October 2009

INTEGRATED SMART SURVEY

(Nutrition, WASH and Food Security & Livelihoods)

In

MWINGI DISTRICT, KENYA

Funded by the Office of U.S. Foreign Disaster Assistance (OFDA)

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ACKNOWLEDGMENTS

On behalf of Action Against Hunger – USA (ACF-USA) the authors would like to express their deep gratitude to the Ministry of Health in the larger Mwingi District, especially the DNOs from Mwingi and Kyuso for their relentless support.

We would like to thank team members from Kenya National bureau of statistics (KNBS) and the Arid Land Resource Management Program (ALRMP).

We would like to thank ACF-USA staff, particularly the management team in Nairobi who helped solving logistics, personnel and administrative issues and supported the fieldwork. Without such support this survey would not have been possible.

Furthermore, we thank all team members (measures, data recorders and team leaders) who were involved in ensuring the survey obtained good quality data. Thanks also to all the drivers who ensured timely movement of field staff.

Special thanks to the chiefs of all the divisions and the elders of Nuu, Nguni, Tseikuru and Ngomeni for their support during the survey.

We finally like to say many thanks to the mothers and the fathers who pleasantly allowed the team to measure their children and patiently sat through the interviews and shared with the team valuable information.

1. EXECUTIVE SUMMARY

In October 2009, in order to determine the extent of malnutrition problem in the area, ACF-USA and the Ministry of Health (MOH)-Mwingi conducted an integrated nutrition survey in selected divisions within the Larger Mwingi District, in the Eastern Province of Kenya. The nutrition survey was implemented using the Standardized Monitoring and Assessment of Relief and Transitions (SMART) methodology. The survey covered the four divisions (Nuu, Nguni, Ngomeni and Tseikuru) and thirteen locations in the larger Mwingi District.

The was implemented in collaboration with the Ministry of Health, Arid Lands Management (ALRMP) and the Mwingi District Kenya National Bureau of Statistics (KNBS) Office. The survey was preceded by the training of local partners on SMART methodology from the 5th - 10th October 2009. The survey itself was conducted from October 12th to 21st, 2009. 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 acute malnutrition such as illnesses and care practices, water and sanitation and food security situation.

A total of 709 children aged 6-59 months were measured and for mortality 3,813 people from 627 households were surveyed. The mean household size was 6.1; the mean number of under five per household was 1.1. In the final analysis for the nutritional status of the population 697 children (353 boys and 344 girls) were included (12 data not considered as out of plausibility range). The Global Acute Malnutrition (GAM, weight for height <-2 Z score or oedema) based on the WHO 2005 standard reference was 8.3% [6.1-11.3, 95%C.I.] and Severe Acute Malnutrition (SAM, weight for height <-3 or oedema) was 0.6% [0.2-1.5, 95% C.I.] and there was no oedema cases. The rates of acute malnutrition, when considered with 95% confidence intervals, range from poor to serious according to WHO thresholds.

The Crude Death Rate finding was 0.12 [0.04-0.13, 95%C.I.], which is below the emergency threshold of 1/10,000/day levels. The assessment revealed a high level of morbidity in the area where at least 40 % of the surveyed children (697) had some form of illness in the two weeks prior to the survey.. fever with difficult breathing showed the highest prevalence (21.4%) followed by chills like malaria (18.9%) and diarrhea (8.6%).
Measles vaccination coverage for eligible children 9-59 months old (669) was good (93.1%) with 59.8% verified by cards and 33.3% through mothers statement. Vitamin A supplementation coverage was good (89.4%) in the assessed population.

In Mwingi, less than half of the population accesses safe water sources (see narrative for definitions, 36% in the dry season and only 29% in the rainy season), and only 11% reported some kind of water treatment. Based on the types of water sources, it seems that households prioritize short distances and shorter queuing time, rather than quality of water when choosing a source. The per capita water consumption in liters for drinking, cooking, bathing, washing and cleaning at the time of the survey was 11.5 [11.1-12.0 95%CI], which is comparable to similar arid areas in Kenya, as well as national standards for “low potential areas,” which is 10 L/p/d. Latrine coverage in the survey areas was poor with 73% of the households using open defecation and only about 26% having a toilet facility in their compound.

The assessed population had experienced series of poor rainfall causing three years of successive crop failure. It was reported that only 11.4% households have harvested any crop in the last harvesting season. According to the LRA the area was classified as Generally Food Insecure and the situation is expected to deteriorate if rain failure continues.

The survey revealed that the most common sources of food in the last 30 days before the survey were purchase, food aid, gift and own production, with 93, 57, 42 and 83% of households reporting, respectively.

It also highlighted that the average number of food groups consumed based on the HDDS (Household diet diversity score) 12 food groups within 24hr recall period was 3.4 with 56% of the households consuming three or less food groups.

The main source of income was reported by the surveyed households to be wage payment followed by sale of livestock, livestock product, petty trade and bush products sales. Expenditure of the households reached around 63% on food purchase followed by farm inputs, education fees, medical bills and dept repayment.

The households had adopted a range of coping strategies amongst which prominently used include reducing the size of the meals, purchase food on credit/borrow from local vendors/relatives and skipping meals.

The results for the Mwingi October 2009 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[1]
WHO (n=697)	***Z- scores***	***Global Acute Malnutrition*** W/H < -2 z and/or oedema	**8.3% [6.1-11.3]**
		Severe Acute Malnutrition W/H < -3 z and/or oedema	**0.6% [0.2-1.5]**
NCHS (n-697)	***Z-scores***	***Global Acute Malnutrition*** W/H < -2 z and/or oedema	**7.9% [6.0-10.4]**
		Severe Acute Malnutrition W/H < -3 z and/or oedema	**0.0% [0.0-0.0]**
	% Median	***Global Acute Malnutrition*** W/H < 80% and/or oedema	**2.1% [0.9-3.3]**
		Severe Acute Malnutrition W/H < 70% and/or oedema	**0% [0.0-0.0]**
MUAC	***Height> 65 cm***	***Global Acute Malnutrition*** MUAC <12.5cm	**5.1% [3.4-6.6]**
		Severe Acute Malnutrition MUAC <11.5 cm	**0.9% [0.3-1.7]**
Total crude retrospective mortality (last 3 months) /10,000/day Under five crude retrospective mortality /10,000/day			**0.12 [0.04-0.13]** **0.29 [0.08-1.05]**
Measles immunization coverage by Card (N=400, children 9-59 months old)			**59.8% [56.1-63.5]**
Children who received vitamin A supplementation in last one year (N=623)			**89.4% [87.1-91.7]**
Proportion of children 6-59 months of age with diarrhea in 2 weeks prior to the survey (N=697)			**8.6% [6.5-10.7]**
Proportion of children 6-59 months of age with chills like malaria in 2			**18.9% [16.0-21.9]**

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

weeks prior to the survey (N=697)	
Proportion of children 6-59 months of age with fever & difficult breathing in 2 weeks prior to the survey (N=697)	**21.4% [18.3-24.4]**
Proportion of households with a family latrine within a compound (N= 627)	**25.8% [22.4-29.3]**
Proportion of households at least one member using a mosquito net the night before the survey date (N=627)	**67.5% [63.8-71.1]**
Proportion of households who access a safe water source in the dry season (N=627)	**36.4%[32.6-40.1]**
Proportion of households who access a safe water source during the rainy season (N=627)	**28.9% [25.3-32.4]**
Average daily per person water consumption at the time of the survey (liters) N=627	**11.5% [11.1-12.0]**
Proportion of households engaged in crop farming who harvested in the last cropping season (N=627)	**24.4% [21.1-27.7]**
Mean Household Dietary Diversity (N=627)	**3.4% [3.3-3.6]**
Proportion of households who consumed ≤3 food groups (N=627)	**56.0% [52.1-59.9]**

2. INTRODUCTION

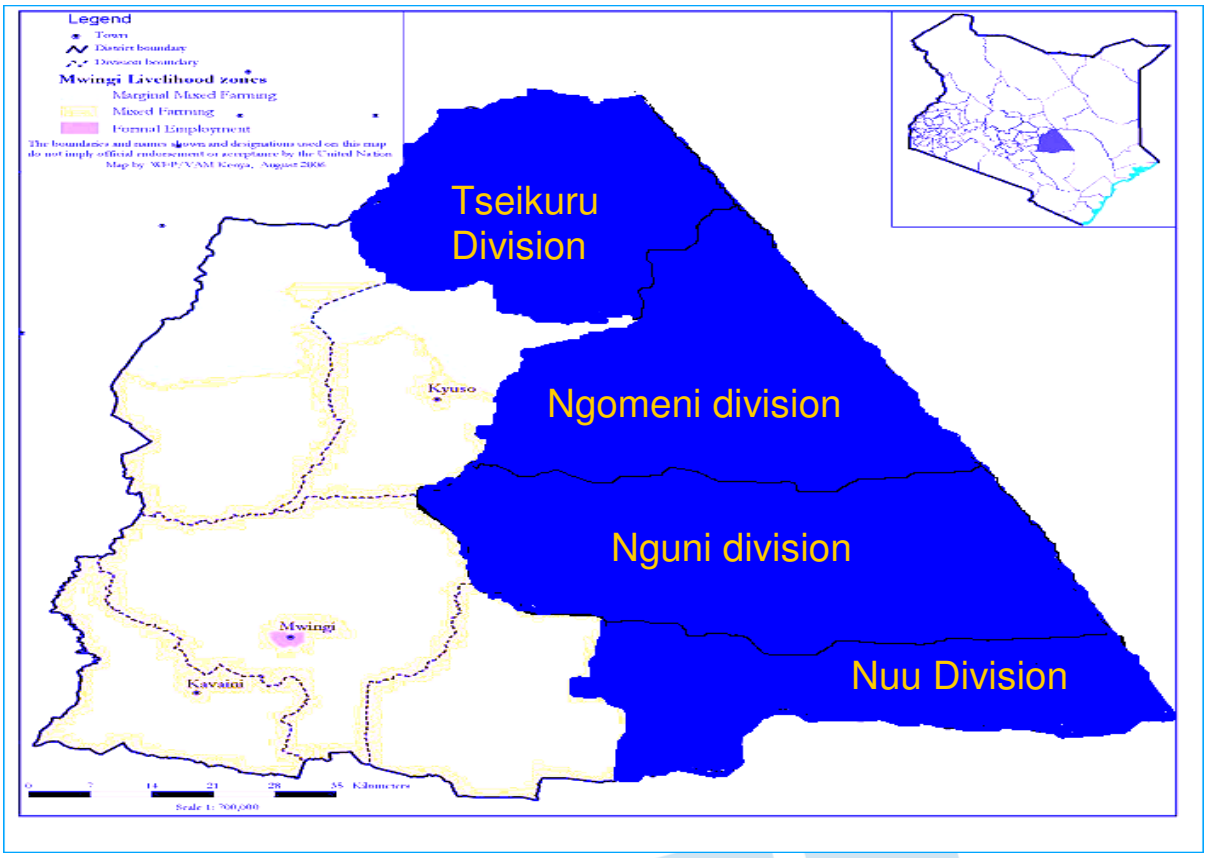
Mwingi District is located in the Eastern Province bordering the districts of Kitui to the south, Machakos to the west, Mbeere and Tharaka to the north west, Isiolo and Meru to the north and Tana River to the east. The District covers an area of 10,030.30km^2. The population is estimated at 353,060 based on 2008 projections and is rural based at up to 95 percent. Poverty levels are estimated at 60 percent.[2] By livelihood zone, the district population is classified as mixed farming (69%), marginal mixed farming (28%) and formal employment/casual labour (3%).[3] The survey covered rural villages in four divisions (Nuu, Nguni, Ngomeni and Tseikuru) and thirteen locations in the larger Mwingi District.

Following the prolonged drought and resulting successive crop failures, food aid distribution started in 2004 in Mwingi District. Since then, the food aid recipients have been steadily increasing and according to the district Arid Lands Resource Management Project (ALRMP), currently 215,019 beneficiaries receive food aid, 61% of the total population[4]. According to the Kenya Food Security Steering Group (KFSSG) 2009 Long Rain Assessment (LRA), the food security situation in the District was "acute food and livelihood crisis at a high risk of worsening". In response to the LRA recommendations, Action Against Hunger (ACF-USA) began a capacity building program with the MOH on therapeutic and supplementary feeding programs (TFP and SFP respectively) in July 2009 to treat severely and moderately acute malnourished cases. Thus far, according to MOH, children's admission to the feeding program was 3241 in SFP, 89 in OTP and 537 moderated malnourished pregnant and lactating mothers by the end of September 2009.

The survey areas were selected as the most vulnerable based on the 2009 LRA ranking and the recommendation of the local authorities and implementing partners. In terms of livelihood zone, the survey covered mainly the marginal farming zone. Common crops grown include maize, beans, sorghum and millet while common livestock kept include cattle, poultry, donkey, goats and sheep. The district receives an annual rainfall that ranges between 400mm and 800mm. It receives rain in two seasons, the long rain season between March and April and the short rain season between October and December. The rainfall is highly unreliable.

[2] Kenya Food Security Steering Groug (KFSSG) Mwingi District Long Rain Assessment, 2009
[3] Arid Lands Resource Management Project (ALRMP)
[4] KFSSG Mwingi District Long Rain Assessment, 2009

Figure 1: Survey Divisions in Mwingi District



SURVEY OBJECTIVES

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

- Prevalence of acute malnutrition in children aged 6-59 months
- Crude and under five mortality rates
- Coverage of measles and vitamin A capsules among targeted children
- Exclusive breastfeeding and child feeding practices
- Illnesses in children aged 6-59 months
- 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 the analytical approach. The survey results and discussion are presented under section three. The final section provides a brief conclusion 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) software for SMART was used to determine the sample size required. Village level population data were obtained from location and sub-location chiefs and sub-chiefs[5]. Since no nutritional surveys were conducted in the recent past that could provide information on the expected prevalence of global acute malnutrition (GAM), the sample size was determined using the survey conducted by ACF-USA in the adjacent Tana River district in November 2008 which showed rates of GAM of 14.7%. Using a precision of 4%, a design effect of 2 and a 3% non response rate, 602 children (621 households) were then planned for the survey.

For the mortality, taking the prevalence of 0.37 per 10,000/day from 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 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 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 the household list available from 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 between 1 and the sampling interval to select the first household and the sampling interval repeatedly added to determine the remaining households. Respondents were primarily heads of households and spouses. Additional information was solicited from the relevant household members.

3.2. Training and organization of survey teams

Capacity building of the local partners on the SMART methodology 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 Mwingi and five from Kitui districts. 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 a second three-day intensive training session from October 8th to 10th, 2009 in Mwingi town for the anthropometrics measurers (10), data collectors (5) and team leaders (5). The training focused on the survey implementation including the objectives, sample household selection and interviewing and anthropometrics measurement techniques.

The five team leaders in Mwingi 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 was requested to complete a cluster in a day (13 households).

[5] The population estimate obtained from Mwingi 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.

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 second training . In addition, field testing of the survey instruments and survey teams in a non surveyed village adjacent to Mwingi town was conducted on the last day of the training where each 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 were 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 improving performance and quality of data.

3.4. Data Collection

The field data collection was conducted from October 12th to 23rd, 2009, covering the 50 clusters/villages and 13 households from each cluster. The following categories of data were collected using three survey instruments. While the anthropometric and mortality questionnaires were adopted from the SMART, the survey instrument for the WASH/Food Security was developed specifically for this survey and pre-tested as part of the training of enumerators and team leaders.

- **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 (17th) was used as the start of the recall period. Each sample 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.

- **Food Security and WASH:**

From the same households the mortality data were collected, the WASH and food security 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 and hygiene practices, crop and livestock production, food sources, dietary diversity, income and expenditure and coping strategies (see Annex V).

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 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.

3.5.1. Analysis of Acute Malnutrition

Acute malnutrition rates are estimated from the weight for height (WFH) index values combined with the presence of oedema. The WFH indices are expressed in both Z-scores and percentage of the median, according to WHO 2005 and NCHS 1977 reference standards.

- **Z-Score**

- Severe malnutrition is defined by WFH < -3 SD and/or existing bilateral oedema on the lower limbs.
- 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 oedema.

- **Percentage of Median**

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

3.5.2. 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

3.5.3. 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
- Solid waste practices

3.5.4. 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. RESULTS 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 and sanitation and food security and livelihoods related indicators. Quantitative results are presented in tables, graphs or charts.

4.1. Child health and nutrition status

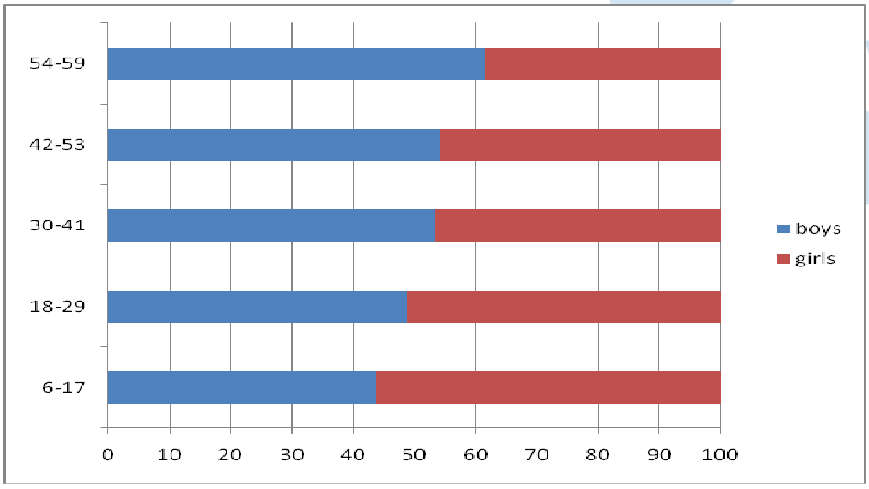
4.1.1. Distribution by age and sex

A total of 709 children aged 6-59 months were assessed in the survey. Twelve children were flagged out of range and excluded leaving 697 children, 354 boys (50.8%) and 343 girls (49.2%), in the final analysis. The overall sex ratio was 1.0, within the acceptable range.

Table 2: Distribution of age and sex

Age Group (months)	Boys		Girls		Total		Ratio
	N	%	N	%	N	%	Boy : girl
6-17	73	43.7	94	56.3	167	24.0	0.8
18-29	80	48.8	84	51.2	164	23.5	1.0
30-41	93	53.4	81	46.6	174	25.0	1.1
42-53	76	54.3	64	45.7	140	20.1	1.2
54-59	32	61.5	20	38.5	52	7.5	1.6
Total	**354**	**50.8**	**343**	**49.2**	**697**	**100.0**	**1.0**

Figure 2: Distribution of age and sex



4.1.2. Anthropometric analysis

The rates of global acute malnutrition (GAM, weight for height <-2 Z score or oedema) based on the WHO 2006 standard reference was 8.3% [95% CI: 6.1 - 11.3] and severe acute malnutrition

(SAM, weight for height <-3 or oedema) was 0.6% [95% CI: 0.2-1.5]. There were no oedema cases. The acute malnutrition level, when considering the 95% confidence interval ranges from poor to serious according to the WHO thresholds.

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 poor nutritional situation of the assessed population (Figures 3 and 4).
With WHO 2006 Standards, the mean Z-scores of the sample was -0.59 and the Standard Deviations (SD) 1.08. The SD is within the acceptable range of 0.80-1.20, which shows that the sample was 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 = 697	**Boys** n = 353	**Girls** n = 344
Prevalence of global malnutrition (<-2 z-score and/or oedema)	(58) 8.3 % (6.1 - 11.3)	(35) 9.9 % (6.5 - 14.8)	(23) 6.7 % (4.4 - 10.1)
Prevalence of moderate malnutrition (<-2 z-score and >=-3 z-score, no oedema)	(54) 7.7 % (5.6 - 10.5)	(33) 9.3 % (6.1 - 14.0)	(21) 6.1 % (3.9 - 9.4)
Prevalence of severe malnutrition (<-3 z-score and/or oedema)	(4) 0.6 % (0.2 - 1.5)	(2) 0.6 % (0.1 - 2.3)	(2) 0.6 % (0.1 - 2.3)

The prevalence of oedema is 0.0 %
Results between brackets are expressed with 95% confidence

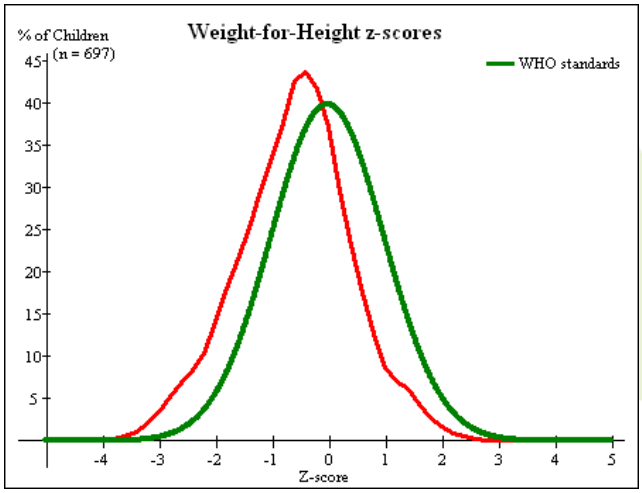
Table 4: Prevalence of acute malnutrition by age based on weight-for-height z-scores and/or oedema

		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	168	0	0.0	8	4.8	160	95.2	0	0.0
18-29	163	1	0.6	9	5.5	153	93.9	0	0.0
30-41	174	1	0.6	15	8.6	158	90.8	0	0.0
42-53	140	2	1.4	18	12.9	120	85.7	0	0.0
54-59	52	0	0.0	4	7.7	48	92.3	0	0.0
Total	697	4	0.6	54	7.7	639	91.7	0	0.0

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. 0 (0.0 %)	Kwashiorkor No. 0 (0.0 %)
Oedema absent	Marasmic No. 9 (1.3 %)	Not severely malnourished No. 700 (98.7 %)

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 = 702	**Boys** n = 359	**Girls** n = 343
Prevalence of global malnutrition (<-2 z-score and/or oedema)	(63) 9.0 % (6.6 - 12.1)	(39) 10.9 % (7.3 - 15.9)	(24) 7.0 % (4.5 - 10.7)
Prevalence of moderate malnutrition (<-2 z-score and >=-3 z-score, no oedema)	(57) 8.1 % (5.9 - 11.1)	(34) 9.5 % (6.3 - 14.0)	(23) 6.7 % (4.3 - 10.3)
Prevalence of severe malnutrition (<-3 z-score and/or oedema)	(6) 0.9 % (0.4 - 1.9)	(5) 1.4 % (0.6 - 3.3)	(1) 0.3 % (0.0 - 2.2)

The prevalence of oedema is 0.0 %
Results between brackets are expressed with 95% confidence

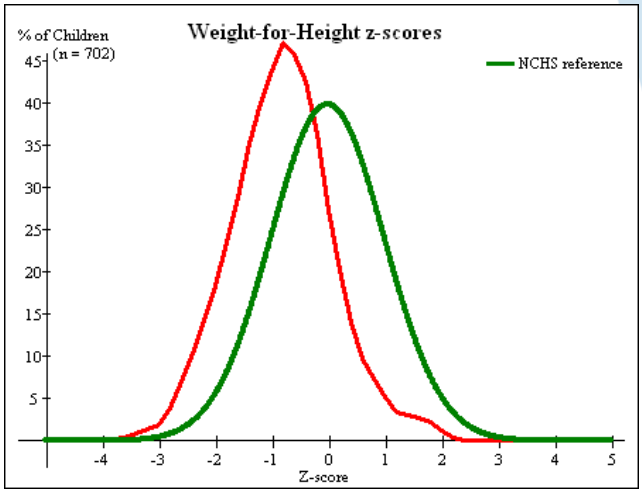
Table 7: Prevalence of acute malnutrition by age based on weight-for-height z-scores and/or oedema

		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	167	1	0.6	7	4.2	159	95.2	0	0.0
18-29	164	1	0.6	17	10.4	146	89.0	0	0.0
30-41	177	2	1.1	16	9.0	159	89.8	0	0.0
42-53	141	2	1.4	14	9.9	125	88.7	0	0.0
54-59	53	0	0.0	3	5.7	50	94.3	0	0.0
Total	702	6	0.9	57	8.1	639	91.0	0	0.0

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. 0 (0.0 %)
Oedema absent	Marasmic No. 6 (0.8 %)	Not severely malnourished No. 703 (99.2 %)

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	4	2.5%	2	0.6%	0	0.0%	6	0.9%
115 < = MUAC < 125	11	6.7%	9	2.9%	9	4.2%	29	4.2%
125 < = MUAC < 135	38	23.3%	49	15.9%	18	8.4%	105	15.3%
MUAC > = 135	110	67.5%	249	80.6%	188	87.4%	547	79.6%
Total	163	100%	309	100%	215	100%	687	100%

When considering the results per MUAC, GAM and SAM rates reach 5.1% and 0.9% respectively.

- **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 = 706	**Boys** n = 361	**Girls** n = 345
Prevalence of underweight (<-2 z-score)	(233) 33.0 % (28.3 - 38.1)	(129) 35.7 % (29.6 - 42.3)	(104) 30.1 % (24.9 - 36.0)
Prevalence of moderate underweight (<-2 z-score and >=-3 z-score)	(183) 25.9 % (22.1 - 30.1)	(98) 27.1 % (22.2 - 32.7)	(85) 24.6 % (20.2 - 29.7)
Prevalence of severe underweight (<-3 z-score)	(50) 7.1 % (5.0 - 9.9)	(31) 8.6 % (5.7 - 12.7)	(19) 5.5 % (3.4 - 8.7)

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	171	7	4.1	31	18.1	133	77.8	0	0.0
18-29	165	12	7.3	44	26.7	109	66.1	0	0.0
30-41	177	16	9.0	49	27.7	112	63.3	0	0.0
42-53	140	12	8.6	42	30.0	86	61.4	0	0.0
54-59	53	3	5.7	17	32.1	33	62.3	0	0.0
Total	706	50	7.1	183	25.9	473	67.0	0	0.0

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

	All n = 698	Boys n = 356	Girls n = 342
Prevalence of stunting (<-2 z-score)	(377) 54.0 % (48.4 - 59.5)	(204) 57.3 % (50.8 - 63.5)	(173) 50.6 % (43.5 - 57.6)
Prevalence of moderate stunting (<-2 z-score and >=-3 z-score)	(219) 31.4 % (27.7 - 35.3)	(116) 32.6 % (27.7 - 37.9)	(103) 30.1 % (25.3 - 35.4)
Prevalence of severe stunting (<-3 z-score)	(158) 22.6 % (19.1 - 26.7)	(88) 24.7 % (20.4 - 29.6)	(70) 20.5 % (15.8 - 26.1)

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	172	33	19.2	46	26.7	93	54.1
18-29	162	48	29.6	54	33.3	60	37.0
30-41	173	42	24.3	56	32.4	75	43.4
42-53	139	28	20.1	50	36.0	61	43.9
54-59	52	7	13.5	13	25.0	32	61.5
Total	698	158	22.6	219	31.4	321	46.0

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	697	-0.60±0.99	1.54	0	12
Weight-for-Age	706	-1.57±1.00	1.89	0	3
Height-for-Age	698	-2.11±1.11	2.18	0	11

* 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 mothers' or caretakers' confirmation. The measles immunization coverage was 93.1% of eligible children were immunized (59.8% confirmed by verification of immunization cards and 33.3% based on caretakers' confirmation). In terms of vitamin A coverage, close to 90% of children had received Vitamin A capsule at least once in the last one year indicating good coverage.

Table 15: Measles Immunization and Vitamin A Coverage

Measles (Children 9-59 months)	N	%
Not Immunized	46	6.9
Immunized (by Card)	400	59.8
Immunized (Mother's Confirmation)	223	33.3
Total	669	100
Vitamin A in the last one year		
Not received	74	10.6
Once	413	59.3
Twice or more	210	30.1
Total	697	100

4.1.4. Children treated in an TFP/SFP program

In order to assess access to TFP/SFP services, data on whether a child measured had been in treated in an TFP/SFP was collected. The result indicates that 20 children (2.9%) had participated in TFP 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 are presented in Table 9.
A high proportion of the respondents reported "Immediately after birth within an hour" accounting to 82.5%, an indicator of good knowledge on immediate breastfeeding.

The result for the introduction of complementary food, however, indicates that a considerable proportion of mothers introduced food before four months of age (42.3%). Only 15.7% of mothers introduced complementary feeding after six months. There were several possible contributing factors to this including a local cultural practice that encourage mothers to give glucose water to children to prevent diarrhea. Secondly, due to high level of food insecurity, availability and consumption of adequate food may have been insufficient for some mothers to maintain breastfeeding. In some instances mothers reported having had to work away from their homes or their farms, leaving children at home which results to early weaning. There seems to be a need for promotion and facilitation of exclusive breastfeeding.

Table 16: Initiation of Breastfeeding and Introduction of Complementary Food (Mothers with Child <2 Years)

Initiation of Breastfeeding	**N**	**%**
Immediately (within 1 hour)	339	82.5
More than 1 hour/within a day	63	15.3
More than a day	9	2.2
Total	411	100.0
Complementary Feeding		
Less than 4 months	170	42.3
4-6 months	169	42.0
After 6 months	63	15.7
Total	402	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), mothers/caretakers were asked whether their children had any sickness in the two weeks prior to the survey date. About 48% of the children had some kind of sickness.
Mothers with sick children in the reference period were further asked on the type of sicknesses. The result indicates that “fever with difficulty in breathing” was more prevalent among the assessed children (21.4%). This was followed by fever with chills like malaria (18.9%) and diarrhea (8.6%).

Table 17: Percentage children 6-59 Months old by type of sickness reported (N=697)

Type of Sickness	**N**	**%**
Diarrhea	60	8.6
Fever with chills like Malaria	132	18.9
Fever with difficulty in breathing	149	21.4

Disease is believed to be an important immediate contributing factor to malnutrition and a chi square test was performed if morbidity was associated with malnutrition. The survey result indicates that there was statistically significant correlation between chills like malaria and nutritional status of children, but not with fever with difficult in breathing or diarrhea diseases. Children from households with a mosquito net but nobody was using and children from households without nets both combined were more at risk of chills like malaria ($p<0.05$).

Mothers with sick children were also asked whether they sought any treatment service and 78.7% reported that they had sought assistance. The distribution of respondents by the type of assistance sought is indicated in the following Table. The single most important source of assistance was public clinic accounting to about 57% as public clinics provide free services.

Table 18: Mothers with sick children <5 by type of Assistance Sought (N=277)

Assistance Sought from	N	%
Public clinic	158	57.0
Shop/kiosk	43	15.5
Private clinic/ pharmacy	10	3.6
Others	7	2.6

4.2. Mosquito Net Use

The survey result on mosquito nets indicates that the proportion of households with mosquito net was 76.6%. 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. A higher proportion of households (67.5%) reported that at least one household member had been using the net while 31.3% out of these 67.5% reported everybody slept under the net. Households who didn't have a net and those who had but nobody was using accounted to 32.5% of the sample households.

Table 19: Distribution of Households by use of Mosquito Nets (N=627)

Response	N	%
Households owning	480	76.6
Households used net the night before the survey	424	67.5
Households with no use of net	203	32.5

4.3. Mortality

The retrospective death rate was calculated based on the data collected on the 90 day recall period. Data were collected from 627 sample households with or without children under 5 years. Both the crude death and under five morality rates were below the emergency thresholds of 1/10,000 persons /day and 2/10,000 persons/day, respectively. The results are summarized in the following Table.

Table 20: **Mortality Result**

Demographic Data	Result
Current resident	3813
Current resident < 5 years old	784
People who joined the household	38
< 5 years who joined household	5
People who left the household	111

< 5 years who left household	7
Birth	37
Death	4
Death < 5 years old	2
Recall Period (days)	90
CMR (deaths /10,000 people/day)	0.12 [0.04-0.31]
U5MR (deaths in children<5/ 10000 / day)	0.29 [0.07-1.18]

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, headed by one household head and eating from the same pot. According to the sample survey finding, the average household size was 6.1 persons (S.D=2.5). The data on household heads disaggregated by gender show that male account for 80.4% and females 19.6%. The survey result on main occupation indicates that the majority of household heads were engaged in crop farming (53.1%). Daily labor is the second most reported occupation accounting for about 23% (Table 21).

Table 21: Main Occupation of Sample Household Heads

Main Occupation	Male		Female		Total	
	N	%	N	%	N	%
Crop farming	248	49.2	85	69.1	333	53.1
Livestock farming	10	2.0	1	0.8	11	1.8
Small business/petty trade	44	8.7	10	8.1	54	8.6
Salary Employment	74	14.7	5	4.1	79	12.6
Daily Labor	124	24.6	21	17.1	145	23.1
Other	4	0.8	1	0.8	5	0.8
Total	**504**	**100**	**123**	**100**	**627**	**100**

Survey data on the educational status of household heads was collected and the result indicates that a significant proportion of the household heads, 60 per cent, had primary level education. A further look at the data on educational status disaggregated by gender of household heads shows that males tend to have better educational status than females (Table 22).

Table 22: Educational Status of Sample Household Heads

Educational status	Male		Female		Total	
	N	%	N	%	N	%
None	88	17.5	56	45.5	144	23.0
Non formal	15	3.0	7	5.7	22	3.5
Primary Level	327	64.9	52	42.3	379	60.4
Secondary Level	62	12.3	5	4.1	67	10.7
Above Secondary	12	2.4	3	2.4	15	2.4
Total	**504**	**100**	**123**	**100**	**627**	**100**

4.5. Water and Sanitation

4.5.1. Water Source and Use

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

A classification was set for each water source as a proxy indicator[6] for access to safe or unsafe water based on past experience in the ASAL areas of Kenya, as shown in the table below. Most households access unsafe sources (64% in the dry season and 71% in the rainy season). The predominant source of water in the dry season was dry river beds (scooping in to the sand, an unsafe source) for 50.6% of households, followed by hand pumped wells (a safe source, at 17.9%). In the rainy season earth pans were the main source of water for most households (an unsafe source, at 46.4%), followed by dry river beds (also an unsafe source, at 19.3%). It seems from this data that households tend to prioritize water sources that are closer with less waiting time over quality of water supplied.

Table 23: Households by Main Source of Drinking Water

Proxy Classification	Sources of Water	Dry Season		Rainy Season	
		N	%	N	%
Safe	Hand pumped well (shallow well or borehole)	112	**17.9**	0	0.0
Safe	Piped water system (water kiosk, taps)	84	13.4	57	9.1
Safe	Motor pumped well (borehole)	32	5.1	73	**11.6**
Safe	Water trucking to public tank	0	0.0	16	2.6
Safe	Household roof rain catchments	0	0.0	31	4.9
Safe	Public roof rain catchments (school, health center etc.)	0	0.0	3	0.5

[6] This is common WASH practice. It is a "proxy" indicator in that there is much in the handling process that can affect water quality at a household level.

	Summary for safe sources	**228**	**36.4**	**180**	**28.7**
unsafe	Dry River bed (scooping into the sand, temporary)	317	**50.6**	121	19.3
unsafe	Earth pan	21	3.3	291	**46.4**
unsafe	Shallow well (with no pump, bucket to take water)	33	5.3	1	0.2
unsafe	River (that is flowing, not dry)	26	4.1	30	4.8
unsafe	Water seller (ex. Using a cart, or tank, or donkey)	2	0.3	3	0.5
	Summary for unsafe sources	**399**	**63.6**	**446**	**71.2**
	Total	**627**	**100**	**627**	**100**

Sample households were required to indicate the daily water consumption at the time of the survey. Taking a household size of 6.1 persons, the average daily per person water consumption in liters for drinking, cooking and washing at the time of the survey which was considered dry season was 11.5 [95% CI: 11.1- 12.0]. This is comparable to similar ASAL areas in Kenya and the national standard for "low potential areas" of 10 L/p/d, but less than the 15 liters/person/day recommended by the SPHERE project.

In terms of one way travel time or distance to water point, about 22.8% of households travel 15 minutes or less (the SPHERE standard for distance is 15 minutes or less/less than 500 meters). About 77% travel 15 minutes or more with 30.9% over an hour The response to the waiting time at water points at the time of the survey indicates that about 45% waited for less than 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. Households have to spend more time to collect water leaving less time for other productive activities. This will have direct bearing on mothers with children under five who have to spend limited time for child care.

Table 24: Households by one way distance and Queuing Time at Water Source

One way Distance	N	%
It takes 15 minutes or less to walk there (less than 500m)	143	22.8
It takes between 15 minutes and 1 hour (more than 500m – 2 km)	290	46.3
It takes more than one hour (more than 2 km)	194	30.9
Total	627	100.0
Waiting Time		
15 minutes or less	281	44.8
15 to 30 minutes	75	12.0
30 min to 1 hour	93	14.8
More than 1 hour	178	28.4
Total	627	100
Daily Water consumption (Liters/Person)	11.5 [11.1-12.0 95%CI]	

Safety of water depends on handling at home, especially treatment practices used at household level. Close to 89% of the households (n=556) reported didn't practice any water treatment practice, despite the fact that most access from unsafe sources. Boiling and chlorination were used by a small proportion of households, respectively, by 8.9% and 3.0% (Table 15).

Treatment of water is necessary for reducing the prevalence of water borne diseases such as diarrhea. With most (64-71%) households accessing from unsafe sources, increasing the use of appropriate water treatment practices could contribute to improved health status and nutritional outcomes.

Table 25: Water Treatment Practice

Response	N	%
Nothing	556	88.7
Boiling	56	8.9
Chlorination(aqua tabs/PUR/water guard)	19	3.0
Sitting to settle	9	1.4
Other	3	0.6

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

4.5.2. Hand Washing Practice

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 was the two most reported events, respectively by 92.7% and 52.2% of households. When asked about use of soap 32.5% of caretakers reported using soap at hand washing and 8.8% use when they can afford. 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 at any special time, when they look dirty.	115	18.3
Before latrine	47	7.5
After toilet / latrines	327	52.2
Before cooking	240	38.3
Before eating	581	92.7
Before breastfeeding	116	18.5
After taking children to the toilet	115	18.3
After handling animals	137	21.9
After working in the farm	239	38.1
Others	49	7.8

Note: Multiple responses, 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%) reported that members of households relieve themselves in the bushes or use open defecation. Those who use a family latrine within a homestead or neighbor's latrine account to about 27%. In terms of garbage disposal the majority of the households (44%) did nothing but throwing it to the surrounding environment while 30.6% reported burning their garbage.

Table 27: Households by Defecation and Garbage Deposal (N=627)

Defecation	N	%
In the bushes, open defecation	458	73.0
A family latrine in this compound	162	25.8
Neighbors latrine	7	1.1
Total	**627**	**100**
Garbage Disposal *		
Give food waste to animals	94	15.0
Put food waste into the Shamba/farm	85	13.6
Put into a pit and bury	82	13.1
Burn it	192	30.6
Nothing, or throw it into nature	276	44.0

*Multiple responses for garbage disposal, percentages don't add up to 100

To establish if there was any risk of diarrhea based on type of defection used by households (with and without latrine) analysis was performed. Children from households without latrine tend to be more at risk of diarrhea but no statistically significant association.

4.6. Food Security and Livelihoods

With the objective of assessing the households food security and livelihoods situation, data were collected on key and livelihoods 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 economic activity where 97.8% of the sample households reported to have been engaged and of this 53% identified crop farming as the main occupation of the household heads. The main crops grown in the District are sorghum, pigeon peas, cowpeas, millet, green grams, maize and beans. Crop production in Mwingi is 100% rain-fed where irrigation is constrained by water scarcity. Poor rain performance and its associated crop failures in the last three successive seasons coupled with increasing prices of food have contributed to the deterioration of the food insecurity problem. Despite the fact that over 97.8% of the sample households being engaged in farming, only about 11.6% harvested any crop in the last harvesting season depicting the extent of crop failures farmers have been experiencing (Table 19). It was reported some of the area where receiving showers which enable them to produce some of the crops.

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

Crop (N=613)	N	% HH citing any harvest	Production (Mean KG)
Maize	42	6.9	125.7
Beans	4	0.7	7.3
Pigeon pea	14	2.3	22.2
Cow peas	45	7.3	68.6
Green gram	29	4.7	45.8
Sorghum	20	3.3	69.3
Millet	36	5.9	179.9

Mean is calculated from N for the respective crops

4.6.2. Livestock Holding

Livestock production is an important livelihood activity in the survey areas. The Marginal Mixed Farming relies mostly on goats and sheep while the Mixed Farming depends mainly on cattle. Livestock is source of food, draft power and cash income. To assess the importance of the sector as source of food and livelihoods, sample households were required to indicate the type and number of animals owned at the time of the survey. The following table 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, donkeys, poultry and cattle, respectively by 68.7, 65.6, 47.0 and 44.8%. The fact that goats were kept by most households indicates the importance households attach as sources of cash income and also food (milk). Moreover, goats are adapted to the local agro-ecology. Next to goats, donkeys were owned by most households as they play important role as draft power as well as transport of goods.

Overall livestock ownership was low for households. The maximum holding per household reported was for goats (70) and poultry (40). 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=627)

Livestock	N	%	Mean (S.D)
Cattle	281	44.8	1.79 (3.1)
Goats	431	68.7	5.6 (8.2)
Sheep	71	11.3	0.6 (2.5)
Poultry	295	47.0	2.3 (3.5)
Donkeys	411	65.6	1.0 (0.9)

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

In order to assess 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 27.6% of the households reported producing milk and the average production per household was a bare minimum of 0.54 liters[7] [95% CI: 0.13-0.21].

[7] When the mean calculated from those who produced milk at the time of the survey (27.6%), the mean

Consumption of milk was also very low. 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 93% of the children weren't provided any milk. The household dietary diversity score in the following section also confirms that consumption was limited, just 16.6% consuming any milk or milk products. 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 based on the importance to individual households from first important to fourth or least important. The common sources of food in the 30 days before the survey measured by the proportion of households using as a source of food were purchase, food aid, gift and own production, respectively used by 96.5, 45.3, 21.1 & 15.9% of the households. Purchase from the market was identified the single most important sources and ranked as the first important source by most households using purchase (93.2%). The reason could be that one month before the assessment, due to breakdown in the food pipeline, there was no food distribution. As a result most of the households indicated that purchase of food was as first important source of food. There is an ongoing activity by other agencies like voucher for asset. According to the interviewee the exchange of the voucher is considered as they are purchasing. It was not clear if they pay physical cash or exchange it for voucher.

The poor rains and crop failure encountered in the past recessive seasons have led households to depend on food aid. Prior to the survey about 61%[8] the Mwingi District population was food aid recipient and the survey result on source of food and ranking indicates dependence on food aid. It is alarming that only few households were able to identify own production as a source of food, a sign of increasing dependence on food aid or purchase. With increasing prices of food, dependence on market compromises households' ability to access adequate food.

Table 30: Proportion of Households by Ranking of Food Sources (N=627)

Source of Food	N	Ranking (%)			
		1st	2nd	3rd	4th
Purchase	605	93.2	6.8	0.0	0.0
Production	100	7.0	5.0	5.0	83.0
Food Aid	284	21.1	57.0	19.4	2.5
Gift	132	1.5	50.0	41.7	6.8

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. Cereals was consumed by all households (100%), followed by pulses & nuts (60%) and sugar/honey (52%).

was 0.54 liters [95% CI: 047-0.61]

[8] KFSSG Mwingi district Long Rain Assessment (2009)

The consumption of fish, eggs, fruits, meat and roots/tubers was negligible. The average number of food groups consumed based on the 12 food groups and 24 hour recall period was 3.4 with 56% 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	627	100.0	One Food Group	92	14.67
Roots or tubers	45	7.2	Two Food Groups	151	24.08
Any vegetables	109	17.4	Three Food Groups	108	17.22
Fruits	19	3.0	Four Food Groups	90	14.35
Eggs	4	0.6	Five Food Groups	100	15.95
Meat	53	8.5	Six Food Groups	51	8.13
Fish	2	0.3	Seven Food Groups	19	3.03
Beans, peas, lentils, or nuts	376	60.0	Eight Food Groups	10	1.59
Milk or milk product	104	16.6	Nine Food Groups	5	0.80
Fat or oil	234	37.3	Ten Food Groups	1	0.16
Sugar or honey	326	52.0	Eleven Food Groups	0	0.00
Other condiments (e.g. coffee, tea)	253	40.4	Twelve Food Groups	0	0.00
Total	-	-	**Total**	**627**	**100.0**
Mean HDDS	**3.4**				

* 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. There was a statistically significant risk of malnutrition ($p<0.05$) where children from households with three or less food group were more at risk of malnutrition than their counterparts from households consuming four or more food groups.

4.6.5. Coping Strategies

The sample households were asked if any coping strategies among the list indicated in Table 23 used during the 30 days before the survey date. The households reported using a range of coping strategies amongst which prominently used include reducing the size of the meals, purchase food on credit/borrow from local vendors/relatives and skipping meals. When asked the frequency of use most households reported frequently, 3-4 times in a week (Table). The use of these 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)	Frequently (3-4/ week)	Always (≥5/week)
Skip meals (excluding Ramadan if Muslim)	19.8	34.6	44.5	1.1
Reduce the size of meals	7.8	17.1	53.4	21.7
Eat less preferred foods (e.g. foods not normally eaten, wild foods etc.)	73.4	6.4	18.2	2.1
Purchase food on credit/borrow from local vendors/relatives	13.2	21.2	62.2	3.3
Withdrawing children from school	89.2	9.4	1.4	0.0
Sell off productive assets (breeding livestock, ox, farming tools, household assets etc.)	75.8	17.1	7.2	0.0
Engaged in charcoal making, fire wood, etc.	87.7	6.4	4.6	1.3
Other	100.0	0.0	0.0	0.0

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 notoriously 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 preceding 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 57.7% of the households. The second most important source based on the proportion of households reporting was sale of livestock and livestock products (35.7% of households). Remittance, loan/credit and earning from own business were income sources for 20.1, 19.5 and 19.1% of households, respectively. Sale of bush products (charcoal & firewood) was reported by relatively small proportion, however, given the widespread charcoal production practiced in the area, the true proportion of households earning income from this source believed to be much higher as the activity was considered illegal and hence underreported.

The mean household income for the reference period was KSH 5,108 [95%CI: 4,614-5,602] and median income of KSH 3,000. Since high income reported by few households earning from salary employment skewed upwards, excluding households with salary income results to a mean income of KSH 4,424 [95%CI: 3,935-4,913] that better reflects the income of surveyed communities. The data disaggregated by gender of household heads reveals quite disparity between female and male household heads. The mean monthly income for female heads was KSH 3,773 [95% CI: 2,548- 4,998] and for males KSH 5,434 [4,899-5,969]. This could be explained partly by the main occupation of the households 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 6.1 persons the monthly per capita income for the reference period was just KSH 837 or KSH 725 excluding households earning salary income. However, actual income could be higher due to seasonal fluctuations.

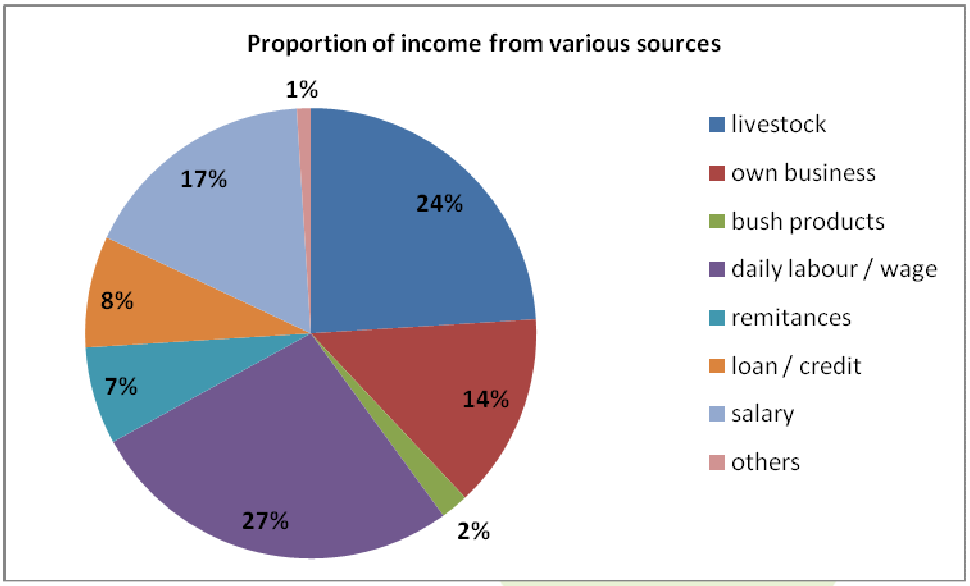
Table 33: Average Household Income from different sources (last 30 Days) KSH

Income Source	N	%	Mean (KSH)
Livestock and livestock products sale (including milk & honey)	224	35.7	3437
Earning from own business (petty/small scale trading)	120	19.1	3620
Sale of bush products (charcoal, firewood, etc.)	73	11.6	968
Daily labor/wage	362	57.7	2396
Remittances from family/relatives	126	20.1	1720
Loans /credit	122	19.5	2213
Salary	82	13.1	6603
Other	11	1.7	2915
TOTAL	**627**	**100**	**5108**

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 27% of the total income reported, followed by income from sale of livestock and livestock products accounting to 24% of the total income (Figure 5).

Figure 5: Proportion of income from various sources



Expenditures

The most reported line of expenditure for the 30 days period prior to the survey was food, cited by 98.3% of the households and which covers 63% of the total household expenditure. Farm inputs were the second most frequently reported lines of expenditure, covering 11% of the household expenditure value. It should be noted that fuel was most frequently quoted, it consume a relatively low percentage of total average expenditure. The mean monthly expenditure per household was KSH 3,960 [95% CI: 3,653-4,267], food expenditure constitutes the lion share (KSH 2,493). Comparing the monthly mean income with the mean expenditure, it appears that there was a net income in excess of expenditure which is very unlikely. One potential factor could be the seasonal fluctuations since the income and expenditure data covered the 30 days prior to the survey. Like the income, the expenditure data could be biased due to seasonality and missing expenditure lines.

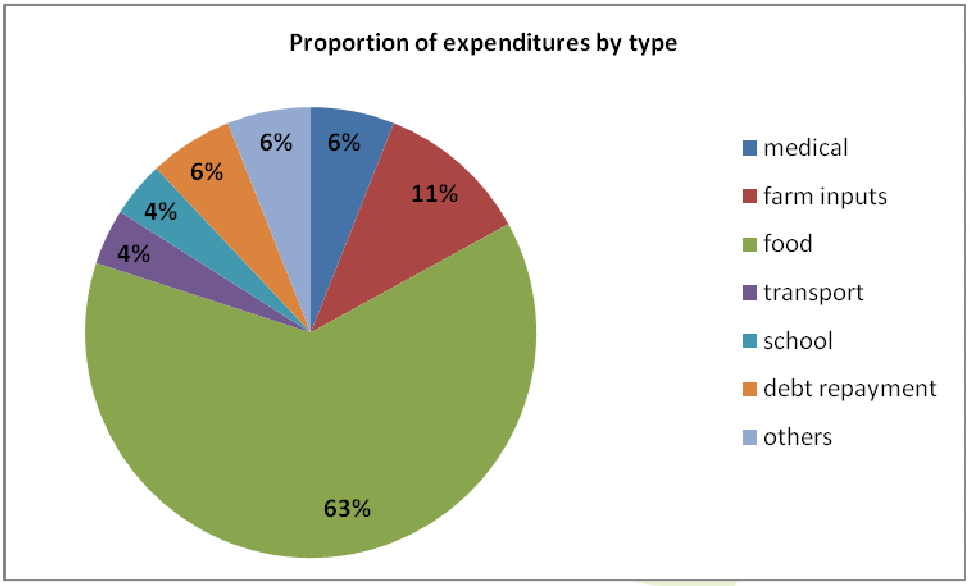
Table 34: Average monthly household expenditure the last 30 days (KSH)

Expenditure	N	%	Mean (KSH)
Medical and health (service fees, medicine, etc.)	283	45.1	509
Farm inputs (seeds, fertilizers, livestock medication, etc)	350	55.8	764
Food	606	96.7	2579
Water	186	29.7	280
Transportation	148	23.6	638
School (fees, books, uniform, etc.)	216	34.4	495
Debt repayments	195	31.1	791
Fuel	376	60.0	139
Clothing	64	10.2	715
Others	7	1.1	251
Total	627	100	3960

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

Breakdown by types of expenditure reveals that food expenditure accounts to 63%, followed by farm inputs purchase (11%).

Figure 6: Proportion of expenditures per type



5. CONCLUSION AND RECOMMENDATIONS

The nutritional assessment provided information on nutritional status specifically on the prevalence of acute malnutrition and on the immediate and underlying contributing factors. With WHO Growth Standards 2006, the GAM rate was 8.9%. Although the rate with 95% confidence interval was below the 15% WHO emergency threshold, the prevalence was within poor to serious range requiring adequate attention. The situation requires a look into the prevention, identification, referral and treatment of acutely malnourished children in order to ensure addressing the nutritional problems in a timely and adequate manner. Interventions in child feeding and care practices, water and sanitation and diversification of livelihood options should be an integral component of addressing the problem on the long-term basis. The following are possible areas of interventions.

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 non existent 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 a scarce resource, particularly in the dry season. Quantity and quality was shown to be inadequate. Considering that close sources seem to be prioritized by households,

investment should be made in aiming to make "close sources" into "safe sources". Households have to trek long distance and spend time queuing at water points. Supporting in the construction/provision of large water containers/storage would contribute in easing the problem of water.

- To improve health and nutritional outcome, ensuring that water is safe through introduction of improved and simple water treatment practices and increasing awareness through promotion of hygienic practices.
- There was limited coverage in terms of access to latrines where over 70% of households use open field defecation. This will undoubtedly contribute to spread of communicable diseases such as diarrhea. Increasing latrine coverage would contribute to improved hygiene and health and ultimately to improved nutritional status

Food Security/Livelihoods

- Households are net buyers of food using income primarily from daily labor and sale of livestock. The total value of Expenditure on food was about 63% of income. An increase in the price of cereals will have serious implication on the food security of the population. Improving the terms of trade i.e. income from labor and livestock versus the price of food contributes to households' continued access to adequate food. Support income-generating activities as a way to diversify income sources with special focus on female headed households would be one potential area of intervention. Further detailed analysis is required to identify specific needs and come up with feasible strategies.
- Crop farming was highly rainfall dependent contrary to the fact that rainfall was highly unreliable and risk of crop failures. There is a need to diversify crop farming from reliance on staple maize which is not drought tolerant towards more drought tolerant crops like sorghum, millet. The potential for water harvesting for irrigation in areas where feasible should also be explored.
- The effect of the drought combined with high food price required an immediate response. In short term, access to the humanitarian assistant should be increased for those most vulnerable households, so as to protect the household asset 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

Geographical unit	Population size	Cluster	Geographical unit	Population size	Cluster
Mukeke	98		Kalangungi	549	
Wangw'iu B	262		Kaluku North	328	
Kia	265		Mukameni	492	
Kangilyo	99		Nzeeni	262	
Kiliku	195		Kyakali	258	
Mitang'a	217		Kivundui	358	
Nguuweni	159		Kakunguu	272	
Mimuuni	320		Kyamwea	359	
Wangw'iu A	139		Kaseve	258	11
Kyambu	351		Ingoi	338	
Nguka Imwe	353		Muangeni C	292	
Kithituni	396		Ngieni	560	12
Kavuti	346	1	Kaai	442	
Ngulini	258		Kawala	297	13
Nzanzu	627		Kandundu	301	
Nduyuni	200		Kalesi	352	
Imwamba	566	2	Kiwani	160	
Mitavo	447		Kavui	240	
Luluu	552	3	Kimongo	210	
Matulani	448		Yungama Nduu	380	
Kiviu	505		Mutoleka	249	
Kyunduani	339	4	Kaluku South	233	
Kalalani	371		Kaluma	276	
Kyumakethe	259		kavisu	282	14
Mikuyuni	255		katutu	246	
Kwangumu	163		kuanzue	216	
Mutulu	192		Kamulengeni	240	
Kyutuni	366		Ngutani	210	
Ilamba	413		Kaundua	140	
Mbia	289	5	Ngaza	155	
Mbuuni	230		Kitundumo	284	
Kyangati	267	6	Yumbandei	126	
Ndandini	245		Mungao	132	15
Muthithini	302	RC	Kyangawee	126	
Ngangani	296		Katune	201	
Yulambesa	208		Ivuusya	162	
Kawelu	427	7, 8	Mutembuka	182	
Yongoni	206		Kitala	360	16
Kaluilaa	520		Musovo	368	
Yatwa	359		Musosya	282	
Nzongoini	321		Kyanika	306	
Nguuni	389	9, 10	Muaani	285	
Nzeeni	294		Matia	462	
Kanyungu	491		Syumiatu	361	
Kandongu	410		musyosya	460	
Wisili	386		Ngauluka	440	
Kamaende	368		Katiliku	191	21

Geographical unit	Population size	Cluster	Geographical unit	Population size	Cluster
Kiwanza	338	17	Karuini	163	
Tumbuni	232		Nzikani	204	22
Ukasi	245		Kwakitoo	226	
Mutwauthau	228		Levoni	150	
Town	136		Kakunike	248	
Kitumbini	170		Kavuko	154	
Kathumula	114		Kalandini	107	
Imba	114		Kiatine	150	
Mulinde	114		Ngulini	114	
Nzikani	114		Musasiki	130	
Makutano	114	18	Kiseuni	103	
Mwalali	114		Nthiitu	150	
Mauu	114		Syukimau	109	
Kanako	114		Kasunguni	105	
Kaango	114		Kalulu	110	
Kaluma	114		Kalanga C	293	
Kyalumuko	114		Kalanga B	266	
Kilile	114		Kwasyukatenge	311	
Kavuluti	114		Mwania	425	
Mathini	114		Kiisu	397	
Kasaa	114		Yondo	364	
Kiio	114		Kyanda	213	
Myuuni	114		Mukini	292	
Yasomba	114		Syamatani	292	
Ngooni	114		Muangeni	261	
Sosoma Junction	114		Kamuliwu	224	
Manzui	114		Kawalasere	346	
Ililuni	114		Mwusuma	231	
Kwetumo	114		Kawala	355	
Sosoma	114		Mwalikanzi	356	
Mbuvu	150		Maatini	354	
Kyanguli	164		Isou	284	
Kathungu	122		Itungali	266	23
Nding'eni	203		Kamukuna	306	
Mandove	276		Musavani	224	
Kasomo	146		Kalulu	337	24
Kamulalani	215	19	kilindini	367	
Muthamba	211	RC	Kisime	283	25
Kavala	169		Kavoko	283	
Malatani	242		Kangarai	243	
Kathome	140		Mutalani	450	
Kakongo	215		Nzalani	303	
Kendili	130		Syunoo	333	
Kathuri	220		Kithumula	276	
Kasyathyu	107		Nzengeni	427	26
Kangoto	170	20	Kyanzendu	280	
Thaana	177		Kaliani	229	27
Levakoo	429		Kandatha	300	

Geographical unit	Population size	Cluster	Geographical unit	Population size	Cluster
Kwanzili	238		Kakokoa	360	
Katooni	301		kathungu	540	
Makuka	314	28	Kalalani	360	
Kyambusya	242		Kasanga	356	
Ndiamuno	239		Ngathuni	375	30, 31
Musalani	368		Ilioni	358	
Kaluku	259		Imale	325	
Levuni	363		Ngalange	308	RC
Kaundua	298		Kasyathuni	265	
Kakunguu	395		Kalalani	388	
Kyenini	237	29	Syamatani	290	
Kivou	318		Nguni Kuruni	179	
Kathaala	258		Mwaangeni/Kyungu	386	
Kyaangu	362		Itavanguu	337	
Kwanyumu	220		Kyanzou	260	32
Kwangumu	216		Itaa	260	
Kitovoto	350		Nziitu	224	
Syumiko	300		Muuna	278	
Kyuasini	332		Kamanga	264	
Mbondoni	218		Kyandani	243	
Muunga	314		Kalimbui	375	
Kawela	205		Usi wiu	329	
Kalanga	210		Nguuni	355	
Katumbi	240		Kaluilaa	263	RC
Ndaluni	234		Kiluilu	249	33
Itoloni	244		Kawongo	390	
Kingetho	250		Kwakamari	320	
Kangarai	131		Ndooni	290	
Kaivirya	198		Ngiluni	240	34
Kavutoni	264		Muthungue	260	
Kilindini	152		Ngauni	190	35
Sumoni	200		Masimbani	180	
Kilawa	245		Kathiani	400	
Mwangea	180		Kalimani	325	
Kwamwanza	150		Musambyo	260	
Kangae	185		Utingaa	275	
Kambwee	120		Ngovovoni	380	
Kaumini	165		Muthunyani	210	
Ngongoni	130		Karindi	270	
Kiamurikima	179		Kyandani	265	
Kamatungu	179		Ngaani	295	36
Gakuranja	170		Kwa mathumbi	260	
Makauru	142		Syumavuo	305	
Itavangungi	139		Katumbi	300	
kavogo	135		Ndongolange	270	
Kariuko	165		Utundumaa	290	
Kangwata	168		Musambyo	270	RC
Miangeni	260		Ngereni	217	

Geographical unit	Population size	Cluster	Geographical unit	Population size	Cluster
Katilinge	275		Thangatha	230	
Kayoveaa	300		Nzikani	211	
Makulende	300		Siveta	226	
Kaimiaa	325		Ngathuni	205	
Kyamuta	350		Kakua Wee	212	41
Kinolu	313		Kithurini	201	
Kiseuni	326		Ikuma Nzai	184	
Nganga 1	327		Nyamboni	281	
Kathuri	341		Kenu	182	
Kyambere	327		Ndunguni	214	
Kathungu	397		Nthi Yonthe	176	
Kauma	334		Kaningo	223	
Kwa Mweu	225		karumu	226	
Karisa	430		Masasini	201	
Kasaini	326		Mukekeni	202	
Mangulu	469		Maru	213	
Ituva	220		Kamuthanga	287	
Maseveseveni	212		Itura	260	
Mbiriviri	454		Ngamyone	176	
Kalambani	201		Kithayoni	187	
Kwa Mbiti	302	37	Makathia	188	
Ngomano	209		Kasolelo	167	
Kyenini	392		Masimbani	183	
Kaminyambu	475		Twaathi	605	
Ilamba	311		Ndunguni	496	
Nduguini	402		Tulanduli	381	
Kangovi	224		Kaango	388	42
Manzinga	262		Kakunguu	496	
Ngomano	237		Musenge	306	
Mususya	266		Kavaani	544	43
Mathurini	234		Syumithwa	656	
Kiseuni	257		Mulingani	464	
Katambaliku	333		Katoo	392	
Kaseluni	231		Katangini	504	44
Kakunguu	346		Mutambui	424	
Unyoleni	208	38	Mandongoi	784	45
Itunguni	227		Kasiluni	472	
Kangemi	295		Masamba	480	
Kithimani	215		Kakunguu	664	
kamivunga	399		Kanyungi	592	46
Kamboya	334	39, 40	Ikime	832	
Kalulu	239		Yamwenze	800	
Kalalani	322		Manzungi	536	
Ngeani	233		Mutulu	768	
Kyamalutu	268		Itivanzou	656	47
Kyangini	229		Mukavo	536	
Kamaguna	337		Kathua	384	

Geographical unit	Population size	Cluster
Inywanzai	624	
Mutwakata	342	
Imale	396	
Kalunge	360	
Manguu	414	48
Kyambyu	258	
Makuka	402	
Malatani	276	
Karengi	300	
Syunguu	335	
Wikilumi	335	
Kamavui	435	
Katoo	310	
Ngulini	435	
Munyinginyi	265	
Katue	315	
Kanzika	310	
Ikongo	290	
Kyangima	375	
Kwanguna	270	
Ilange	425	
Mutulya N	530	49
Katumbini	460	50
Mutulya S	610	
Ngomano	380	
Tumana	550	
Mutusya	280	
Mutala	335	
Mavaoni	420	
Itumbwa	380	
Ndatani	570	
Wengeni	430	
Maturumbe	400	
Nzouni	300	RC
Kyanganga	325	
Mavauni B	350	

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 Calendar of Events

MONTH	SEASONS	MAIN ACTIVITIES	2004	2005	2006	2007	2008	2009
JANUARY (Mwai wa Mbee)	NGETHA (HARVEST)	New year celebrations School opening		57	45	33 Somali-Kenya border closes	21 Post election Skirmishes	10
FEBRUARY (Mwai wa Keli)		Valentine Day		56	44	32	20	9
MARCH (Mwai wa Katatu)		Move to water points. Preparation of farm lands.		55	43)	31	19 Grand Coalition	8
APRIL (Mwai wa Kana)	MBUA YA W'UUA (SHORT RAINS)	Easter Holiday School holiday		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)		Labour day		53	41	29	17	6 KATULU (FOOD FOR WORK)
JUNE (Mwai wa Thanthatu	NGETHA (HARVEST)	Madaraka day		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)		Circumcision for boys		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.		**49**	**37**	**25** Ramathan	**13** Idd Fitr	**2**
OCTOBER (Mwai wa Ikumi)	**PLANTING AND LONGRAINS START**	MOI day&Kenyatta day celebration		**48** Ramatha n	**36** Ramathan	**24** Idd Fitr Start of Heavy rains	**12**	**1**
NOVEMBER (Mwai wa Ikumi na Umwe)	**MBUA YA NZWA (LONG RAINS)**	KCPE Exams	**59**	**47**)	**35** Idd Fitr and Referendu m	**23** Flooding	**11**	
DECEMBER (Mwai wa Ikumi na Ili)		Christmas celebration	**58**	**46**	**34** Start of severe drought	**22** General elections in Kenya	**10**	

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: Mwingi 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** (1.7 %)
Overall Sex ratio	Incl	p	>0.1	>0.05	>0.001	<0.000	
(Significant chi square)			0	2	4	10	**0** (p=0.573)
Overall Age distrib	Incl	p	>0.1	>0.05	>0.001	<0.000	
(Significant chi square)			0	2	4	10	**4** (p=0.022)
Dig pref score - weight	Incl	#	0-5	5-10	10-20	> 20	
			0	2	4	10	**0** (4)
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** (-0.09)
Kurtosis WHZ	Excl	#	<±1.0	<±2.0	<±3.0	>±3.0	
			0	1	3	5	**0** (0.12)
Poisson dist WHZ-2	Excl	p	>0.05	>0.01	>0.001	<0.000	
			0	1	3	5	**1** (p=0.020)
Timing	Excl	Not determined yet					
			0	1	3	5	
OVERALL SCORE WHZ =			<5	<10	<15	<25	**5** %

At the moment the overall score of this survey is 5 %, 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=15/ID=15: **WHZ (2.574)**, Weight may be incorrect
Line=85/ID=4: HAZ (1.695), Age may be incorrect
Line=304/ID=5: HAZ (2.736), Age may be incorrect
Line=306/ID=7: HAZ (-5.797), Age may be incorrect
Line=376/ID=15: **WHZ (3.228)**, Weight may be incorrect
Line=377/ID=16: **WHZ (3.331)**, WAZ (1.491), Weight may be incorrect
Line=381/ID=4: **WHZ (-3.871)**, Weight may be incorrect
Line=408/ID=2: HAZ (3.993), Age may be incorrect
Line=419/ID=13: HAZ (-5.543), WAZ (-4.725), Age may be incorrect
Line=422/ID=16: **WHZ (-4.155)**, Weight may be incorrect
Line=445/ID=8: HAZ (0.998), Age may be incorrect
Line=455/ID=4: **WHZ (3.060)**, Weight may be incorrect
Line=462/ID=11: **WHZ (-4.049)**, HAZ (0.981), Height may be incorrect
Line=522/ID=5: **WHZ (2.778)**, Height may be incorrect
Line=541/ID=10: HAZ (-5.551), Age may be incorrect
Line=591/ID=1: **WHZ (2.630)**, HAZ (-5.287), Height may be incorrect
Line=621/ID=3: HAZ (-5.191), WAZ (-4.895), Age may be incorrect

Line=660/ID=11: **WHZ (2.735)**, Weight may be incorrect
Line=663/ID=1: **WHZ (-3.593)**, HAZ (1.607), Height may be incorrect
Line=677/ID=2: **WHZ (-3.682)**, Weight may be incorrect

Percentage of values flagged with SMART flags:WHZ: 1.7 %, HAZ: 1.6 %, WAZ: 0.4 %

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: 0.91 (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	76/84.0 (0.9)	96/80.5 (1.2)	172/164.5 (1.0)	0.79
18 to 29	12	81/81.9 (1.0)	84/78.5 (1.1)	165/160.4 (1.0)	0.96
30 to 41	12	96/79.4 (1.2)	82/76.1 (1.1)	178/155.5 (1.1)	1.17
42 to 53	12	77/78.1 (1.0)	64/74.9 (0.9)	141/153.0 (0.9)	1.20
54 to 59	6	32/38.6 (0.8)	21/37.0 (0.6)	53/75.7 (0.7)	1.52
6 to 59	54	362/354.5 (1.0)	347/354.5 (1.0)		1.04

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

Overall sex ratio: p = 0.573 (boys and girls equally represented)
Overall age distribution: p = 0.022 (significant difference)
Overall age distribution for boys: p = 0.248 (as expected)
Overall age distribution for girls: p = 0.015 (significant difference)
Overall sex/age distribution: p = 0.001 (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: **4** (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	exclusion from observed mean
.			

.		(EPI Info 6 flags)	(SMART flags)	
WHZ				
Standard Deviation SD:	1.08	1.08	0.99	
(The SD should be between 0.8 and 1.2)				
Prevalence (< -2)				
observed:	8.9%	8.9%		
calculated with current SD:	9.4%	9.4%		
calculated with a SD of 1:	7.9%	7.9%		
HAZ				
Standard Deviation SD:	1.20	1.20	1.11	
(The SD should be between 0.8 and 1.2)				
Prevalence (< -2)				
observed:	53.9%	53.9%	54.0%	
calculated with current SD:	53.3%	53.3%	54.0%	
calculated with a SD of 1:	54.0%	54.0%	54.4%	
WAZ				
Standard Deviation SD:	1.02	1.02	1.00	
(The SD should be between 0.8 and 1.2)				
Prevalence (< -2)				
observed:	33.1%	33.1%	33.0%	
calculated with current SD:	33.7%	33.7%	33.3%	
calculated with a SD of 1:	33.4%	33.4%	33.2%	

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

WHZ	p= 0.000	p= 0.000	p= 0.031
HAZ	p= 0.000	p= 0.000	p= 0.105
WAZ	p= 0.577	p= 0.577	p= 0.458

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

Skewness

WHZ	0.04	0.04	-0.09
HAZ	0.25	0.25	0.03
WAZ	-0.08	-0.08	-0.04

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	0.96	0.96	0.12
HAZ	1.04	1.04	-0.37
WAZ	0.01	0.01	-0.17

(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=1.46 (p=0.020)

WHZ < -3: ID=0.94 (p=0.595)
GAM: ID=1.46 (p=0.020)
SAM: ID=0.94 (p=0.595)
HAZ < -2: ID=1.73 (p=0.001)
HAZ < -3: ID=1.43 (p=0.027)
WAZ < -2: ID=1.73 (p=0.001)
WAZ < -3: ID=1.51 (p=0.012)

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: 1.09 (n=50, f=2)  ############
02: 1.02 (n=50, f=1)  #########
03: 1.10 (n=50, f=0)  #############
04: 1.19 (n=50, f=2)  ################
05: 1.07 (n=50, f=1)  ###########
06: 1.13 (n=50, f=0)  ##############
07: 0.89 (n=50, f=0)  ####
08: 1.12 (n=50, f=0)  ##############
09: 1.03 (n=49, f=0)  #########
10: 0.81 (n=48, f=0)
11: 1.15 (n=48, f=2)  ################
12: 1.04 (n=46, f=0)  ##########
13: 1.00 (n=45, f=0)  ########
14: 0.94 (n=27, f=0)  OOOOOO
15: 1.42 (n=18, f=2)  OOOOOOOOOOOOOOOOOOOOOOOOO
16: 1.94 (n=12, f=2)  ~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
17: 0.72 (n=09, f=0)
18: 1.27 (n=05, 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:	1.4	3.8	0.8	1.2	1.4
HAZ:	0.0	1.5	3.3	2.4	0.7
WAZ:	0.0	0.8	0.0	1.2	0.0
Age ratio of 6-29 months to 30-59 months:					
	0.86	0.93	1.03	1.13	0.65
Sex ratio (male/female):					
	0.99	1.05	0.97	1.00	1.23
Digit preference Weight (%):					
.0 :	7	9	11	9	8

.1 :	12	8	10	13	10	
.2 :	9	8	13	10	12	
.3 :	11	6	10	10	8	
.4 :	17	11	9	10	10	
.5 :	12	9	14	15	10	
.6 :	10	12	9	10	17	
.7 :	7	12	8	4	8	
.8 :	6	13	10	9	12	
.9 :	10	13	7	11	6	
DPS:	10	8	7	9	10	Digit preference score (0-5 good, 5-10 acceptable, 10-20 poor and > 20 unacceptable)

Digit preference Height (%):

.0 :	8	12	13	11	6	
.1 :	6	10	7	13	13	
.2 :	10	13	11	8	14	
.3 :	15	10	12	11	12	
.4 :	11	11	8	8	11	
.5 :	13	17	11	11	6	
.6 :	13	8	11	8	14	
.7 :	9	9	13	8	6	
.8 :	5	6	7	9	9	
.9 :	10	5	10	11	8	
DPS:	10	11	7	5	11	Digit preference score (0-5 good, 5-10 acceptable, 10-20 poor and > 20 unacceptable)

Standard deviation of WHZ:

SD	1.09	1.22	0.97	1.00	1.09
Prevalence (< -2) observed:					
%	10.3	9.0			6.2
Prevalence (< -2) calculated with current SD:					
%	10.6	12.8			8.0
Prevalence (< -2) calculated with a SD of 1:					
%	8.7	8.3			6.3

Standard deviation of HAZ:

SD	1.07	1.22	1.34	1.26	1.12
observed:					
%	51.0	54.1	50.8	58.4	53.8
calculated with current SD:					
%	55.6	54.2	50.3	54.1	52.3
calculated with a SD of 1:					
%	56.0	55.1	50.4	55.1	52.5

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	13/16.7 (0.8)	20/16.9 (1.2)	33/33.6 (1.0)	0.65
18 to 29	12	19/16.3 (1.2)	15/16.5 (0.9)	34/32.8 (1.0)	1.27
30 to 41	12	23/15.8 (1.5)	14/16.0 (0.9)	37/31.8 (1.2)	1.64
42 to 53	12	10/15.5 (0.6)	17/15.8 (1.1)	27/31.3 (0.9)	0.59
54 to 59	6	7/7.7 (0.9)	7/7.8 (0.9)	14/15.5 (0.9)	1.00
6 to 59	54	72/72.5 (1.0)	73/72.5 (1.0)		0.99

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

Overall sex ratio: p = 0.934 (boys and girls equally represented)
Overall age distribution: p = 0.802 (as expected)
Overall age distribution for boys: p = 0.158 (as expected)
Overall age distribution for girls: p = 0.891 (as expected)

Overall sex/age distribution: p = 0.103 (as expected)

Team 2:

Age cat.	mo.	boys	girls	total	ratio boys/girls
6 to 17	12	12/15.8 (0.8)	17/15.1 (1.1)	29/30.9 (0.9)	0.71
18 to 29	12	18/15.4 (1.2)	17/14.7 (1.2)	35/30.1 (1.2)	1.06
30 to 41	12	17/14.9 (1.1)	13/14.3 (0.9)	30/29.2 (1.0)	1.31
42 to 53	12	11/14.7 (0.7)	12/14.0 (0.9)	23/28.7 (0.8)	0.92
54 to 59	6	10/7.3 (1.4)	6/6.9 (0.9)	16/14.2 (1.1)	1.67
6 to 59	54	68/66.5 (1.0)	65/66.5 (1.0)		1.05

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

Overall sex ratio: p = 0.795 (boys and girls equally represented)
Overall age distribution: p = 0.681 (as expected)
Overall age distribution for boys: p = 0.463 (as expected)
Overall age distribution for girls: p = 0.889 (as expected)
Overall sex/age distribution: p = 0.303 (as expected)

Team 3:

Age cat.	mo.	boys	girls	total	ratio boys/girls
6 to 17	12	14/13.7 (1.0)	25/14.2 (1.8)	39/27.8 (1.4)	0.56
18 to 29	12	11/13.3 (0.8)	11/13.8 (0.8)	22/27.1 (0.8)	1.00
30 to 41	12	15/12.9 (1.2)	17/13.4 (1.3)	32/26.3 (1.2)	0.88
42 to 53	12	15/12.7 (1.2)	8/13.2 (0.6)	23/25.9 (0.9)	1.88
54 to 59	6	4/6.3 (0.6)	0/6.5 (0.0)	4/12.8 (0.3)	
6 to 59	54	59/60.0 (1.0)	61/60.0 (1.0)		0.97

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

Overall sex ratio: p = 0.855 (boys and girls equally represented)
Overall age distribution: p = 0.011 (significant difference)
Overall age distribution for boys: p = 0.737 (as expected)
Overall age distribution for girls: p = 0.001 (significant difference)
Overall sex/age distribution: p = 0.000 (significant difference)

Team 4:

Age cat.	mo.	boys	girls	total	ratio boys/girls
6 to 17	12	22/19.3 (1.1)	24/19.3 (1.2)	46/38.5 (1.2)	0.92
18 to 29	12	17/18.8 (0.9)	25/18.8 (1.3)	42/37.6 (1.1)	0.68
30 to 41	12	19/18.2 (1.0)	18/18.2 (1.0)	37/36.4 (1.0)	1.06
42 to 53	12	21/17.9 (1.2)	13/17.9 (0.7)	34/35.8 (0.9)	1.62
54 to 59	6	4/8.9 (0.5)	3/8.9 (0.3)	7/17.7 (0.4)	1.33
6 to 59	54	83/83.0 (1.0)	83/83.0 (1.0)		1.00

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

Overall sex ratio: p = 1.000 (boys and girls equally represented)
Overall age distribution: p = 0.073 (as expected)
Overall age distribution for boys: p = 0.435 (as expected)
Overall age distribution for girls: p = 0.076 (as expected)
Overall sex/age distribution: p = 0.016 (significant difference)

Team 5:

Age cat.	mo.	boys	girls	total	ratio boys/girls
6 to 17	12	15/18.6 (0.8)	10/15.1 (0.7)	25/33.6 (0.7)	1.50
18 to 29	12	16/18.1 (0.9)	16/14.7 (1.1)	32/32.8 (1.0)	1.00
30 to 41	12	22/17.5 (1.3)	20/14.3 (1.4)	42/31.8 (1.3)	1.10
42 to 53	12	20/17.3 (1.2)	14/14.0 (1.0)	34/31.3 (1.1)	1.43
54 to 59	6	7/8.5 (0.8)	5/6.9 (0.7)	12/15.5 (0.8)	1.40
6 to 59	54	80/72.5 (1.1)	65/72.5 (0.9)		1.23

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

Overall sex ratio: p = 0.213 (boys and girls equally represented)
Overall age distribution: p = 0.163 (as expected)
Overall age distribution for boys: p = 0.597 (as expected)
Overall age distribution for girls: p = 0.321 (as expected)
Overall sex/age distribution: p = 0.066 (as expected)

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: 0.56 (n=10, f=0)
02: 1.41 (n=10, f=1)  ##########################
03: 0.71 (n=10, f=0)
04: 1.07 (n=10, f=0)  ###########
05: 1.06 (n=10, f=0)  ###########
06: 1.34 (n=10, f=0)  #######################
07: 1.30 (n=10, f=0)  #####################
08: 1.26 (n=10, f=0)  ###################
09: 0.70 (n=10, f=0)
10: 0.89 (n=10, f=0)  ####
11: 0.53 (n=10, f=0)
12: 1.12 (n=10, f=0)  ##############
13: 1.13 (n=10, f=0)  ##############
14: 1.26 (n=05, f=0)  OOOOOOOOOOOOOOOOOOO
15: 2.24 (n=04, f=1)
OOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOO
16: 0.93 (n=03, f=0)  ~~~~~
17: 0.78 (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: 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: 1.68 (n=10, f=1)  #####################################
02: 0.68 (n=10, f=0)
03: 1.16 (n=10, f=0)  ###############
04: 0.89 (n=10, f=0)  ####
05: 1.50 (n=10, f=1)  ############################
06: 1.56 (n=10, f=0)  ################################
```

07: 0.66 (n=10, f=0)
08: 0.89 (n=10, f=0) ####
09: 1.09 (n=09, f=0) ############
10: 0.90 (n=09, f=0) ####
11: 0.87 (n=09, f=0) ###
12: 1.47 (n=09, f=0) ############################
13: 0.98 (n=08, f=0) ########
14: 0.40 (n=05, f=0)
15: 1.86 (n=03, f=1) ~~~~~~

(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: 1.16 (n=09, f=0) ###############
02: 1.02 (n=09, f=0) #########
03: 0.93 (n=09, f=0) ######
04: 0.84 (n=09, f=0) ##
05: 1.05 (n=09, f=0) ##########
06: 1.05 (n=09, f=0) ##########
07: 0.91 (n=09, f=0) #####
08: 0.79 (n=09, f=0)
09: 0.63 (n=09, f=0)
10: 1.00 (n=09, f=0) ########
11: 1.13 (n=09, f=1) ###############
12: 0.18 (n=08, f=0)
13: 0.92 (n=08, f=0) #####
14: 1.58 (n=04, f=0) OOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOO

(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: 1.11 (n=11, f=0) #############
02: 0.84 (n=11, f=0) ##
03: 0.88 (n=11, f=0) ###
04: 1.41 (n=11, f=1) ##########################
05: 0.79 (n=11, f=0)
06: 0.83 (n=11, f=0) #
07: 0.53 (n=11, f=0)
08: 1.09 (n=11, f=0) ############
09: 1.23 (n=11, f=0) ##################
10: 0.60 (n=11, f=0)
11: 1.15 (n=11, f=0) ###############
12: 0.75 (n=10, f=0)
13: 1.21 (n=10, f=0) #################
14: 0.42 (n=07, f=0)
15: 0.78 (n=06, f=0)
16: 1.47 (n=05, f=1) OOOOOOOOOOOOOOOOOOOOOOOOOOO
17: 0.83 (n=04, f=0) O
18: 1.44 (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: 0.81 (n=10, f=0)  #
02: 0.95 (n=10, f=0)  ######
03: 1.16 (n=10, f=0)  ###############
04: 1.51 (n=10, f=1)  ##############################
05: 0.83 (n=10, f=0)  #
06: 0.83 (n=10, f=0)  #
07: 0.95 (n=10, f=0)  ######
08: 1.23 (n=10, f=0)  ##################
09: 1.30 (n=10, f=0)  ####################
10: 0.49 (n=09, f=0)
11: 1.64 (n=09, f=1)  ####################################
12: 1.27 (n=09, f=0)  ####################
13: 0.85 (n=09, f=0)  ##
14: 0.53 (n=06, f=0)
15: 1.20 (n=04, f=0)  OOOOOOOOOOOOOOOO
16: 1.70 (n=03, f=0)  OOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOO
17: 0.61 (n=02, f=0)
18: 0.44 (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)

(for better comparison it can be helpful to copy/paste part of this report into Excel)