	2006	2007	2008	2009
SEPTEMBER (Mwai wa Keenda)	**KUTUUTA (CLEARING SHAMBAS)**	Preparation of farm lands.Dry season stars, Schools open		**49**	**37**	**25** Ramathan	**13** Idd Fitr	**2**
OCTOBER (Mwai wa Ikumi)	**PLANTING AND LONGRAINS START**	Planting of maize and tomatoes. National examinations KCSE takes place, Rains start		**48** Ramathan	**36** Ramathan	**24** Idd Fitr Start of Heavy rains	**12**	**1**
NOVEMBER (Mwai wa Ikumi na Umwe)	**MBUA YA NZWA (LONG RAINS)**	Harvesting mangoes. Weeding, National Exams KCPE, Christmas ceremony	**59**	**47 REFEREDUM (KULA SYA YIIU NA ISUNGWA)**	**35** Idd Fitr and Referendum	**23** Flooding	**11**	
DECEMBER (Mwai wa Ikumi na Ili)			**58**	**46**	**34** Start of severe drought	**22** General elections in Kenya	**10 Rift Valley Tribal Clashes**	

Annex IV: Household Mortality Questionnaire

Household Mortality Questionnaire (one sheet/household)

Division:_____Location:_____ Sub-location: _____

Cluster number:_____

HH number:_____Date:_____Team number:_____

	1	2	3	4	5	6	7
ID	HH member	Present now	Present at beginning of recall (include those not present now and indicate which members were not present at the start of the recall period)	Sex	Date of birth/or age in years	Born during recall period?	Died during the recall period
1							
2							
3							
4							
5							
6							
7							
8							
9							
10							
11							
12							
13							
14							
15							
16							
17							
18							
19							
20							

Tally (these data are entered into Nutrisurvey for each household):

Current HH members – total		Y in Col 2
Current HH members - < 5		Age < 5 in Col 5 AND Y in Col 2
Current HH members who arrived during recall (exclude births)		X in Col 3
Current HH members who arrived during recall - <5		Age <5 in Col 5 AND X in Col 3
Past HH members who left during recall (exclude deaths)		X in Col 2
Past HH members who left during recall - < 5		Age <5 in Col 5 AND X in Col 2
Births during recall		Birth in Col 3 and 6
Total deaths		Deaths in Col 2 and 7
Deaths < 5		

Annex V: WASH and Food Security Questionnaire

1. Identification	**Data Collector**_____			**Team Leader**_____			
1.1 Larger District	1.2 Division	1.3 Location	1.4 Sub-location	1.5 Cluster No	1.6 HH No	1.7 Team Number	1.8 Date

2. Household Structure	
2.1	Sex of household head 1. Male |____| 2. Female
2.2	What is the main occupation of the household head 1. Crop farming 2. Livestock farming |____| 3. Small business/petty trade 4. Salary Employment 5. Daily Labor 6. Firewood/charcoal making 7. Other (Specify _____
2.3	Highest educational status of the household head 1. None |____| 2. Non formal 3. Primary Level 4. Secondary Level 5. Above Secondary 6. Other (Specify)

3. Child Health and Nutrition (Children 0-59 months of age) -the mother/caretaker should be asked for this section	
3.1	Does the household have children 0-59 months old? 0. No (if No, skip to section 4) |____| 1. Yes
3.2	Did any of your children 0-59 months old have had sickness during the past 2 weeks? |____| 1. No (If No, skip to Question # 3.5) 2. Yes
3.3	When the child was sick did you seek assistance? 1. No (If No, skip to question # 3.5) |____| 2. Yes
3.4	If the response to question # 3.3 is yes where did you seek (More than one response possible- **Use 0 if no and 1 if yes**) • Traditional healer |____| • Community health worker |____| • Private clinic/ pharmacy |____| • Shop/kiosk |____| • Public clinic |____| • Mobile clinic |____| • Relative or friend |____| • Local herbs |____| • NGO/FBO |____|
3.5	In the last 24 hours did the child(ren) who is < 5 years and is not breastfeeding receive milk? 0. No |____| 1. Yes

	2. Not applicable
3.6	**Ask Questions 3.6 & 3.7 if there is child <2 years in the household (otherwise skip to section 4).** When did you begin breastfeeding the youngest child after birth? 1. Less than one hour 2. More than one hour but within 24 hours |____| 3. More than one day
3.7	At what age in MONTHS did the youngest child receive food other than breast milk? (Foods includes other milk, water, fruit, juices, artificial drinks, sugar water solutions, porridge, etc.) 1. Less than 4 months |____| 2. Between 4-6 months 3. After 6 months

4. Water, Sanitation and Hygiene (WASH)/- Ask the mother/care taker	
4.1	Where did you fetch the water stored in the household or water used today? 1. Piped water system (water kiosk, taps) 2. Dry River bed (scooping into the sand, temporary) 3. Water seller (ex. Using a cart, or tank, or donkey) |____| 4. Water trucking to public tank 5. Hand pumped well (shallow well or borehole) 6. Motor pumped well (borehole) 7. Shallow well (with no pump, where they use bucket to take water) 8. Earth pan 9. Household roof rain catchments 10. Public roof rain catchments (at school, health center etc.) 11. River (that is flowing, not dry) 12. OTHER, please specify_____
4.2	How long does it take you to walk to where you fetch water (ONE WAY ONLY, GOING)? 1. It takes me 15 minutes or less to walk there (less than 500m) |____| 2. It takes between 15 minutes and 1 hour to walk there (more than 500m – 2 km) 3. It takes more than one hour to walk there (more than 2 km)
4.3	How long do you wait (cueing) at the water point? 1. 15 minutes or less |____| 2. 15 to 30 minutes 3. 30 min to 1 hour 4. More than 1 hour
4.4	Is water available everyday at the water point? 1. YES - there is always water at the source |___| 2. NO – there is only water in the source every 2 days 3. NO – there is only water every 3 days or more
4.5	How many 20 L Jerrycans do you **USE** per day in your household (excluding for animals, only for people)? |____|
4.6	What is (are) done now to the water before household members drink the water **NOW**? (MULTIPLE RESPONSES POSSIBLE- **Use 0 if no and 1 if yes**) • Nothing |____| • Boiling |____| • Alum stone |____| • Chlorination(aqua tabs/PUR/water gaurd) |____| • Sitting to settle |____| • Passing through cloth |____|

	• Other (specify_____)	|____|
4.7	From where do you fetch water for your Household during RAINY season? 1. Piped water system (water kiosk, taps) 2. Dry River bed (scooping into the sand, temporary) 3. Water seller (e.g. Using a cart, or tank, or donkey) 4. Hand pumped well (borehole) 5. Motor pumped well (borehole) 6. Shallow well (well with no pump, where they use bucket to take water) 7. Water trucking to public tank 8. Earth pan 9. Household roof rain catchments 10. Public roof rain catchments (at school, health center etc.) 11. River (that is flowing) 12. Other ,please specify_____	|____|
4.8	When do you wash your hands? (MULTIPLE RESPONSE- **Use 0 if no and 1 if yes**)	|____|
	• Does not wash hands	|____|
	• Does not wash hands at any special time, when they LOOK dirty.	|____|
	• Abolutions (prayers)	|____|
	• Before latrine	|____|
	• After toilet / latrines	|____|
	• Before cooking	|____|
	• Before eating	|____|
	• Before breastfeeding	|____|
	• After taking children to the toilet	|____|
	• After handling animals	|____|
	• After working in the Shamba	
	• OTHER: Specify _____	
4.9	If the mother washes her hands, then probe: What do you use to wash your hands? 1. Only water 2. Soap 3. Soap when I can afford it 4. Ashes	|____|
4.10	Where do members of your household relieve themselves? (probe to get details) 1. In the bushes, open defecation 2. A family latrine in this compound 3. Neighbors latrine 4. Communal / public latrine (not VIP) 5. Communal / public latrine VIP 6. Refused to answer 7. Other, please specify_____	|____|
4.11	What do you do with your waste (garbage)? (MULTIPLE RESPONSE- Use 0 if no and 1 if yes)	
	• Give food waste to animals	|____|
	• Put food waste into the shamba	|____|
	• Put into a bit and bury	|____|
	• Burn it	|____|
	• Nothing, or throw it into nature	|____|
	• Other, specify_____	|____|

4.12	Does this household have a mosquito net? 0. (if No, skip to section 5) No 1. Yes
4.13	If the household owns mosquito net, who slept under the mosquito net last night? (Probe-enter all responses mentioned **Use 0 if no and 1 if yes**) • Children <5 years old |____| • Children ≥5 years |____| • Adult females. |____| • Adult males |____| • Every body |____| • Nobody uses |____|

5. Crop and Livestock Production	
5.1	Is the household engaged in farming? 0. No (if No, skip to Q# to 5.3) |____| 1. Yes
5.2	Type of crops planted in the last main cropping season and production? (ASK in **SACKS** and Convert to **KILOGRAMS** and write in the space in KG) • Maize |_____| • Beans |_____| • Pigeon pea |_____| • Cow peas |_____| • Green gram |_____| • Sorghum |_____| • Millet |_____|
5.3	Does the household currently own livestock? 0. No(if No, skip to section 6) |____| 1. Yes
5.4	If yes, how many? • Cattle |_____| • Goats |_____| • Sheep |_____| • Poultry |_____| • Donkeys |_____| • Camels |_____|
5.5	Did the household milk any animal yesterday? 0 No (skip to section 6) |____| 1. Yes
5.6	If yes total amount milk produced? (ask in cup or bottle and covert it into liters) _____liters

6. Dietary Diversity, Food Sources and Coping Strategies	
6.1	Did the household eat the following yesterday during the day or night? **(place a 1 beside the food if someone consumed it and zero if no one did)** • Any Ugali, pasta, rice, bread, or any food made from maize, |____| sorghum, millet, wheat, or rice |____| • Any potatoes, yams, beets or other foods from roots or tubers |____| • Any vegetables? |____| • Any fruits? |____| • Any eggs? • Any meats (camel, cattle, chicken, poultry/fowl, sheep, lamb, and |____| |____|

	organ meats (heart, liver, kidney, etc)? • Any fish or dried fish? • Any foods made from beans, peas, lentils, or nuts? • Any milk, yogurt, cheese, or other milk product? • Any foods made with oil, fat, ghee, or butter? • Sweets (Any sugar or honey?) • Any other condiments (coffee, *pilipili*, tea)?	|____| |____| |____| |____| |____|
6.2	Rate the importance of each food source to your household food consumption in the last 30 days (Rank from most important to least important, **use codes 1= 1st or most important, 2= 2nd important, 3= 3rd important, 4= 4th or least important**	|____|
	• Own Production • Purchased • In kind borrowing or gift from relatives or church • Food Aid	|____| |____| |____|
6.3	How frequent have you experienced the following in the last 30 days **[Use the codes: 0= Never (never used), 1= Rarely (1-4 times a month), 2= Frequently (3-4 times a week, 3= Always (5 or more times a week)]**	
	• Skip meals (excluding Ramadan if Muslim) • Reduce the size of meals • Eat less preferred foods (e.g. foods not normally eaten, wild foods etc.) • Purchase food on credit/borrow from local vendors/relatives • Withdrawing children from school • Sell off productive assets (breeding livestock, ox, farming tools, household assets etc.) • Engaged in charcoal making, fire wood, etc. • Other (specify)	|____| |____| |____| |____| |____| |____| |____| |____|

7. Income Sources and Expenditure		
7.1	What was the household's income in the last 30 days (amount in KSH)?	
	• Agricultural / Horticulture products sale • Livestock and livestock products sale (including milk & honey) • Earning from own business (petty/small scale trading) • Sale of bush products (charcoal, firewood, etc.) • Daily labour/wage • Remittances from family/relatives • Loans /credit • Salary • Other (Specify)_____	|_____| |_____| |_____| |_____| |_____| |_____| |_____| |_____| |_____|
7.2	What was the household's expenditure in the last 30 days (amount in KSH)?	|_____|
	• Medical and health (service fees, medicine, etc.) • Farm inputs (seeds, fertilizers, livestock medication, etc) • Food • Water • Transportation • School (fees, books, uniform, etc.) • Debt repayments • Fuel • Clothing • Other (specify)_____	|_____| |_____| |_____| |_____| |_____| |_____| |_____| |_____| |_____||

Annex VI: Anthropometrics Data Plausibility Check (WHO)

Plausibility check for: Kitui_October2009.as

Standard/Reference used for z-score calculation: WHO standards 2006
(If it is not mentioned, flagged data is included in the evaluation)

Overall data quality

Criteria	Flags*	Unit	Good	Accept	Poor	Unacceptable	**Score**
Missing/Flagged data	Incl	%	0-2.5	>2.5-5.0	>5.0-10	>10	
(% of in-range subjects)			0	5	10	20	**0** (0.2 %)
Overall Sex ratio	Incl	p	>0.1	>0.05	>0.001	<0.000	
(Significant chi square)			0	2	4	10	**0** (p=0.622)
Overall Age distrib	Incl	p	>0.1	>0.05	>0.001	<0.000	
(Significant chi square)			0	2	4	10	**4** (p=0.007)
Dig pref score - weight	Incl	#	0-5	5-10	10-20	> 20	
			0	2	4	10	**0** (2)
Dig pref score - height	Incl	#	0-5	5-10	10-20	> 20	
			0	2	4	10	**0** (5)
Standard Dev WHZ	Excl	SD	<1.1	<1.15	<1.20	>1.20	
			0	2	6	20	**0** (0.99)
Skewness WHZ	Excl	#	<±1.0	<±2.0	<±3.0	>±3.0	
			0	1	3	5	**0** (-0.01)
Kurtosis WHZ	Excl	#	<±1.0	<±2.0	<±3.0	>±3.0	
			0	1	3	5	**0** (0.04)
Poisson dist WHZ-2	Excl	p	>0.05	>0.01	>0.001	<0.000	
			0	1	3	5	**0** (p=0.110)
Timing	Excl	Not determined yet					
			0	1	3	5	
OVERALL SCORE WHZ =			<5	<10	<15	<25	**4** %

At the moment the overall score of this survey is 4 %, this is good.

There were no duplicate entries detected.

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):

Line=11/ID=11: HAZ (-5.066), Age may be incorrect
Line=33/ID=1: **WHZ (2.435)**, WAZ (1.922), Weight may be incorrect
Line=38/ID=6: HAZ (1.106), Height may be incorrect
Line=48/ID=16: HAZ (-5.058), Age may be incorrect
Line=49/ID=17: HAZ (2.367), Age may be incorrect
Line=100/ID=10: **WHZ (-3.733)**, HAZ (-5.448), WAZ (-5.589)
Line=120/ID=17: WAZ (1.645), Weight may be incorrect
Line=568/ID=3: HAZ (-5.486), Age may be incorrect
Line=584/ID=19: HAZ (1.169), Age may be incorrect
Line=599/ID=1: HAZ (2.505), Height may be incorrect
Line=606/ID=8: HAZ (1.349), Height may be incorrect
Line=611/ID=13: HAZ (2.051), Age may be incorrect
Line=668/ID=15: HAZ (1.687), Age may be incorrect
Line=691/ID=8: HAZ (1.445), Age may be incorrect
Line=698/ID=15: HAZ (5.800), WAZ (2.599), Age may be incorrect
Line=699/ID=16: HAZ (2.590), Height may be incorrect

Percentage of values flagged with SMART flags:WHZ: 0.2 %, HAZ: 1.7 %, WAZ: 0.5 %

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: 0.87 (The value should be around 1.0).

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

Age cat.	mo.	boys	girls	total	ratio boys/girls
6 to 17	12	86/95.4 (0.9)	99/92.1 (1.1)	185/187.5 (1.0)	0.87
18 to 29	12	104/93.0 (1.1)	86/89.8 (1.0)	190/182.8 (1.0)	1.21
30 to 41	12	111/90.1 (1.2)	92/87.0 (1.1)	203/177.2 (1.1)	1.21
42 to 53	12	78/88.7 (0.9)	95/85.7 (1.1)	173/174.3 (1.0)	0.82
54 to 59	6	32/43.9 (0.7)	25/42.4 (0.6)	57/86.2 (0.7)	1.28
6 to 59	54	411/404.0 (1.0)	397/404.0 (1.0)		1.04

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

Overall sex ratio: p = 0.622 (boys and girls equally represented)
Overall age distribution: p = 0.007 (significant difference)
Overall age distribution for boys: p = 0.021 (significant difference)
Overall age distribution for girls: p = 0.059 (as expected)
Overall sex/age distribution: p = 0.000 (significant difference)

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: **2** (0-5 good, 5-10 acceptable, 10-20 poor and > 20 unacceptable)

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: **5** (0-5 good, 5-10 acceptable, 10-20 poor and > 20 unacceptable)

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

.	**no exclusion**	**exclusion from reference mean (EPI Info 6 flags)**	**exclusion from observed mean (SMART flags)**
WHZ			
Standard Deviation SD:	1.00	1.00	0.99

(The SD should be between 0.8 and 1.2)

Prevalence (< -2)
observed:
calculated with current SD:
calculated with a SD of 1:

HAZ

Standard Deviation SD:	1.27	1.27	1.15
(The SD should be between 0.8 and 1.2)			
Prevalence (< -2)			
observed:	49.8%	49.8%	50.1%
calculated with current SD:	48.0%	48.0%	49.0%
calculated with a SD of 1:	47.4%	47.4%	48.8%

WAZ

Standard Deviation SD:	1.06	1.06	1.03
(The SD should be between 0.8 and 1.2)			
Prevalence (< -2)			
observed:	31.1%	31.1%	31.1%
calculated with current SD:	32.1%	32.1%	31.9%
calculated with a SD of 1:	31.0%	31.0%	31.3%

Results for Shapiro-Wilk test for normally (Gaussian) distributed data:

WHZ	p= 0.729	p= 0.729	p= 0.761
HAZ	p= 0.000	p= 0.000	p= 0.056
WAZ	p= 0.336	p= 0.336	p= 0.072

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

Skewness

WHZ	-0.02	-0.02	-0.01
HAZ	0.48	0.48	0.07
WAZ	-0.06	-0.06	-0.12

If the value is:
-below minus 2 there is a relative excess of wasted/stunted/underweight subjects in the sample
-between minus 2 and minus 1, there may be a relative excess of wasted/stunted/underweight subjects in the sample.
-between minus 1 and plus 1, the distribution can be considered as symmetrical.
-between 1 and 2, there may be an excess of obese/tall/overweight subjects in the sample.
-above 2, there is an excess of obese/tall/overweight subjects in the sample

Kurtosis

WHZ	0.13	0.13	0.04
HAZ	1.78	1.78	-0.32
WAZ	0.25	0.25	-0.22

(Kurtosis characterizes the relative peakedness or flatness compared with the normal distribution, positive kurtosis indicates a relatively peaked distribution, negative kurtosis indicates a relatively flat distribution)
If the value is:
-above 2 it indicates a problem. There might have been a problem with data collection or sampling.
-between 1 and 2, the data may be affected with a problem.
-less than an absolute value of 1 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=1.25 (p=0.110)
WHZ < -3: ID=1.37 (p=0.045)
Oedema: ID=0.94 (p=0.595)
GAM: ID=1.45 (p=0.021)
SAM: ID=1.46 (p=0.020)

HAZ < -2: ID=1.47 (p=0.018)
HAZ < -3: ID=1.27 (p=0.098)
WAZ < -2: ID=1.41 (p=0.032)
WAZ < -3: ID=1.25 (p=0.110)

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 < 0.05 it indicates that the cases are UNIFORMLY distributed among the clusters. If the p value is higher than 0.05 the cases appear to be randomly distributed among the clusters, if 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 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: 1.00 (n=50, f=1)  #########
02: 0.89 (n=50, f=0)  ####
03: 1.11 (n=50, f=0)  ##############
04: 0.83 (n=50, f=0)  #
05: 0.99 (n=50, f=0)  ########
06: 1.02 (n=50, f=0)  #########
07: 1.02 (n=50, f=0)  #########
08: 0.98 (n=50, f=0)  #######
09: 0.99 (n=50, f=0)  ########
10: 1.09 (n=48, f=1)  ############
11: 0.83 (n=48, f=0)  #
12: 0.96 (n=46, f=0)  #######
13: 1.13 (n=45, f=0)  ###############
14: 0.98 (n=37, f=0)  #######
15: 0.83 (n=34, f=0)  #
16: 1.03 (n=29, f=0)  ##########
17: 0.93 (n=25, f=0)  OOOOOO
18: 1.36 (n=18, f=0)  OOOOOOOOOOOOOOOOOOOOOOO
19: 0.77 (n=09, f=0)
20: 1.06 (n=05, f=0)  ~~~~~~~~~~~
21: 0.69 (n=04, f=0)
22: 1.76 (n=03, f=0)  ~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
23: 1.57 (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)

Analysis by Team

Team	**1**	**2**	**3**	**4**	**5**
Percentage of values flagged with SMART flags:					
WHZ:	0.0	0.0	2.0	1.2	0.6
HAZ:	0.6	1.4	1.3	3.6	1.7
WAZ:	0.0	0.0	2.0	1.8	1.1
Age ratio of 6-29 months to 30-59 months:					
	0.94	0.99	0.68	0.77	0.98
Sex ratio (male/female):					
	0.85	0.91	0.87	1.39	1.22

Digit preference Weight (%):

.0 :	15	10	12	5	9	
.1 :	12	10	5	10	12	
.2 :	11	12	11	9	8	
.3 :	4	12	7	11	9	
.4 :	9	7	10	13	16	
.5 :	10	16	12	7	9	
.6 :	7	9	11	14	11	
.7 :	9	5	8	14	9	
.8 :	12	9	14	7	10	
.9 :	10	10	10	10	8	
DPS:	10	9	8	10	7	Digit preference score (0-5 good, 5-10 acceptable, 10-20 poor and > 20 unacceptable)

Digit preference Height (%):

.0 :	14	8	12	0	13	
.1 :	13	13	13	11	13	
.2 :	12	14	10	12	7	
.3 :	15	10	10	14	11	
.4 :	7	7	10	10	12	
.5 :	12	10	10	7	13	
.6 :	8	10	9	12	12	
.7 :	11	12	7	9	8	
.8 :	2	11	10	15	2	
.9 :	6	5	8	10	9	
DPS:	13	9	5	13	11	Digit preference score (0-5 good, 5-10 acceptable, 10-20 poor and > 20 unacceptable)

Standard deviation of WHZ:

SD	0.90	1.00	0.95	1.11	0.98

Prevalence (< -2) observed:

%	7.5	14.0

Prevalence (< -2) calculated with current SD:

%	7.3	13.0

Prevalence (< -2) calculated with a SD of 1:

%	7.2	10.6

Standard deviation of HAZ:

SD	1.17	1.12	1.25	1.29	1.39

observed:

%	49.1	58.5	49.7	33.9	57.8

calculated with current SD:

%	49.9	53.6	50.6	36.3	50.9

calculated with a SD of 1:

%	49.9	54.0	50.7	32.5	51.2

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	18/17.4 (1.0)	27/20.4 (1.3)	45/37.8 (1.2)	0.67
18 to 29	12	17/17.0 (1.0)	17/19.9 (0.9)	34/36.9 (0.9)	1.00
30 to 41	12	17/16.4 (1.0)	20/19.3 (1.0)	37/35.7 (1.0)	0.85
42 to 53	12	17/16.2 (1.1)	18/19.0 (0.9)	35/35.2 (1.0)	0.94
54 to 59	6	6/8.0 (0.7)	6/9.4 (0.6)	12/17.4 (0.7)	1.00
6 to 59	54	75/81.5 (0.9)	88/81.5 (1.1)		0.85

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

Overall sex ratio: p = 0.309 (boys and girls equally represented)
Overall age distribution: p = 0.508 (as expected)

Overall age distribution for boys: p = 0.965 (as expected)
Overall age distribution for girls: p = 0.427 (as expected)
Overall sex/age distribution: p = 0.220 (as expected)

Team 2:

Age cat.	mo.	boys	girls	total	ratio boys/girls
6 to 17	12	11/16.2 (0.7)	19/17.9 (1.1)	30/34.1 (0.9)	0.58
18 to 29	12	23/15.8 (1.5)	20/17.4 (1.1)	43/33.3 (1.3)	1.15
30 to 41	12	27/15.3 (1.8)	11/16.9 (0.7)	38/32.2 (1.2)	2.45
42 to 53	12	8/15.1 (0.5)	20/16.6 (1.2)	28/31.7 (0.9)	0.40
54 to 59	6	1/7.5 (0.1)	7/8.2 (0.9)	8/15.7 (0.5)	0.14
6 to 59	54	70/73.5 (1.0)	77/73.5 (1.0)		0.91

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

Overall sex ratio: p = 0.564 (boys and girls equally represented)
Overall age distribution: p = 0.072 (as expected)
Overall age distribution for boys: p = 0.000 (significant difference)
Overall age distribution for girls: p = 0.497 (as expected)
Overall sex/age distribution: p = 0.000 (significant difference)

Team 3:

Age cat.	mo.	boys	girls	total	ratio boys/girls
6 to 17	12	14/16.5 (0.8)	17/19.0 (0.9)	31/35.5 (0.9)	0.82
18 to 29	12	17/16.1 (1.1)	14/18.5 (0.8)	31/34.6 (0.9)	1.21
30 to 41	12	15/15.6 (1.0)	21/18.0 (1.2)	36/33.5 (1.1)	0.71
42 to 53	12	16/15.3 (1.0)	24/17.7 (1.4)	40/33.0 (1.2)	0.67
54 to 59	6	9/7.6 (1.2)	6/8.8 (0.7)	15/16.3 (0.9)	1.50
6 to 59	54	71/76.5 (0.9)	82/76.5 (1.1)		0.87

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

Overall sex ratio: p = 0.374 (boys and girls equally represented)
Overall age distribution: p = 0.607 (as expected)
Overall age distribution for boys: p = 0.946 (as expected)
Overall age distribution for girls: p = 0.292 (as expected)
Overall sex/age distribution: p = 0.147 (as expected)

Team 4:

Age cat.	mo.	boys	girls	total	ratio boys/girls
6 to 17	12	21/22.3 (0.9)	15/16.0 (0.9)	36/38.3 (0.9)	1.40
18 to 29	12	19/21.7 (0.9)	17/15.6 (1.1)	36/37.3 (1.0)	1.12
30 to 41	12	24/21.0 (1.1)	15/15.1 (1.0)	39/36.2 (1.1)	1.60
42 to 53	12	22/20.7 (1.1)	17/14.9 (1.1)	39/35.6 (1.1)	1.29
54 to 59	6	10/10.2 (1.0)	5/7.4 (0.7)	15/17.6 (0.9)	2.00
6 to 59	54	96/82.5 (1.2)	69/82.5 (0.8)		1.39

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

Overall sex ratio: p = 0.036 (significant excess of boys)
Overall age distribution: p = 0.892 (as expected)
Overall age distribution for boys: p = 0.923 (as expected)
Overall age distribution for girls: p = 0.870 (as expected)

Overall sex/age distribution: p = 0.163 (as expected)

Team 5:

Age cat.	mo.	boys	girls	total	ratio boys/girls
6 to 17	12	22/23.0 (1.0)	21/18.8 (1.1)	43/41.8 (1.0)	1.05
18 to 29	12	28/22.4 (1.3)	18/18.3 (1.0)	46/40.7 (1.1)	1.56
30 to 41	12	28/21.7 (1.3)	25/17.8 (1.4)	53/39.5 (1.3)	1.12
42 to 53	12	15/21.4 (0.7)	16/17.5 (0.9)	31/38.8 (0.8)	0.94
54 to 59	6	6/10.6 (0.6)	1/8.6 (0.1)	7/19.2 (0.4)	6.00
6 to 59	54	99/90.0 (1.1)	81/90.0 (0.9)		1.22

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

Overall sex ratio: p = 0.180 (boys and girls equally represented)
Overall age distribution: p = 0.005 (significant difference)
Overall age distribution for boys: p = 0.129 (as expected)
Overall age distribution for girls: p = 0.039 (significant difference)
Overall sex/age distribution: p = 0.001 (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: 1.23 (n=10, f=0)  ##################
02: 0.71 (n=10, f=0)
03: 0.70 (n=10, f=0)
04: 0.75 (n=10, f=0)
05: 1.19 (n=10, f=0)  ################
06: 0.48 (n=10, f=0)
07: 1.09 (n=10, f=0)  ############
08: 0.59 (n=10, f=0)
09: 0.69 (n=10, f=0)
10: 0.79 (n=09, f=0)
11: 0.89 (n=09, f=0)  ####
12: 1.06 (n=09, f=0)  ############
13: 0.98 (n=08, f=0)  ########
14: 1.16 (n=07, f=0)  ################
15: 0.93 (n=07, f=0)  ######
16: 0.83 (n=06, f=0)  #
17: 0.54 (n=05, f=0)
18: 1.38 (n=03, f=0)  OOOOOOOOOOOOOOOOOOOOOOO
19: 0.92 (n=02, f=0)  ~~~~~
20: 1.47 (n=02, f=0)  ~~~~~~~~~~~~~~~~~~~~~~~~~~~
21: 0.01 (n=02, f=0)
22: 1.30 (n=02, f=0)  ~~~~~~~~~~~~~~~~~~~~~
23: 2.21 (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: 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: 0.87 (n=10, f=0) ###
02: 0.78 (n=10, f=0)
03: 1.19 (n=10, f=0) ################
04: 0.77 (n=10, f=0)
05: 0.75 (n=10, f=0)
06: 0.70 (n=10, f=0)
07: 0.79 (n=10, f=0)
08: 1.28 (n=10, f=0) ###################
09: 1.07 (n=10, f=0) ##########
10: 1.54 (n=10, f=0) ##############################
11: 0.98 (n=10, f=0) ########
12: 1.33 (n=09, f=0) ######################
13: 1.09 (n=09, f=0) ###########
14: 1.01 (n=05, f=0) OOOOOOOOO
15: 0.65 (n=04, f=0)
16: 1.34 (n=04, f=0) OOOOOOOOOOOOOOOOOOOOOO
17: 0.22 (n=03, f=0)
18: 0.12 (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: 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: 0.49 (n=10, f=0)
02: 0.74 (n=10, f=0)
03: 0.74 (n=10, f=0)
04: 0.54 (n=10, f=0)
05: 0.64 (n=10, f=0)
06: 1.21 (n=10, f=0) #################
07: 1.16 (n=10, f=0) ###############
08: 0.85 (n=10, f=0) ##
09: 1.18 (n=10, f=0) ################
10: 1.40 (n=09, f=1) ########################
11: 0.61 (n=09, f=0)
12: 0.76 (n=09, f=0)
13: 0.81 (n=09, f=0)
14: 1.03 (n=06, f=0) OOOOOOOOO
15: 1.01 (n=06, f=0) OOOOOOOOO
16: 0.39 (n=04, f=0)
17: 0.48 (n=04, f=0)
18: 0.95 (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: 1.41 (n=10, f=1) ##########################
02: 1.09 (n=10, f=0) ###########
03: 1.02 (n=10, f=0) #########
04: 1.03 (n=10, f=0) ##########
05: 1.21 (n=10, f=0) #################
06: 1.02 (n=10, f=0) #########
07: 1.11 (n=10, f=0) ############

08: 0.97 (n=10, f=0) #######
09: 1.08 (n=10, f=0) ############
10: 0.84 (n=10, f=0) ##
11: 0.84 (n=10, f=0) ##
12: 0.80 (n=10, f=0)
13: 1.49 (n=10, f=0) ############################
14: 0.94 (n=10, f=0) ######
15: 0.70 (n=08, f=0)
16: 1.16 (n=06, f=0) OOOOOOOOOOOOOO
17: 1.35 (n=06, f=0) OOOOOOOOOOOOOOOOOOOOO
18: 2.50 (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: 0.89 (n=10, f=0) ####
02: 1.06 (n=10, f=0) ##########
03: 1.40 (n=10, f=0) ########################
04: 0.93 (n=10, f=0) ######
05: 1.02 (n=10, f=0) #########
06: 1.32 (n=10, f=0) ######################
07: 1.04 (n=10, f=0) ##########
08: 0.99 (n=10, f=0) ########
09: 0.59 (n=10, f=0)
10: 0.71 (n=10, f=0)
11: 0.56 (n=10, f=0)
12: 0.86 (n=09, f=0) ##
13: 1.09 (n=09, f=0) ############
14: 1.02 (n=09, f=0) #########
15: 0.85 (n=09, f=0) ##
16: 1.05 (n=09, f=0) ##########
17: 0.81 (n=07, f=0) #
18: 1.17 (n=07, f=0) ###############
19: 0.78 (n=04, f=0)
20: 0.51 (n=02, f=0)
21: 1.17 (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)