INTEGRATED NUTRITION SURVEY OF 6 TO 59 MONTH CHILDREN

RATHEDAUNG TOWNSHIP
RAKHINE STATE, REPUBLIC OF THE UNION OF MYANMAR

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Final report

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LIST OF ACRONYMS

ACF	Action Contre la Faim
CI	Confidence Interval
CLTS	Community Lead Total Sanitation
CWF	Ceramic Water Filter
CMAM	Community based Management of Acute Malnutrition
ENA	Emergency Nutrition Assessment
FCS	Food Consumption Score
FS	Food Security
GAM	Global Acute Malnutrition
HAZ	Height for Age z-score
HDDS	Household Dietary Diversity Score
ID	Index of Dispersion
IDDS	Individual Dietary Diversity Score
IDP	Internally Displaced Person
INGO	International Non-Governmental Organization
IUGR	Intra-uterine growth restriction
IYCF	Infant and Young Child Feeding
LBW	Low birth weight
MAM	Moderate Acute Malnutrition
MH	Mental Health
MICS	Multiple Indicator Cluster Survey
MOH	Ministry of Health
MUAC	Middle Upper Arm Circumference
NCHS	National Centre for Health Statistics
NGO	Non-Governmental Organization
PLW	Pregnant and Lactating Women

SAM	Severe Acute Malnutrition
SMART	Standardized and Monitoring Assessment for Relief and Transition
SD	Standard Deviation
UN	United Nations
UNDP	United Nation Development Program
UNHCR	United Nations High Commissioner for Refugees
UNICEF	United Nations International Children's Emergency Fund
WASH	Water, Sanitation and Hygiene
WAZ	Weight for Age z-score
WHO	World Health Organization
WHZ	Weight for Height z-score
WFP	World Food Program

SUMMARY

The main objective of the survey was to assess the prevalence of global and severe acute malnutrition among children from 6 to 59 months old in Rathedaung Township. This survey established a baseline, since no previous surveys had been done before in this Township.

The survey was conducted using a two stage random cluster sampling methodology. The target population for the anthropometric survey was children between 6-59 months as they represent the most vulnerable part of a population in regard to malnutrition. Standardized Monitoring and Assessment of Relief and Transitions (SMART) methodology was used for all components of the survey from the preparation phase to the report writing. Analysis of the data was performed using ENA for SMART November 10, 2014, Epi Info version 7 and excel. Data collected pertained to anthropometric measurements for children 6-59 months, Pregnant and Lactating Women (PLW); morbidity; Infant & Young Child Feeding (IYCF) practices; Food Security (FS); Water, Sanitation and hygiene (WASH) and Mental Health (MH).

A total of 372 children aged 6-59 months were included in the survey. The prevalence of global acute malnutrition (GAM) was 10.5% (6.7 – 16.0 95% C.I) and severe acute malnutrition (SAM) was 1.6% (0.7- 3.8 95% C.I).
Global stunting was 37.9% (31.8-44.4 95% C.I) and severe stunting was 15.6% (11.9- 20.2 95% C.I). Global underweight was 30.4% (24.4-37.2 95% C.I.) and severe underweight was 10.5 % (6.2 - 17.3 95% C.I.)

A total of 193 Pregnant and Lactating Women were included in the survey.
9.3% of the Pregnant and Lactating women had a MUAC under 210 mm. 33.7% of them were found with MUAC <230mm.

Findings revealed measles vaccination coverage of 59.2% for 9-59 months old children. Vitamin A supplementation in the last six months had occurred in 39.7% of children. 65% of children were reported having some sort of acute illness.

The IYCF section of the survey included 107 children 6-23 months. The percentage of children receiving a minimum acceptable diet was low**:** 12.4%

Food security information from 276 households was collected. The average household dietary diversity score (HDDS) was 6.4, which is above the minimum acceptable score of 4. The Food Consumption Score (FCS) revealed that 96% of households had an adequate FCS and 4% had a borderline FCS.

Regarding mental health status, 275 mothers/caretakers were interviewed. 41.8% show a score less than the threshold for poor well-being (13) and thus potentially affected by depressive mood and stress. The average score for all respondents was 13.6, almost equal to the threshold. As a result, the level of wellbeing is considered generally acceptable.

The villages assessed show low sanitation coverage with only 27% of the 273 households surveyed reporting the use of latrine and just about half of the schools having latrines. In terms of drinking water source, 97% of households had no access to an improved water source and only 67% reported treating the water, however, typically with ineffective methods. Analysis of hygiene practices evidenced the need of improvements in this issue as well.

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1. CONTEXT

1.1 General Context

The Union of Myanmar is the second largest country by geographical area in the Southeast Asian region. The country shares borders with Thailand, Laos and the People's Republic of China to the east and north-east and Bangladesh and India to the west and northwest. One third of Myanmar's total perimeter forms an uninterrupted coastline to the Bay of Bengal and the Andaman Sea.

Myanmar is made up of 7 divisions and 7 states. The divisions are mostly populated by ethnic Bamars (Ayeyarwaddy, Sagaing, Tanintharyi, Magway, Bago, Yangon and Mandalay divisions) and the states are predominately populated by ethnic minorities (Kachin, Kayan, Kayin, Chin, Mon, Rakhine, Shan states). Each division and state is further broken down into districts, townships, village tracks (rural areas) or wards (urban areas) and hamlets.

In the 2014 United Nations Human Development Index (HDI), Myanmar ranked 150th out of 187 countries[1], same position as in 2012-13.

Rakhine State is one of the poorest states in Myanmar. Rathedaung is one of the 17 Townships of the Rakhine State, located in western Myanmar bordering with Bay of Bengal and separated from the rest of the country by the Arakan Mountains. Rakhine State had the lowest proportion of households with access to improved sanitation (36%, compared to a national average of 67%), the second lowest proportion of households with access to an improved water source (41%, compared to 63% nationally), the second lowest proportion of births attended by skilled health personnel (49%, compared to 73% nationally), and the second lowest proportion of the population with access to primary healthcare services in general (48.1% compared to 64.9% nationally) [2].

The tensions that flared in June and October of 2012 resulted in wide-spread displacement and camp settlement; the loss of housing, productive assets, and livelihoods; disrupted market access and crop planting cycles, restricted access to basic health and education services, and psycho-social trauma that impacted both community and family level traditional support mechanisms as well as individual mental health. With chronic poverty as a baseline, these aggravated conditions leave families in a vulnerable situation. While the context has stabilized somewhat through relief assistance, basic food security remains fragile and sustainable options for income opportunities and livelihoods recovery are extremely challenged.

While the majority of the displaced populations and largest camps are found in Sittwe Township, Rathedaung was also touched by the violence. Five camps were established after the unrest, and humanitarian actors are present in WASH and Health sectors running programs in both affected communities.

[1] UNDP. 2014. Human development report.

[2] Ministry of National Planning and Economic Development (MNPED) / UNDP (2007), *Integrated Household Living Conditions Survey in Myanmar: MDG-Relevant Information*.

1.2 Geography, demography and climate

Rakhine State has a surface of 14,200 square miles and a population of about 3.3 million[3] people. The capital of the state is Sittwe.

Rathedaung Township is surrounded by Maungdaw and Buthidaung Townships to the north, by Kyauktaw Township (Eastern Rakhine State) to the east and Sittwe Township to the south-east.

The population ethnicity in the Rakhine State varies from one township to the other. In Rathedaung, the Rakhine is the main ethnicity, followed by the Muslim ethnicity and a minority of others (Khame, Chin, Dainat, Thet, Hindu). Rathedaung Township has a population of ± 180,000 people.

The climate is tropical with a monsoon regime. Three distinct seasons are observed: the dry and hot season lasting from March to May; the rainy season lasting from June to October and the dry and cold season lasting from November to February.

1.3 Food Security

The livelihood context in Rakhine State, one of the least developed of Myanmar, is that of chronic poverty, high population density, malnutrition and food insecurity, aggravated from time to time by transitory factors (i.e. the recent conflict in June 2012). Food security remains fragile and depends on seasonality.

Rakhine State receives plenty of rain throughout the year and rice is the main crop, occupying around 85% of the total agricultural lands. The technology is however limited and there is lack of appropriate inputs as well as limited access to high yielding seeds and to fertilizers. Coconuts and nipa palm plantations are also important crops. Fishing is a major industry but most of the catch is transported to Yangon.

The lean season takes place between June and October, and is traditionally the most difficult period of the year.

During the rainy season (June to October), the labor work opportunities are limited and households are more prone to food stock shortages and deterioration of the nutritional situation.

1.4 Water, Sanitation and Hygiene

Sanitation, access to safe drinking water and proper hygiene practices have been and still continue to pose major challenges in Rathedaung. The majority of households do not have access to improved sanitation, which is among the main contributing factors for the prevalence of diarrhoea. In a context where the incidence of diarrhoea is observed to be significant, the provision of safe water without comprehensive sanitation coverage and complementary hygiene promotion is not enough to guarantee full reduction in the number of faecal oral transmitted diseases. Sanitation indeed ranks second to hand washing in the reduction of diarrhoea cases, which is the second leading cause of death among children under the age of 5 worldwide.

[3] 2011 Statistical yearbook- Myanmar

Water quality is a major concern in areas where people rely on unprotected ponds or rivers for drinking water and effective filtration methods are rarely practised. Risks are enhanced by lack of proper sanitation and poor hygiene behaviours, due to water shortage as well as to improper habits adopted by the population, resulting in high incidences of diarrhoea, skin infection and other water-related diseases.

1.5 Health

The health system and situation in Myanmar is consistently classified as one of the poorest in the world by the World Health Organization (WHO). Public hospitals lack basic facilities, equipment and human resources. The situation is particularly harsh in remote areas such as Rakhine State.[4]

Table 1: Health facilities in Rathedaung Township

Township hospital	1
Station hospital	1
Maternal and child health	1
Rural health center	7
Sub-rural health center	30

Medical treatment costs and hospitalization fees are unaffordable to a large majority of the population. Medical statistics for Rakhine State from The Ministry of Health (MoH) reveals that together with pregnancy and birth related complications, malaria, tuberculosis, diarrhea and respiratory infections are the main causes of illness and death in Rakhine state.[5] Rakhine State has the second largest proportion of delivery by a traditional birth attendant (30.2%)[6]. This proportion is believed higher in remote locations of Rathedaung Township where access to health services is difficult and most deliveries occur at home.

Regular free immunization campaigns were conducted by the MoH before the unrest in 2012 and has recommenced with an example being the EPI campaign. In addition, Vitamin A and Deworming campaigns occur on a systematic basis although there are some challenges with coverage. The MoH will launch a national measles rubella vaccination campaign targeting 1.5 million children in January and February 2015 through a two phased approach targeting 5-15 year olds in schools and Under-Fives in communities.

A mental health policy is incorporated to the general health policy, and the last mental health plan was revised in 2006. Mental Health expenditure is 0.3% of total health care expenditures[7]. Country-wide, there are 25 outpatient mental health facilities, 2 day treatment facilities, 17 community-based psychiatric inpatients units and 2 mental hospitals. The percentage of female users is less than 40% of the patient population in all mental health facilities, psychiatric inpatients units, and the 2 mental hospitals. The most frequent diagnoses are schizophrenia, neurotic disorders and mood disorders. According to WHO-AIMS report, in terms of refresher training on mental health, 1% of primary health care doctors, 3% of nurses, and 2% of non-doctor/non-nurse primary health care workers have received at least two days of training. Psychiatrists represent 0.016 per 100,000 population, psychologists 0.01 per 100,000 population and social workers 0.04 per 100,000 population.

[4] Myanmar Department of Health Planning (2002-2003) : Hospital and dispensaries by state and division
[5] Annual hospital statistic report 2008, government of Myanmar, ministry of health
[6] UNICEF-Myanmar MoH 2011. Myanmar Multiple Indicator Survey 2009-2010
[7] WHO-AIMS report on Mental Health System in Myanmar 2006

No mental health services are provided in Rathedaung Township; the majority of the people with mental health concerns consult mainly the hospital and the community health workers where it is possible. Psychiatric services are available at Sittwe level through the General Hospital as well as private practice, however human resources are limited.

1.6 Nutrition

In the Myanmar Multiple Indicator Cluster Survey (MICS)[8] done in 2009-2010, the nutrition status in Rakhine State was ranked as the poorest of the country, with 10.8% wasting, 37.4% stunting and 49.9% underweight prevalence. It also showed that Rakhine State had the lowest percentage of exclusive breastfeeding (1.3%) and the 3rd lowest coverage of Vitamin A supplementation (32.5%).

ACF has nutrition programs in three townships of Rakhine state (Sittwe, Maungdaw and Buthidaung), which border Rathedaung. There are no services for the treatment of malnutrition in Rathedaung Township. In Maungdaw District, the Global Acute Malnutrition (GAM) prevalence, since 2003 up to the latest Nutrition Survey carried out by ACF, in 2013 in Maungdaw (19.7%) and Buthidaung Townships (20.3%), remains critical according to the WHO emergency threshold at 15%. In Sittwe, the GAM prevalence was approximately 10% in both communities according to the last SMART survey done in December 2013 by Save the Children.

The nutrition situation in Rathedaung Township was not evaluated until now. It was a clear gap in the overview of the nutrition situation in Rakhine State. The main objective of this survey is to assess the nutritional status of children under five and provide the indicators for acute and chronic malnutrition and underweight. This study was endorsed by the nutrition cluster and included in the 2014 Nutrition sectorial strategy of the Rakhine Response Plan.

The survey was conducted after the lean season, during the harvest period when food access and job opportunities are available.

2. HUMANITARIAN RELIEF AND INTERVENTIONS

- Rathedaung Township has featured less prominently in humanitarian response and actors' presence in comparison with other townships affected by the conflict. Nonetheless, the presence of UN agencies, ICRC, INGOs, and local organizations assures the international community's response to needs particularly in the domains of WASH and Health for both communities. Important opportunities exist for actors to expand comprehensive programming tackling root causes for under nutrition in Rathedaung Township, as explored further in the conclusions and recommendations section.

[8] UNICEF-Myanmar MoH 2011. Myanmar Multiple Indicator Survey 2009-2010

3. OBJECTIVES

Main objective of the survey:

- To assess the prevalence of global and severe acute malnutrition among children 6-59 months old.

Specific objectives of the survey:

- To evaluate the prevalence of severe and global chronic malnutrition among 6-59 month children.
- To evaluate the prevalence of severe and global underweight among 6-59 month children.
- To assess morbidity, vitamin A supplementation, measles coverage, Infant & Young Child Feeding practices, Mental Health, WASH and Food Security indicators.
- To provide a baseline to compare the results with future nutrition surveys in order to analyze and monitor the evolution of the nutritional situation.
- To propose recommendations in terms of program implementation and nutritional surveillance according to the findings.

4. METHODOLOGY

4.1 Survey type

The Standardised Monitoring and Assessment of Relief and Transitions (SMART) methodology was used. A standard two stage random clustering method[9] was applied for the anthropometric data collected. ENA for SMART software November 10, 2014 was used for children´s anthropometry analysis. EPI software and excel were used for the analysis of other sections.

4.2 Population included in survey and exclusion criteria

The population figures used were provided by the Rathedaung Township Health Department. The latest updates were January 2014 for the Rakhine villages and January 2012 for the Muslim villages.

In certain surveys, the entire population is divided into different strata (sub-groups) before sampling is carried out. The stratification is meant to account for the heterogeneity of the population and the different sub-groups are assessed and analyzed separately (i.e. urban and rural areas; IDP, nomadic population, etc.).

In the context of Rathedaung Township, the urban/rural division is not significant enough as to assess them separately as the results were quite homogeneous between the two and thus did not carry an added value to disaggregate in terms of statistical relevance. Similarly, the IDP population is small (4089 people in 5 camp sites according to UNHCR November 2014 data) and represented a very limited influence in the overall sample size for Rathedaung township. Moreover, as further explained below, the population under IDP status at the moment of survey was part of the population in villages of the data provided. As such, the total population of Rathedaung township was considered for the study as one strata. Nonetheless, disaggregation

[9] SMART. June 2012. Sampling Methods and Sample Size Calculation for the SMART Methodology

was accounted for in the analysis of certain indices where important differences were noted (WASH and IYCF), as detailed in Section 5.

As there was a lack of any other data to crosscheck, the percentage of children under five and household size parameters were calculated from the list provided as an average.

One of the main limitations was the fact that since the 2012 unrest, social changes led to population movements and the dynamics were difficult to take into account. The UNHCR November 2014 data for the IDP camps was also used to make some assumptions during the planning phase of the survey. This data was used to identify the population from the initial list (in the January 2012 list the Muslim population was accounted for in the village data set as there were no IDPs at the time) and crosschecked the figures with the population displaced in camps to make assumptions. The figure of the updated population in camps was considered to be included in the overall population in the list from 2012.

When a cluster was selected in a village where displacement had occurred, the camps were considered as a segment (see section 5.3.1) of the initial village in order to have the same chance of being selected. In one case, the entire selected village had fled to a camp. The random selection of the households (HH) was done from the camp list by using the HHs inhabited with people who fled that village.

After exclusion criteria were applied, an estimated population of 179.550 from 198 villages was determined to be eligible and included in the survey for Rathedaung Township. Including all villages in the random cluster selection process was not feasible as four villages were excluded based on lack of access.

4.3 Sampling procedure and sample size for anthropometric data

Households (HH) were the primary sampling unit and the intended sample size was to give acceptable representative results. The following values for the parameters listed below were entered into ENA for SMART[10] software:

- 10% estimated prevalence
- 3% ± precision[11]
- 1.5 design effect[12]
- 5.8 Average HH size (average calculation from list provided)
- 17.34% children under 5 (average calculation from list provided)
- 7.6 % non-response HH

A representative sample of 750 households including 627 children (6-59 month) was produced by ENA. 50 clusters of 15 HH each was calculated taking into account resources available and characteristics of the context. The villages were accessed by boat through an intra-fluvial network. For a few villages located off of the Bay of Bengal coast, boat and then a vehicle through a rural path had to be used. (See map in annex 4).

[10] ENA for SMART, November 10, 2014 version
[11] SMART. June 2012. Sampling Methods and Sample Size Calculation for the SMART Methodology
[12] SMART. June 2012. Sampling Methods and Sample Size Calculation for the SMART Methodology

5.3.1 Household and individual selection

The definition of the household was determined based on standard SMART and food security assessment methodologies, with a focus on simple criteria that can be easily understood by families and applied by data collectors for maximum accuracy and targeting of the nuclear family component. It is defined as "People who currently sleep in the same house and eat from the same cooking pot."

For each selected cluster the team sought the assistance of community leaders with extensive local knowledge. The village leader was asked to help the team with the following:

- Identify the village boundaries
- Identify houses that were abandoned or the inhabitants were not available during the data collection period
- Identify houses that were occupied by multiple families

This information was cross-referenced with village and township administration and other authorities wherever data was available.

Each team then proceeded to map each cluster.

- For villages with less than 125 households, each household in the cluster was mapped and then arbitrarily numbered.
- For villages with more than 125 households, random segmentation selection[13] was implemented and then each household in the selected segment was arbitrary numbered.
- In the last phase of random household selection, the village leader was asked to assist the team by selecting 15 households with the aid of a random number table. The selected 15 households could be visited in any order because they were randomly selected.

Special cluster cases: three IDP camps were sampled (one as a result of the village selected fleeing to the camp and the other two as a result of random selection by segmentation of the village selected). In two cases the camp list was a better option to be used for the selection of the HHs. In the third case a mapping of the shelters was done.

All children 6-59 months in the selected households were included in the survey. The age was always asked to the mother/caretaker and whenever available verified by means of birth certificate, vaccination card or family list. In all cases an event calendar was used to help determine and/or crosscheck the age.

5.3.2 Selection of individuals for various sections of the questionnaire

The anthropometric and morbidity sections of the questionnaire were asked to the 15 selected households of each cluster that contained 6-59 month children and the Infant & Young child feeding (IYCF) practices section was asked at households with 6-23 month children. All pregnant and lactating women (PLWs) found in the 15 HH of each cluster were measured.

For Mental Health questions, all mothers/caretakers with eligible children were interviewed. Regarding Food Security and WASH questions, a representative sample for cluster sampling was estimated to be achieved.

[13] SMART. June 2012. Sampling Methods and Sample Size Calculation for the SMART Methodology

These questions were asked following a pre-established random order in certain number of HH in each cluster.

5.3.3 Special cases

- During the mapping stage the village leader identified households that were abandoned or households whose occupants would not be present during the data collection period. These households were not numbered to be eligible for random selection. In the rare occasion that one of the households described above was inadvertently numbered and randomly selected, the household was skipped and not replaced with another household.
- If a house was empty, the team revisited until they had to leave the area, and it was not possible to revisit another day because of logistic reasons. A house was never substituted for an alternate one.
- If a child had a MUAC less than 115 mm or edema the team leader informed the caretaker that the child was severely malnourished and advised them to go to the nearest health clinic or hospital.

4.4 Training of survey team

Five teams of three members conducted the data collection in the field. Each team consisted of two data collectors and one team leader. There were 10 females and 5 males. Each team had a male member.

The survey manager was a specialized ACF SMART program manager. The recruitment process included being shortlisted to write a position specific test followed by an in charge person interview. The team was recruited locally (5 in Sittwe, 10 in Rathedaung).

The team received 7 days of nutritional training in Rathedaung, including training on SMART methodology and all of the practical aspects. A standardization test was conducted on the 4th day in order to evaluate the accuracy and precision of the data collectors in taking anthropometric measurements. Results from the standardization test were used in part to determine balanced team selection.

A field test was also conducted on the 6th day of training to evaluate the teams in a practical setting and improvements were made where needed. As well, a concerted effort was taken during training to teach the staff various methods of how to properly determine a child's age if a mother could not remember or if there was no record of a child's birth.

4.5 Supervision of teams and daily management of survey

Data collection took place from 6th December to 19th December. Daily briefings and debriefings with the teams was done by the survey manager to ensure proper implementation of the survey and the quality of the data. On return from the field all sections of the questionnaires were revised by the survey manager with the team leaders to spot potential mistakes and correct them. Data entry was done on daily basis by a data entry officer after teams returned from the field and a double entry of the children´s anthropometry was done at the end of the data collection time to crosscheck the results of the two files produced by ENA. Likewise, after data collection, the data of the other sections of the questionnaire was thoroughly checked by the survey manager to eliminate any potential errors during data entry by referring to the raw data and correct them before proceeding to analysis.

Survey manager and two members of the ACF Nutrition team from Sittwe (Nutrition Program Manager and Deputy Nutrition Program Manager) participated in the supervision and guidance of the teams. The strategy to maximize survey quality included commencing with those selected villages that were closest to the ACF mobile base to gain practice and experience. Remote places which required more time for transport (and in some cases overnights in the field) were progressively surveyed.

4.6 Anthropometric equipment and tools

5.6.1 Age

A detailed local event calendar (in local language) was used extensively to help determine or verify a child's age in months.

5.6.2 Height

A standard wooden anthropometric height board was used for measuring height, with a precision of 0.1 cm. All children less than 2 years old were measured by lying down.

5.6.3 Weight

A standard Salter brand 25 kg hanging scale was used to measure all children to the nearest 100g (0.1kg). All scales were calibrated with a 2 kg weight using SMART methods[14] before weighing each child.

5.6.4 Mid Upper Arm Circumference tape

A standard 30 cm colored ACF MUAC tape was used to measure all children. An all-white MUAC tape was used to measure the PLWs.

4.7 Nutritional indices, definition of terms

5.7.1 Weight-for-height index (WHZ)

The prevalence of acute malnutrition (or wasting) is determined using the weight-for-height index, as an indicator of current nutritional status. A child's nutritional status is estimated by comparing it to the weight-for-height curve of a reference population (WHO 2006).

Table 2: Definition of acute malnutrition according to weight for height index (WHZ), WHO 2006

Z-scores
Global Acute Malnutrition (GAM) : < -2 Z-Scores and/or oedema
Severe Acute Malnutrition (SAM) : < -3 Z-Scores and/or oedema

[14] SMART. April 2006. SMART methodology version 1

5.7.2 Bilateral oedema

Bilateral oedema is a sign of Kwashiorkor, one of the major clinical forms of severe acute malnutrition. When associated with Marasmus (severe wasting), it is called Marasmic-Kwashiorkor. Children with bilateral oedema are automatically categorized as being severely malnourished, regardless of their weight-for-height index[15].

5.7.3 Height-for-Age index (HAZ)

The height-for-age index indicates if a child of a given age is stunted. This index reflects the nutritional history of a child rather than his/her current nutritional status. This is mainly used to identify chronic malnutrition. The same principle is used as for weight-for-height except that a child's chronic nutritional status is estimated by comparing its height with WHO standards height-for-age curves, as opposed to weight-for-height curves. The height-for-age index of a child from the studied population is expressed in z-score (HAZ). The following HAZ cut-off points are used:

Table 3: Cut off points of the height for age index (HAZ) expressed as a z-score, WHO 2006

Not stunted:	**≥ -2 z-score**
Moderate stunting	-3 z-score ≤ HAZ < -2 z-score
Severe stunting	< -3 z-score

5.7.4 Weight-for-age (WAZ)

The weight-for-age index indicates if a child is underweight. The weight-for-age indicator is a composite of wasting and stunting nutritional indices. Evidence has shown that the mortality risk of children who are even mildly underweight is increased, and severely underweight children are at even greater risk[16].

Table 4: Cut off points of the weight for age (WAZ) expressed as a z-score, WHO 2006

Not underweight:	**≥ -2 z-score**
Moderate underweight	-3 z-score ≤ WAZ < -2 z-score
Severe underweight	< -3 z-score

5.7.5 Mid Upper Arm Circumference (MUAC)

- **MUAC for children**

The mid upper arm circumference does not need to be related to any other anthropometric measurement. It is a reliable indicator of the muscular status of the child and is mainly used to identify children with acute malnutrition and risk of mortality. The MUAC cut-off used by ACF in this survey is as in the table below:

[15] SMART. April 2006. SMART methodology version 1
[16] WHO. 2010. Background paper 4 nutrition indicators.

Table 5: Cut off points of the Mid Upper Arm Circumference for children

MUAC (mm)	Nutritional status
135 ≤ MUAC	No malnutrition
125 ≤ MUAC < 135	At risk of malnutrition
115 ≤ MUAC < 125	Moderate malnutrition
MUAC < 115	Severe malnutrition

- **MUAC for Pregnant and Lactating Women**

While there is very limited literature available on optimal targeting cut offs, data from a recent global mapping exercise indicates that for targeted supplementary feeding, over 90% of countries implementing targeted supplementary feeding programs for PLW were using MUAC as the anthropometric admission criteria; with an even split between countries using cut-offs for admission of <21.0 and 23.0 cm (WFP/Valid 2013- Ververs [17] et al, in press).

These two MUACs cut-off to define acute malnutrition have been used by ACF in this survey.

4.8 Morbidity indices, measles coverage and vitamin A supplementation

Acute infections such as acute respiratory infections, fever, and diarrhoea in children are responsible for rapid weight loss. There is a vicious cycle of infection and malnutrition, where undernourished children are unable to fight off disease because of decreased immune response, increasing the severity of disease and at the same time increasing rapid weight loss. Children who are severely malnourished have a greater risk of death due to acute infection than normally nourished children[18].

Morbidity definitions:

- Diarrhoea: minimum 3 watery stools within 24 hours[19].
- Fever: body temperature higher than normal determined by a child having a warm forehead and exhibiting symptoms common with fever such as lethargy.
- Acute respiratory infection (ARI): acute infections pertaining to the lungs including cough, pneumonia, chest in drawing, rapid breathing[20]

Measles coverage and vitamin A supplementation

WHO recommends that 90% of children aged from 9 to 59 months should be vaccinated against measles, to ensure effective epidemic prevention. Myanmar MoH's current target is to achieve routine immunization coverage of 95% nationally with at least 80% coverage in every township for all antigens[21].

[17] Identification of acute malnutrition, adverse birth outcomes and nutritional care for pregnant, lactating women in emergency or protracted crises-2011

[18] WHO. 1999. WHO report on infectious diseases; removing obstacles to healthy development.

[19] WHO. April 2013.Diarrhoeal disease fact sheet 330.

[20] WHO. 2013. Acute respiratory infections

[21] MoH EPI Myanmar Multi Year Plan 2012-2016

Improving case-based management and treatment with vitamin A forms part of the measles eradication strategy, and national guidelines follow the advice for countries with vitamin A deficiency problems for high-dose vitamin A supplementation every six months for all children aged 6-59 months[22].

4.9 Infant feeding indices, definition of terms

Infant and young child feeding practices directly affect the nutritional status of children under two years of age and, ultimately, impact child survival. Improving infant and young child feeding practices in children 0-23 months of age is therefore critical to improved nutrition, health and development of children[23]

5.9.1 Infant feeding definitions

Exclusive breastfeeding: only breast milk (including milk expressed or from wet nurse) as well as ORS, drops, syrups (vitamins, minerals, medicines). [24]

Complementary feeding: breast milk (including milk expressed or from wet nurse) as well as any food or liquid including non-human milk and formula. [25]

5.9.2 Continued breastfeeding at 1 year:

$$\frac{\text{Children 12-15 months of age who received breast milk during the previous day}}{\text{Children 12-15 months of age}}$$

5.9.3 Timely complementary feeding:

$$\frac{\text{Children 6-9 months of age who were breastfed in the past 24 hours and who also received at least one food in the past 24 hours}}{\text{Children 6-9 months of age}}$$

5.9.4 Introduction of solid, semi-solid or soft foods:

$$\frac{\text{Infant 6-8 months of age who received solid, semi-solid or soft foods during the previous day}}{\text{Infant 6-8 months of age}}$$

5.9.5 Individual dietary diversity for infants (Minimum dietary diversity score, IDDS)

Individual dietary diversity for infants 6-23 months can be calculated using the Minimum dietary diversity score, IDDS, in order to determine if a child is consuming a diet from a variety of foods groups. The calculation of IDDS for children 6-23 months is based on food groups (grains/roots/tubers, legumes/nuts,

[22] MoH EPI Myanmar Multi Year Plan 2012-2016
[23] UNICEF, WHO, USAID et al (2007) Indicators for assessing infant and young child feeding practices
[24] UNICEF, WHO, USAID et al (2007) Indicators for assessing infant and young child feeding practices
[25] UNICEF, WHO, USAID et al (2007) Indicators for assessing infant and young child feeding practices

flesh foods/meat, eggs, dairy, vitamin A rich fruit and vegetables, and other fruit and vegetables). Consuming a minimum of four of the above food groups in the 24 h prior to the survey is considered acceptable[26].

5.9.6 Minimum Meal Frequency:

Proportion of breastfed and non-breastfed children 6–23 months of age, who receive solid, semi-solid, or soft foods (but also including milk feeds for non-breastfed children) the minimum number of times or more. The indicator is calculated from the following two fractions:

$$\frac{\text{Breastfed children 6–23 months of age who received solid, semi-solid or soft foods the minimum number of times or more during the previous day}}{\text{Breastfed children 6–23 months of age}}$$

and

$$\frac{\text{Non-breastfed children 6–23 months of age who received solid, semi-solid or soft foods or milk feeds the minimum number of times or more during the previous day}}{\text{Non-breastfed children 6–23 months of age}}$$

Minimum is defined as:

- 2 times for breastfed infants 6–8 months
- 3 times for breastfed children 9–23 months
- 4 times for non-breastfed children 6–23 months

5.9.7 Minimum acceptable diet:

Proportion of children 6-23 months of age who receive a minimum acceptable diet (apart from breast milk). This composite indicator is calculated from the following two fractions[27]:

$$\frac{\text{Breastfed children 6–23 months of age who had at least the minimum dietary diversity and the minimum meal frequency during the previous day}}{\text{Breastfed children 6–23 months of age}}$$

and

$$\frac{\text{Non-breastfed children 6–23 months of age who received at least 2 milk feedings and had at least the minimum dietary diversity not including milk feeds and the minimum meal frequency during the previous day}}{\text{Non-breastfed children 6–23 months of age}}$$

[26] UNICEF, WHO, USAID et al (2007) Indicators for assessing infant and young child feeding practices
[27] UNICEF, WHO, USAID et al (2007) Indicators for assessing infant and young child feeding practices

5.9.8 Children ever breastfed:

$$\frac{\text{Children born in the last 24 months who were ever breastfed}}{\text{Children born in the last 24 months}}$$

5.9.9 Continued breastfeeding at 2 years:

$$\frac{\text{Children 20-23 months of age who received breast milk during the previous day}}{\text{Children 20-23 months of age}}$$

4.10 Food Security indices

There are currently two primary indicators used at household level, the Household Dietary Diversity Score (HDDS) and the Food Consumption Score (FCS).

5.10.1 Household Dietary Diversity Score (HDDS)

The HDDS is used as a proxy measure of the socio-economic level of the household. The calculation of HDDS is based on consuming any amount of the following 12 food groups in the previous 24 hours of a normal day (cereals, roots/ tubers, vegetables, fruits, meat/poultry/offal, eggs, fish/seafood, pulses/legumes/nuts, dairy, oil/fats, sugar/honey, miscellaneous)[28]. Preliminary information suggests that 3 or fewer food groups adequately reflect severe dietary inadequacy while consumption of only 4 food groups indicates moderate dietary inadequacy. Anything above 4 would indicate adequate dietary diversity. Please note that these cutoffs continue to be assessed so recommendations may change over time[29].

5.10.2 Food Consumption Score (FCS)

The frequency weighted diet diversity score or Food Consumption Score (FCS) is a score calculated using the frequency of consumption of different food groups consumed by a household/individual during the 7 days before the survey. The food groups included are cereals/tubers, pulses, vegetables, fruits, meats/fish, dairy, fats/cooking oils, sugars. A score of 0-21 is poor, 21.5-35 is borderline, and over 35 is adequate[30].

4.11 Mental Health indicators

The WHO (Five) Well-Being Index (1998 version) has been designed by the Psychiatric Research Unit - WHO Collaborating Center for Mental Health, Frederiksborg General Hospital, DK-3400 Hillerød.

Instructions: The person has to indicate for each of the five statements, which is closest to how she/he has been feeling over the last two weeks. Higher numbers mean better well-being. For a better understanding during interview, categories of time have been precised as indicated in the table below.

[28] FANTA. Sept 2006. HDDS for measurement of household food access; indicator guide.
[29] FSIN Myanmar. Nov 2012. Recommended indicators to measure the food security status of households and communities
[30] FSIN Myanmar. Nov 2012. Recommended indicators to measure the food security status of households and communities

Example: “If you have felt cheerful and in good spirits more than half of the time during the last two weeks, put a tick in the box with the number 3 in the upper right corner”.

Table 6: WHO-5 Index scale

	Over the last two weeks ...	**All of the time** *(14 days)*	**Most of the time** *(10 to 13 days)*	**More than half of the time** *(7 to 9 days)*	**Less than half of the time** *(4 to 6 days)*	**Some of the time** *(1 to 3 days)*	**At no time** *(0 days)*
1	**... have you felt cheerful and in good spirits ?**	☐ 5	☐ 4	☐ 3	☐ 2	☐ 1	☐ 0
2	**... have you felt calm and relaxed ?**	☐ 5	☐ 4	☐ 3	☐ 2	☐ 1	☐ 0
3	**... have you felt active and vigorous ?**	☐ 5	☐ 4	☐ 3	☐ 2	☐ 1	☐ 0
4	**... did you woke up feeling fresh and rested ?**	☐ 5	☐ 4	☐ 3	☐ 2	☐ 1	☐ 0
5	**... your daily life has been filled with things that interest you ?**	☐ 5	☐ 4	☐ 3	☐ 2	☐ 1	☐ 0

Scoring:
The raw score is calculated by totaling the figures of the five answers. The raw score ranges from 0 to 25, 0 representing worst possible and 25 representing best possible quality of life.
To obtain a percentage score ranging from 0 to 100, the raw score is multiplied by 4. A percentage score of 0 represents worst possible, whereas a score of 100 represents best possible quality of life.

Interpretation:
WHO5 can be used for screening of depression in primary care. It is recommended to administer the Major Depression (ICD-10) Inventory if the raw score is below 13 or if the patient has answered 0 to 1 to any of the five items. A score below 13 indicates poor wellbeing and means that a psychosocial follow-up could be helpful.
WHO5 can also give light preliminary information about signs of unhappiness and changing mood (question 1), stress (question 2), loss of energy (question 3), sleeping problem (question 4) and lack of interests and social support (question 5).

Monitoring change:
In order to monitor possible changes in wellbeing, the percentage score is used. A 10% difference indicates a significant change (ref. John Ware, 1995). WHO5 is used currently by ACF Mental Health and Care Practices sector, during initial and final evaluation.

4.12WASH indicators

Indicators correlate to the monitoring indicators of the Millennium Development Goal (MDG) 7 target C under the 2010-2015 strategy[31] and the mandate of the WHO/UNICEF Joint Monitoring Program (JMP) which are "Proportion of population using an improved drinking water source" and "Proportion of population using improved sanitation facilities."

Indicators demonstrate presence of water and sanitation facilities only. More details per indicator are described below.

5.12.1 Primary Drinking Water Source

Type of primary drinking water source was a water indicator used in this survey. This indicator demonstrates whether the primary drinking water source of the population is "improved" or "unimproved," correlating with the MDG 7 indicator. Note that an "improved water source" means water protected from fecal contamination or "improved access", but it does not guarantee a "safe" drinking water source, therefore this indicator is used as a proxy indicator. In this survey, improved water sources included: boreholes and protected wells; while unimproved water sources included: open wells, ponds and rivers.

5.12.2 Household Water Treatment

This secondary water indicator is collected as a proxy indicator for water quality as laboratory water quality monitoring was not conducted. Effective and ineffective water treatment methods were considered in the survey and distinguished in the analysis. Note that the presence of a treatment method does not necessarily mean that the household drinking water is "safe".

5.12.3 Household Latrines

In the survey, the presence of a household latrine is an indicator used to demonstrate access to sanitation facility at the household level which ultimately provides safer environmental conditions at both the household and community level. This indicator does not classify the household latrine as an improved or unimproved sanitation facility, and for purposes of analysis, it is assumed that households without a latrine are practicing open defecation.

5.12.4 School Latrines

Presence of a school latrine is used as an indicator to show whether schools have basic sanitation infrastructure for safe waste disposal. As well, this indicator is extrapolated to demonstrate whether children have access to school sanitation facilities.

5.12.5 Hand Washing

Setting Millennium Development Goals (MDG) targets for water and sanitation has spurred progress, however the third item in the WASH triumvirate; namely hygiene, did not have an MDG target and has been

[31] "United Nations Millennium Development Goals". Un.org. 2008-05-20.

relatively neglected. This secondary indicator is collected as a proxy indicator for hygiene practices and general understanding of the fecal-oral cycle. Effective and ineffective hand washing methods were considered in the survey and distinguished in the analysis. Note that the presence of a hand washing method does not necessarily mean that the household is practicing proper hygiene.

5. ANALYSIS AND RESULTS

The next section will present the findings of the different indices as explained above. In terms of analysis, no disaggregation per ethnic community is presented in this survey as the findings are quite consistent across the sample. Where there is a significant difference (some WASH and IYCF indices), disaggregation is accounted for and mention is made in the narrative text.

5.1 Anthropometric results (based on WHO 2006)

The anthropometric measurements of 372 children were recorded. The number of children was smaller than the 627 determined by the ENA for SMART sample size calculation according to the parameters chosen. This is linked to the fact of lack of updated population data, indicating that the percentage of children under five was overestimated.

48 cluster were done out of the 50 planned. However the sample is still big enough to be representative of the all Township. Two clusters could not be done due to accessibility issues.

6.1.1 Age and gender distribution

The results show that all the ratios and distributions are within the expected ranges.

The statistical evaluation of sex and age ratios (using Chi squared statistic) indicates that boys and girls are equally represented (p-value=0.836). Likewise, the overall age distribution is as expected (p-value=0.570), as well as the overall age distribution for boys (p-value=0.993) and for girls (p-value=0.434). The overall sex/age distribution is also as expected (p-value=0.400).

Table 7: Distribution of age and sex of sample

	Boys		Girls		Total		Ratio
AGE (months)	**no.**	**%**	**no.**	**%**	**no.**	**%**	**Boy:girl**
6-17	41	55.4	33	44.6	74	19.9	1.2
18-29	43	51.2	41	48.8	84	22.6	1.0
30-41	43	47.3	48	52.7	91	24.5	0.9
42-53	41	50.0	41	50.0	82	22.0	1.0
54-59	20	48.8	21	51.2	41	11.0	1.0
Total	188	50.5	184	49.5	372	100.0	1.0

6.1.2 Acute malnutrition expressed in z-score

A total of 372 children were included in the weight-for-height analysis. The analysis was run with the option Exclusion of z-scores: no exclusion.

The prevalence of GAM was 10.5% (6.7 – 16.0 95% C.I) and SAM was 1.6% (0.7 – 3.8 95% C.I). The prevalence of GAM in boys was 13.3% (8.2 – 20.9 95% C.I), almost double than in girls which was 7.6% (4.2 – 13.4 95% C.I).
The prevalence of MAM in boys was 11.7% (7.3 – 18.2 95% C.I), almost double than in girls which was 6.0% (3.1 – 11.2 95% C.I).
The prevalence of SAM was 1.6 % (0.7 - 3.8 95% C.I.) and equally in boys and girls, 1.6% (0.5 – 4.8 95% C.I).

However, when running the statistical test for significance difference, the p-value for GAM difference in gender was 0.137 and for MAM was 0.087, both above the cut-off (p>0.05) for statistical significant difference. This means no statistical difference was found between weight for height z-scores and gender. In other words, the observed difference is plausibly a chance finding and we can neither reject nor accept the idea of the difference until other factors have been considered.

Table 8: Prevalence of acute malnutrition based on weight-for-height z-scores (and/or oedema) and by sex

	All n = 372	**Boys n = 188**	**Girls n = 184**
Prevalence of global malnutrition (<-2 z-score and/or oedema)	**(39) 10.5 % (6.7 - 16.0 95% C.I.)**	**(25) 13.3 % (8.2 - 20.9 95% C.I.)**	**(14) 7.6 % (4.2 - 13.4 95% C.I.)**
Prevalence of moderate malnutrition (<-2 z-score and >=-3 z-score, no oedema)	**(33) 8.9 % (5.8 - 13.4 95% C.I.)**	**(22) 11.7 % (7.3 - 18.2 95% C.I.)**	**(11) 6.0 % (3.1 - 11.2 95% C.I.)**
Prevalence of severe malnutrition (<-3 z-score and/or oedema)	**(6) 1.6 % (0.7 - 3.8 95% C.I.)**	**(3) 1.6 % (0.5 - 4.8 95% C.I.)**	**(3) 1.6 % (0.5 - 4.8 95% C.I.)**

The analysis per age group shows that among the survey sample, the oldest age groups 42-53 and 54-59 months represented the highest prevalence of MAM with 12.2% of the children affected in each group.

The result for SAM shows no apparent correlation with MAM as the cases of SAM are similarly distributed in all age groups.

No case of oedema was found in the sample.

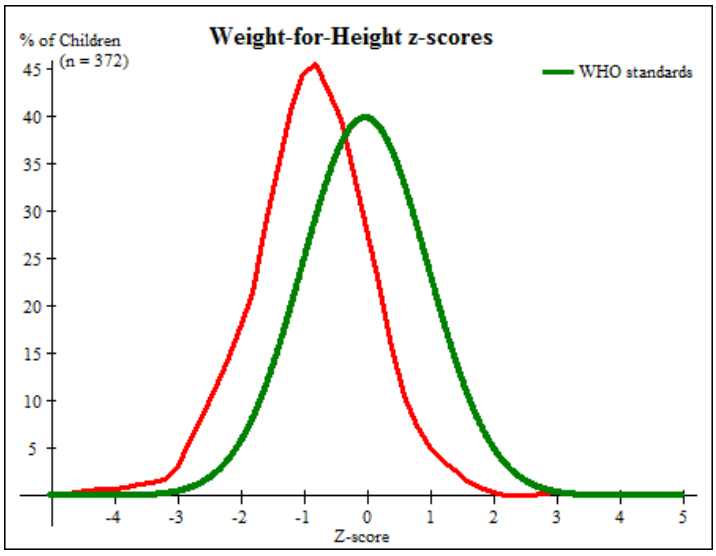
Table 9: Prevalence of acute malnutrition by age, based on weight-for-height z-scores and/or oedema

		Severe wasting (<-3 z-score)		Moderate wasting (>= -3 and <-2 z-score)		Normal (> = -2 z score)		Oedema	
Age (months)	Total no.	No.	%	No.	%	No.	%	No.	%
6-17	74	1	1.4	7	9.5	66	89.2	0	0.0
18-29	84	2	2.4	7	8.3	75	89.3	0	0.0
30-41	91	1	1.1	4	4.4	86	94.5	0	0.0
42-53	82	1	1.2	10	12.2	71	86.6	0	0.0
54-59	41	1	2.4	5	12.2	35	85.4	0	0.0
Total	372	6	1.6	33	8.9	333	89.5	0	0.0

The weight-for-height distribution curve of the observed population is shifted to the left showing a lower weight for a given height when compared to the reference population (WHO standards 2006).

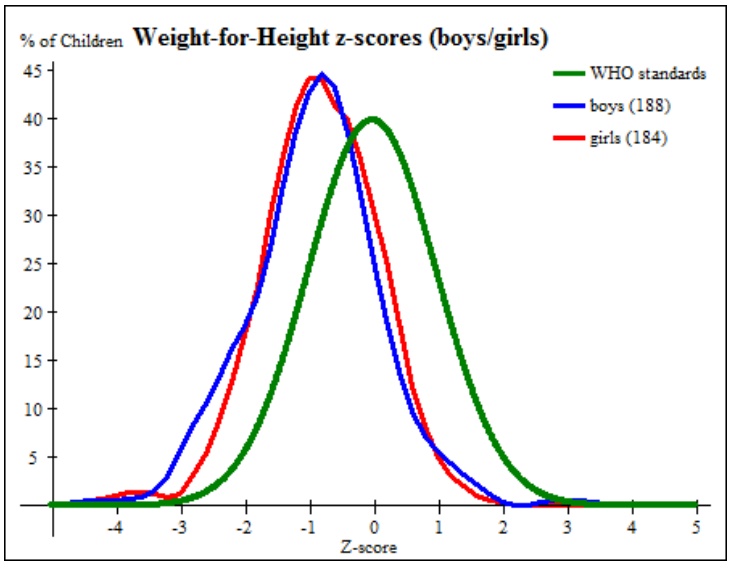
The standard deviation of the distribution curve is 0.94 z-scores. This parameter is the most important statistic that tells about the quality of the data. It measures the width of the distribution. Well conducted surveys showed that the data was normally distributed and remained within a standard deviation of between 0.8 and 1.2 z-scores. The SD is below 1.2 in all good surveys and below 1.1 in 85% of good surveys[32]

Figure 1: Weight for height Z-score distribution curve, all children, WHO standards



[32] Michael Golden. SMART: Ensuring data quality – is survey result usable?

Figure 2: Weight for height z-score distribution curve for boys and girls, WHO standards



6.1.3 Acute malnutrition expressed by MUAC

A total of 372 children were measured by MUAC and included in the analysis.

The prevalence of children with a MUAC <125 mm was 3.5% (1.7 – 6.9 95% C.I) and the prevalence of MUAC <115 mm was 0.5% (0.1 – 2.1 95% C.I).
The prevalence of MUAC (< 125 mm and >= 115 mm) and MUAC (<115) in boys was respectively 2.7% (1.0 - 6.7 95% C.I.) and 0.5 % (0.1 - 3.7 95% C.I.).
The prevalence of MUAC (< 125 mm and >= 115 mm) and MUAC (<115) in girls was respectively 3.3 % (1.4 - 7.5 95% C.I.) and 0.5 % (0.1 - 4.0 95% C.I.).

No statistical difference was found between MUAC scores and gender (p>0.05).

Table 10: Prevalence of acute malnutrition based on MUAC cut offs (and/or oedema) and by sex

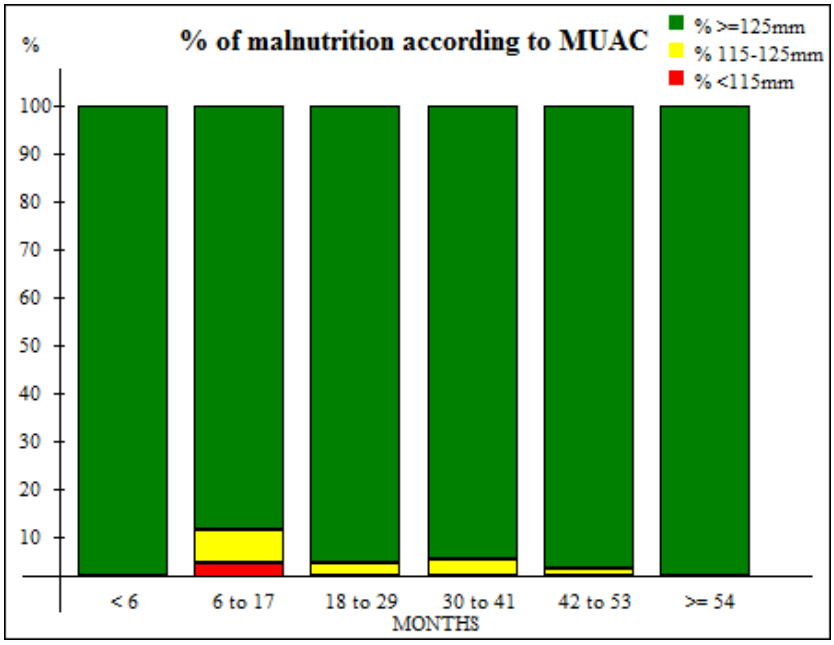
	All n = 372	**Boys** n = 188	**Girls** n = 184
Prevalence of global malnutrition (< 125 mm and/or oedema)	(13) 3.5 % (1.7 - 6.9 95% C.I.)	(6) 3.2 % (1.2 - 8.0 95% C.I.)	(7) 3.8 % (1.8 - 8.0 95% C.I.)
Prevalence of moderate malnutrition (< 125 mm and >= 115 mm, no oedema)	(11) 3.0 % (1.6 - 5.6 95% C.I.)	(5) 2.7 % (1.0 - 6.7 95% C.I.)	(6) 3.3 % (1.4 - 7.5 95% C.I.)
Prevalence of severe malnutrition (< 115 mm and/or oedema)	(2) 0.5 % (0.1 - 2.1 95% C.I.)	(1) 0.5 % (0.1 - 3.7 95% C.I.)	(1) 0.5 % (0.1 - 4.0 95% C.I.)

The findings by age group show that the only cases of SAM identified by MUAC criteria are in the youngest age group (6-17 months). Likewise, the highest prevalence of MAM according to MUAC is found in the same age group with a prevalence of 6.8%.

Table 11: Prevalence of acute malnutrition by age, based on MUAC cut off's and/or oedema

		Severe wasting (< 115 mm)		Moderate wasting (>= 115 mm and < 125 mm)		Normal (> = 125 mm)		Oedema	
Age (mo)	**Total no.**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**
6-17	74	2	2.7	5	6.8	67	90.5	0	0.0
18-29	84	0	0.0	2	2.4	82	97.6	0	0.0
30-41	91	0	0.0	3	3.3	88	96.7	0	0.0
42-53	82	0	0.0	1	1.2	81	98.8	0	0.0
54-59	41	0	0.0	0	0.0	41	100.0	0	0.0
Total	372	2	0.5	11	3.0	359	96.5	0	0.0

Figure 3: MUAC evaluation for age groups



Children are more likely to be identified as acutely malnourished by weight for height z-scores criteria. However, this significant difference is due to MAM, as no statistical difference is found regarding SAM. This means that more children are likely to be identified as MAM based on W/H z-score criteria than MUAC whereas this is not the case when identifying SAM children.

6.1.4 Chronic malnutrition (stunting)

A total of 372 children were included in the analysis.

The global chronic malnutrition rate was 37.9% (31.8 – 44.4 95% C.I) and severe stunting was 15.6% (11.9 – 20.2 95% C.I).
The prevalence of moderate stunting in boys was 24.5 % (18.8 - 31.2 95% C.I.) and in girls was 20.1 % (14.5 – 27.1 95% C.I.).

The prevalence of severe stunting in boys was 13.8 % (9.3 – 20.0 95% C.I.) and in girls was 17.4 % (12.4 – 23.8 95% C.I.).

No statistical different was found between height for age z-score and gender (p >0.05)

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

	All n = 372	**Boys** n = 188	**Girls** n = 184
Prevalence of stunting (<-2 z-score)	(141) 37.9 % (31.8 - 44.4 95% C.I.)	(72) 38.3 % (30.1 - 47.3 95% C.I.)	(69) 37.5 % (30.7 - 44.8 95% C.I.)
Prevalence of moderate stunting (<-2 z-score and >=-3 z-score)	(83) 22.3 % (18.4 - 26.7 95% C.I.)	(46) 24.5 % (18.8 - 31.2 95% C.I.)	(37) 20.1 % (14.5 - 27.1 95% C.I.)
Prevalence of severe stunting (<-3 z-score)	(58) 15.6 % (11.9 - 20.2 95% C.I.)	(26) 13.8 % (9.3 - 20.0 95% C.I.)	(32) 17.4 % (12.4 - 23.8 95% C.I.)

The distribution of severe stunting by age is not homogeneous, showing prevalence above 20% in the age groups 18-29 months (22.6%) and 30-41 months (20.9%). Moderate stunting was over 20% in the 6-17, 18-29 and 54-59 months age groups, the latter presenting the highest prevalence (31.7%).

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 (months)	**Total no.**	**No.**	**%**	**No.**	**%**	**No.**	**%**
6-17	74	5	6.8	16	21.6	53	71.6
18-29	84	19	22.6	23	27.4	42	50.0
30-41	91	19	20.9	15	16.5	57	62.6
42-53	82	12	14.6	16	19.5	54	65.9
54-59	41	3	7.3	13	31.7	25	61.0
Total	372	58	15.6	83	22.3	231	62.1

The height for age distribution curve of the observed population is shifted to the left of the reference population indicating that children of the studied population have a lower height at a given age when it is compared to the reference population.

Figure 4: Height for age z-score distribution, all children, WHO standards

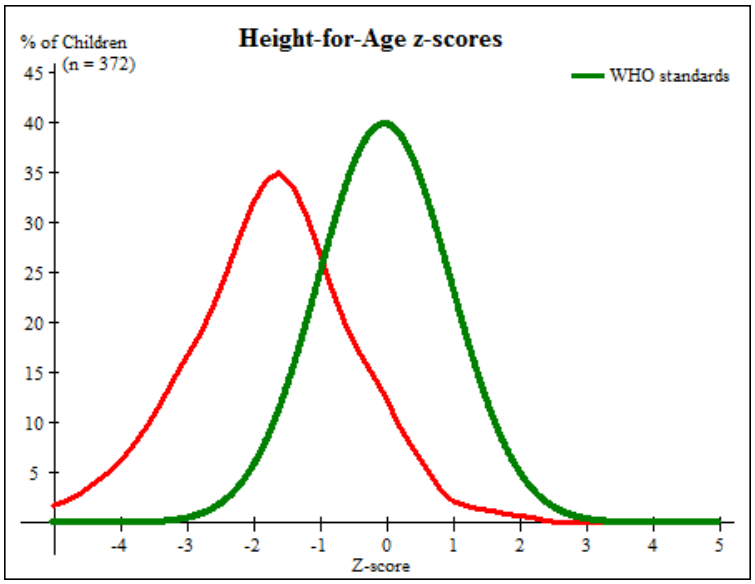
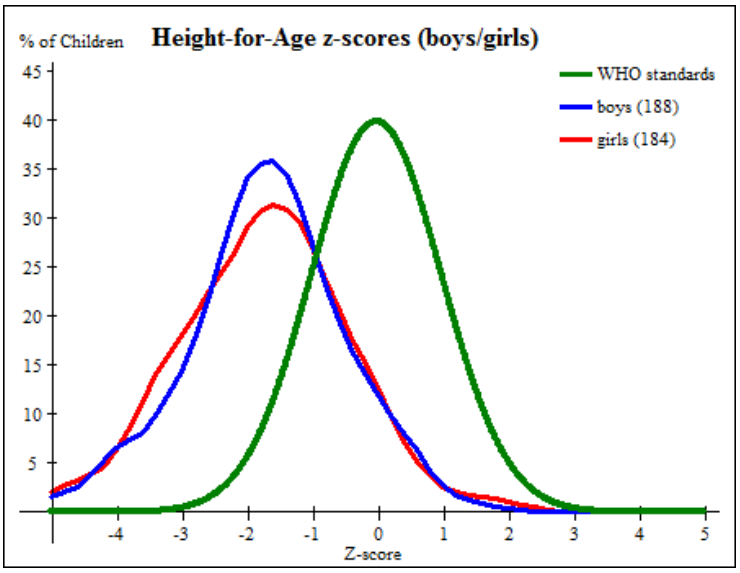


Figure 5: Height for age z-score distribution for boys and girls, WHO standards



6.1.5 Underweight

A total of 372 children were included in the analysis.

The global underweight malnutrition rate was 30.4% (24.4 – 37.2 95% C.I) and severe underweight was 10.5% (6.2 – 17.3 95% C.I).
The prevalence of severe underweight rate in boys was 10.1% (5.1 - 19.0 95% C.I.) and in girls was 10.9% (6.6 - 17.4 95% C.I.).
The prevalence of moderate underweight rate in boys was 18.1% (13.4 - 24.0 95% C.I.) and in girls was 21.7% (15.7 - 29.3 95% C.I.).

No statistical difference was found between height for age z-scores and gender ($p>0.05$).

Table 14: Prevalence of underweight based on weight-for-age z-scores by sex

	All n = 372	**Boys** n = 188	**Girls** n = 184
Prevalence of underweight (<-2 z-score)	(113) 30.4 % (24.4 - 37.2 95% C.I.)	(53) 28.2 % (21.5 - 36.0 95% C.I.)	(60) 32.6 % (25.6 - 40.5 95% C.I.)
Prevalence of moderate underweight (<-2 z-score and >=-3 z-score)	(74) 19.9 % (15.7 - 24.8 95% C.I.)	(34) 18.1 % (13.4 - 24.0 95% C.I.)	(40) 21.7 % (15.7 - 29.3 95% C.I.)
Prevalence of severe underweight (<-3 z-score)	(39) 10.5 % (6.2 - 17.3 95% C.I.)	(19) 10.1 % (5.1 - 19.0 95% C.I.)	(20) 10.9 % (6.6 - 17.4 95% C.I.)

The prevalence of moderate underweight was above 20% in 42-53 months age group (20.7%) and above 40% in the 54-59 months age group (41.5%).

Table 15: Prevalence of underweight by age, based on weight-for-age z-scores

		Severe underweight (<-3 z-score)		**Moderate underweight (>= -3 and <-2 z-score)**		**Normal (> = -2 z score)**		**Oedema**	
Age (mo)	**Total no.**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**
6-17	74	6	8.1	11	14.9	57	77.0	0	0.0
18-29	84	11	13.1	15	17.9	58	69.0	0	0.0
30-41	91	10	11.0	14	15.4	67	73.6	0	0.0
42-53	82	11	13.4	17	20.7	54	65.9	0	0.0
54-59	41	1	2.4	17	41.5	23	56.1	0	0.0
Total	372	39	10.5	74	19.9	259	69.6	0	0.0

The weight-for-age distribution curve of the observed population is shifted to the left, showing a lower weight for a given age when compared to the reference population. The distribution shape also shows a sharper peak with relatively large left tail and smaller body than the reference population, indicating a relative excess of underweight subjects in the sample.

Figure 6: Weight for age z-score distribution curve, all children, WHO standards

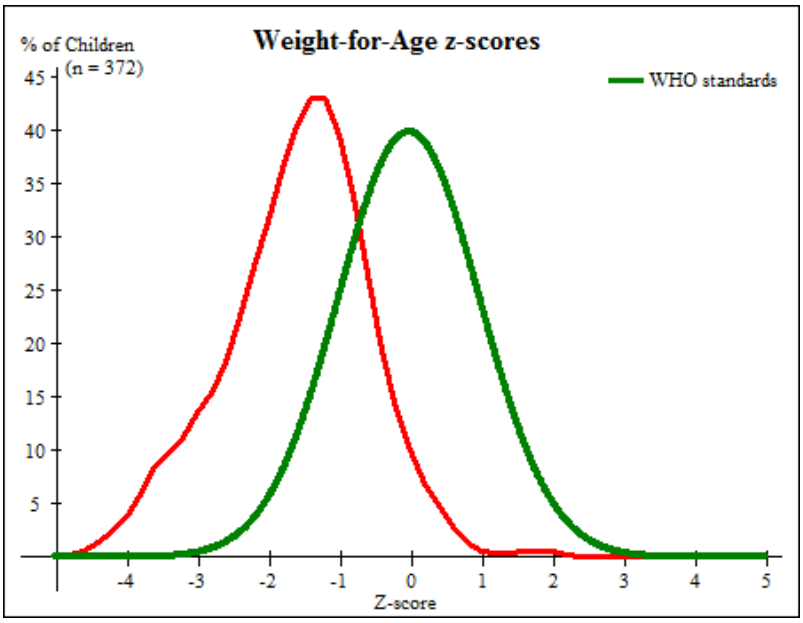


Figure 7: Weight for age z-score distribution curve for boys and girls, WHO standards

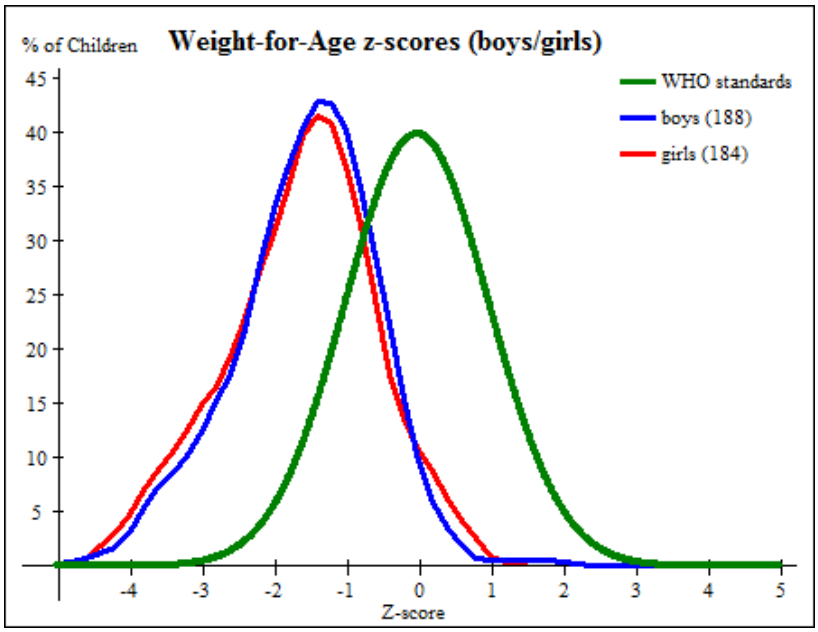


Table 16: Mean z-scores, Design Effects and excluded subjects

Indicator	n	Mean z-scores ± SD	Design Effect (z-score < -2)	z-scores not available	z-scores out of range
Weight-for-Height	372	-0.87±0.94	2.01	0	0
Weight-for-Age	372	-1.60±1.03	1.80	0	0
Height-for-Age	372	-1.76±1.30	1.54	0	0

5.2 Distribution of malnutrition by cluster

The Index of Dispersion (ID) was calculated and comparison with the Poisson distribution was checked to test if cases were randomly distributed or aggregated over the clusters. If the data does not conform to a Poisson distribution, then we can say that the population is not homogenous (with respect to malnutrition).

Table 17: Statistical values for the distribution of malnutrition indicators in clusters

	Global (z-score<-2)	Severe (z-score<-3)
Wasting (WHZ)	ID=2.44	ID=1.23
	p=0.000	p=0.130
Stunting (HAZ)	ID=3.45	ID=2.53
	p=0.000	p=0.000
Underweight (WAZ)	ID=3.19	ID=3.54
	p=0.000	p=0.000

The results indicate that the cases of global acute malnutrition are not uniformly distributed among the clusters, there appear to be pockets of malnutrition. On the contrary, the distribution of SAM follows a Poisson distribution and the cases appear to be randomly distributed among the clusters.

Fig 8: Distribution of GAM (WHZ) cases in clusters

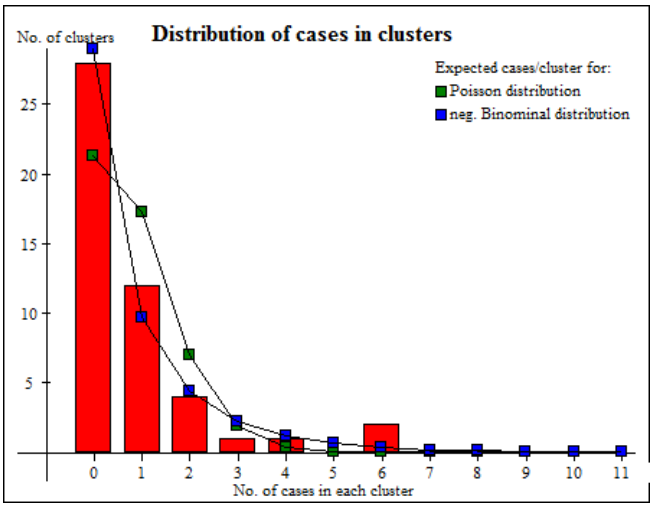
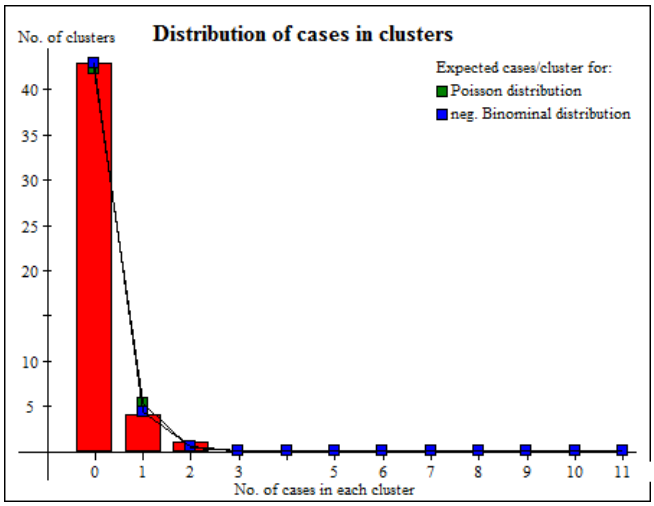


Fig 9: Distribution of SAM (WHZ) cases in clusters



Regarding global and severe stunting, the results show that there appear to be pockets of chronic malnutrition among the clusters.
Likewise, for underweight, the cases are not distributed uniformly but aggregated into certain clusters (pockets of cases).

5.3 Analysis of wasting, stunting and underweight z-scores by cluster

The analysis of the Weight-for-Height z-scores ± SD, Height-for-Age z-scores ± SD and Weight-for-Age z-scores ± SD by cluster, showed that the pockets of malnutrition were present to greater or lesser extent in both communities.

Figure 10: Weight-for-Height z-scores ± SD by cluster

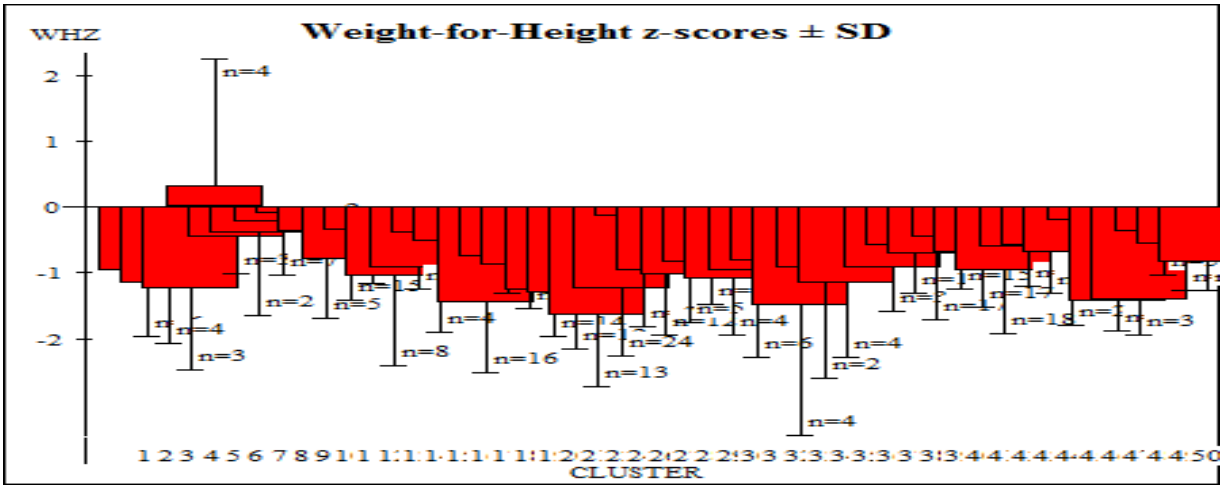


Figure 11: Height-for-Age z-scores ± SD by cluster

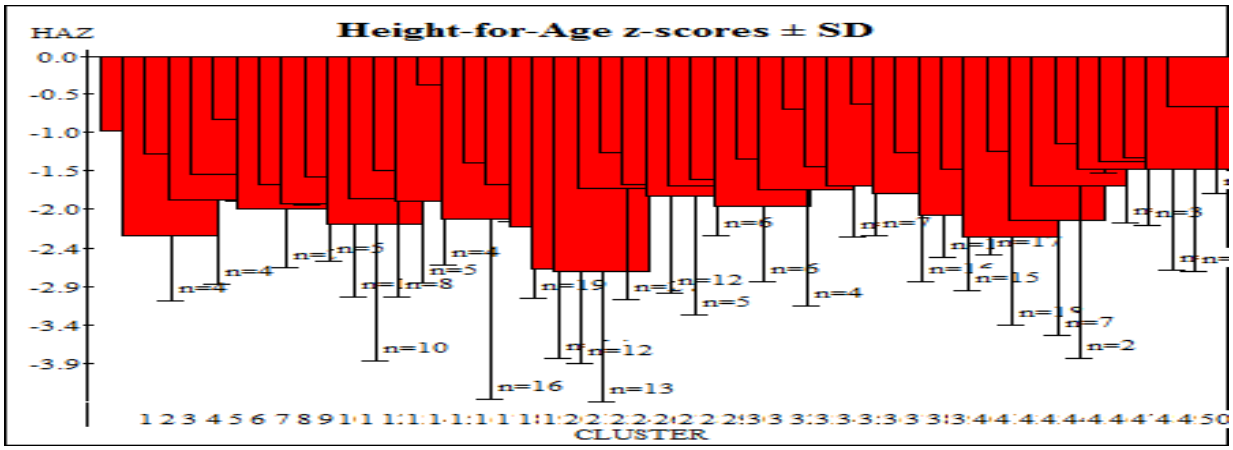
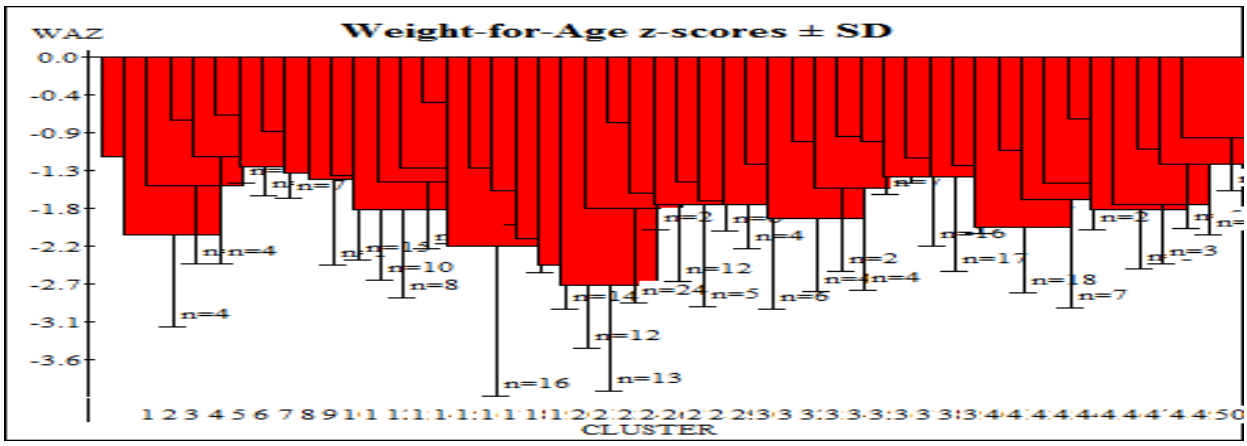


Figure 12: Weight-for-Age z-scores ± SD by cluster



5.4 Pregnant and lactating women – Nutrition status based on MUAC

193 PLWs with ages ranging from 18 to 47 years old were measured. 84.5% of the PLWs (163) were between 18 and 35 year old, both inclusive.

33.7% of the Pregnant and Lactating women have a MUAC under 230 mm. 9.3% of the Pregnant and Lactating women have a MUAC under 210 mm.

There is no statistical difference between pregnant and lactating women.

Table 18: Percent of pregnant and lactating women based on MUAC cut off

MUAC	Total PLW	%	Pregnant	%	Lactating	%
MUAC <210 mm	18	9.3%	5	13.9%	13	8.3%
MUAC ≥210 and <230 mm	47	24.4%	8	22.2%	39	24.8%
MUAC ≥230 mm	128	66.3%	23	63.9%	105	66.9%
Total	193	100.0%	36	100.0%	157	100.0%

5.5 Morbidity, vitamin A supplementation and measles coverage

A total of 65% of children had one or more episodes of acute illness during the two weeks prior to the survey.

Table 19: Percentage of reported acute illness in children in the two weeks prior to interview

Health Status	Number of Children		% of Children		Total	%
	M	F	M	F		
Illness	119	122	63.3%	66.7%	241	**65%**
No illness	69	61	36.7%	33.3%	130	**35%**
Total	188	183	100.0%	100.0%	371	100.0%

Illnesses were categorized as diarrhea, acute respiratory infections (ARI), fever and other type of illness (scabies, runny rose, vomiting, other minor infections…).

Of the 65% of children who had an acute illness, the most common morbidity reported was ARI (36%) followed by fever (34%). 16% of the children were affected by diarrhea and 15% from other type of illness. The results are coherent with the time of the year, the dry and cold season, showing a higher incidence of ARIs and fever and lower incidence of diarrhea which increases typically during the rainy season.

As shown in both tables 19 and 20, there is no significant difference in gender in regard to the incidence of illness or the type of illness reported.

Table 20: Prevalence of type of illness in children reporting acute illness in the two weeks prior to interview

Illness	Number of Children		% of Children		Total	% of type of illness
	M	F	M	F		
Diarrhea	33	38	46.5%	53.5%	71	**16%**
Fever	70	80	46.7%	53.3%	150	**34%**
ARI	80	79	50.3%	49.7%	159	**36%**
Other	33	29	53.2%	46.8%	62	**14%**

39.7% of 6-59 months old children were reported to have received vitamin A supplementation within the last six months by their mothers/caretakers.

Table 21: Vitamin A supplementation within the last 6 months

Vitamin A (6-59 months)	**YES**		**NO**		**Do not know**	
Total	Number of children	%	Number of children	%	Number of children	%
370	147	39.7%	213	57.6%	10	2.7%

Findings revealed a measles vaccination coverage of 59.1% amongst 9-59 month-old children. The majority of vaccinated cases did not have cards, which indicate that they may have been reached through mass-campaign rather than routine immunization, where cards are usually provided.

Table 22: Measles coverage

MEASLES VACCINATION (9-59 months)	**Yes, confirmed by vaccination card**		**Yes, not confirmed by vaccination card**		**No/ Do not know**	
Total	Number of children	%	Number of children	%	Number of children	%
352	7	2%	201	57.1%	144	40.9%

5.6 Child feeding practices

A total of 107, 6-23 month children were included in the survey. The sample size of the population was calculated by ENA for SMART for the anthropometry (6-59 months); therefore, it must be acknowledged that the size of the population for the IYCF indicators (6-23 months) presents limitations, particularly for

indicators with narrow age ranges in both the numerator and the denominator. Findings must be used with caution and interpreted in context.

Breastfeeding status and introduction of complementary foods

International recommendations are to exclusive breastfeed until the age of 6 months and then to timely introduce complementary foods while continuing breastfeeding until 24 months and onwards[33].

All surveyed children had been breastfed at one point. None of the children were exclusively breastfed at the time of survey.
Mothers were asked if the child was still breastfeeding. At the time of the survey, 91.6% of children were still breastfeeding and 8.4% had stopped breastfeeding at ages ranging from 0 to 16 months.

Table 23: Breastfeeding status of 6-23 month children

Breastfeeding status	Number of Children	Percent
Exclusively breastfed	0	0%
Breastfed and complementary feeding	98	91.6%
Stopped breastfeeding	9	8.4%
Total	107	100%

The result of the survey suggests high rates of continued breastfeeding. The indicator for **continued breastfeeding at 1 year** (12-15 months) was **88.2%** and for **continued breastfeeding at 2 years** (20-23 months) was **90.9%.** It was observed that although rates of continued breastfeeding seem high in both communities, weaning tends to occur earlier with Muslim women and the proportion of sustained breastfeeding becomes higher in the Buddhist community at 2 years.

On average, food is introduced at an early age. Before 6 months, 73.7% of the children (79) were introduced to complementary foods, meaning that we can assume that 26.3% had been **exclusively breastfed until 6 months**. See following table for details.

Table 24: Age of 6-23 month children were introduced to complementary foods before 6 months

Months	Number of Children	Percent
0	5	4.7%
1	15	14.0%
2	21	19.6%
3	21	19.6%
4	10	9.3%
5	7	6.5%
TOTAL	79	73.7%

Of those 73.7% of children introduced to complimentary foods before 6 months, the average was 2.5 months.
The average age for introduction of complimentary foods when considering all children (107) was 4 months, with extreme values ranging from 0 to 18 months.

[33] UNICEF.2008. Recommendations for optimal breastfeeding

Rice porridge (78.5%) was the main food introduced to children, followed by rice powder (12.1%), small biscuit/cake (4.7%) and other (4.7%) like chewed rice, cow milk or canned milk.

Timely Complimentary Feeding:
90.5% of breastfed children (6-9 month) received a solid, semi-solid or soft food in the 24 hour recall period. However, the average age for introduction of complimentary foods in these children was 2.8 months, far from the recommended 6 months.

Introduction of solid, semi-solid or soft foods:
94.4% of the 6-8 month children received a solid or semi-solid food in the previous 24 hours recall period.

Information on the consumption of different food groups was collected, but for the calculation of the Individual Dietary Diversity Score (IDDS), only groups from the IDDS food groups were considered (see table 25). The mean **minimum dietary diversity score** was **2.5**, which is below the minimum acceptable score of 4. Only **20.8%** of children 6-23 months met the **minimum acceptable dietary diversity** in the 24 hours prior to the survey. The score was the same for boys and girls (2.5). Of the 79.2% of children below the acceptable score of 4, there was no difference either between boys and girls.

Grains tops the ranking, with 84%, they were the most common IDDS food group consumed in the 24 hours before the interview, followed by vitamin A fruits and vegetables with 46.2% and flesh foods (meat, fish, poultry and liver/organ meats) with 45.3%. Other fruits and vegetables follow with 37.7%; dairy products were less consumed, with 18.9%. The percentage of children consuming legumes and nuts and eggs was low.

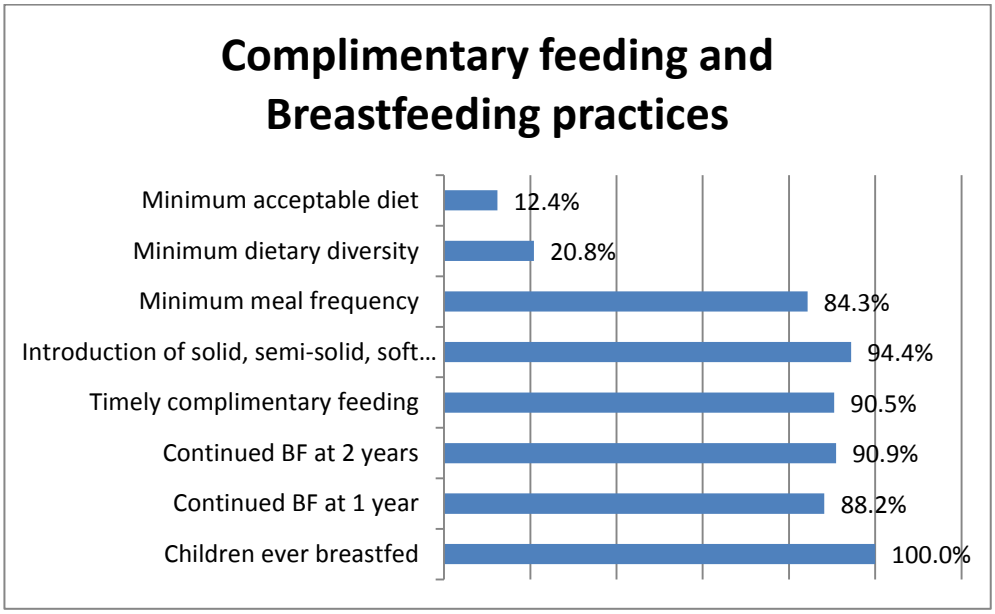
Table 15: IDDS foods group consumption of 6-23 month children in 24 hours before the survey

IDDS Food Groups	Percent of Children
Grains, roots and tubers	84.0%
Legumes and nuts	8.5%
Dairy products	18.9%
Flesh foods	45.3%
Eggs	6.6%
Vitamin A fruits and vegetables	46.2%
Other fruits and vegetables	37.7%
Other food groups	
Sugar	61.%
Cooking oils and fats	40.6%
Infant formula	8.5%

Minimum meal frequency: 84.3% of children 6-23 months had the minimal meal frequency according to their age in the 24 hours prior to the survey (2 meals at least for breastfed children 6-8 months, 3 meals at least for breastfed children 9-23 months; 4 meals at least for the non-breastfed). The percentage was 51% for the breastfed and 33.3% for the non-breastfed.

Minimum acceptable diet: when combining the previous two indicators, only **12.4%** of children 6-23 months received a minimum acceptable diet. Non-breast fed children seem to be more vulnerable than breastfed ones.

Figure 13: Complementary feeding and Breastfeeding Practices, Rathedaung Township.



5.7 Food Security

Food security information from 276 households was collected.

6.7.1 Household dietary diversity score (HDDS)

The mean HDDS score was 6.4, which is above the minimum acceptable of 4. There were 99.3% of households that met the minimum household dietary diversity requirement.

Table 26: Household dietary diversity score from the 24 hours before the survey

HDDS Score	Number of Households	Percent
<= 3	2	0,7%
4-6	154	55,8%
>=7	120	43,5%
Total	276	100%

Cereals and condiments (100%) were the most common HDDS food groups consumed in the 24 hours before the interview, followed by vegetables (96%), oil and fats (91%) and fish/seafood (86%). The highest protein containing food group was fish and seafood. Roots and tubers, pulses, meat, eggs and dairy products food groups were consumed in a low proportion (by less than 20% of households).

Figure 14: Percent of households that consumed HDDS food groups in the 24 hours before the survey

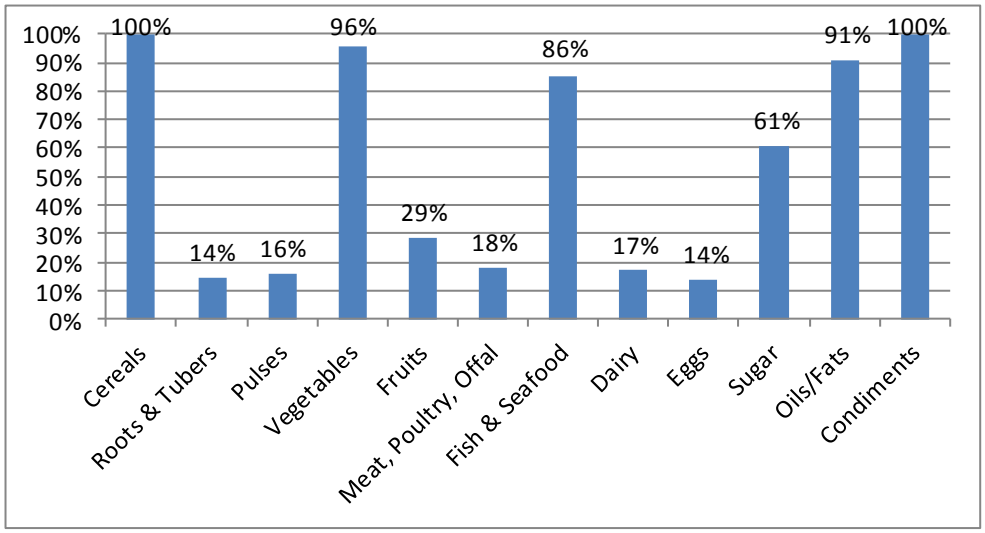


Table 27: Percent of HHs that consumed HDDS food groups (food shown) in the 24 hours before the survey

HDDS Food Groups	Food	Percent of households
Cereals	Rice	100%
	Maize	0%
	Other cereals	17%
Roots and tubers	Potatoes, tubers	14%
Pulses	Beans	11%
	Nuts	6%
Vegetables	Vegetables	96%
Fruits	Fruits	29%
Meat, poultry, offal	Beef	11%
	Pork	5%
	Mutton	0%
	Poultry	4%
Eggs	Eggs	14%
Fish and seafood	Fish	86%
Milk products	Milk products	17%
Oil and fats	Oil and fats	91%
Sugar	Sugar	61%
Condiments	Condiments	100%

6.7.2 Food Consumption Score (FCS)

A total of 96% of households received an adequate FCS score, and 4% a borderline FCS. None of the households had a poor FCS.

Table 28: Food Consumption Score (FCS) from the week before the survey

FCS Score	Number of Households	Percent
Poor (≤21)	0	0%
Borderline (21.5-35)	12	4%
Adequate (>35)	264	96%
Total	276	100%

The FCS food groups consumed in the most number of days in the week before the survey were cereals and tubers (7), vegetables (6.7), meat, fish, eggs (6.1), oils (5.9) and sugar (4.1).

Figure 15: Mean number of days FCS groups were consumed in the week prior to the survey

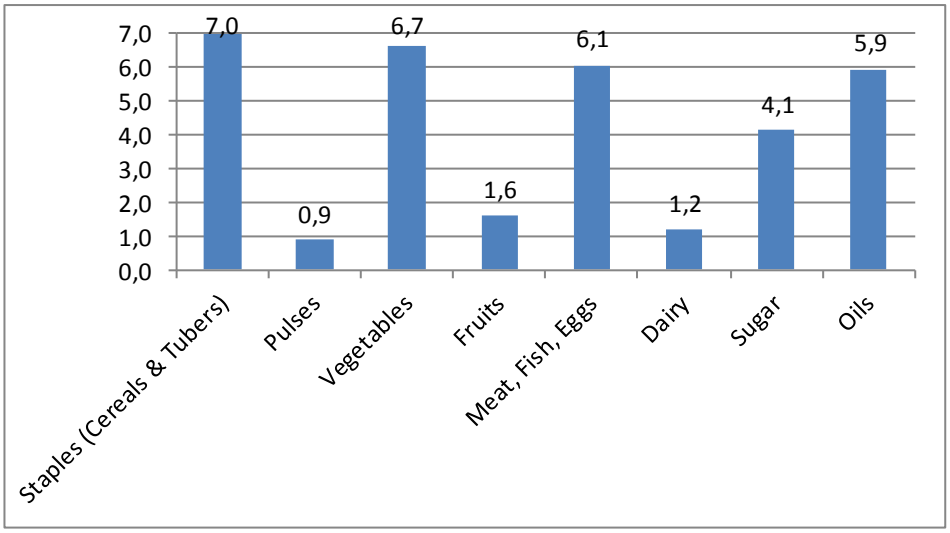


Table 29: Mean number of days FCS food groups (food shown) was consumed in the week before the survey

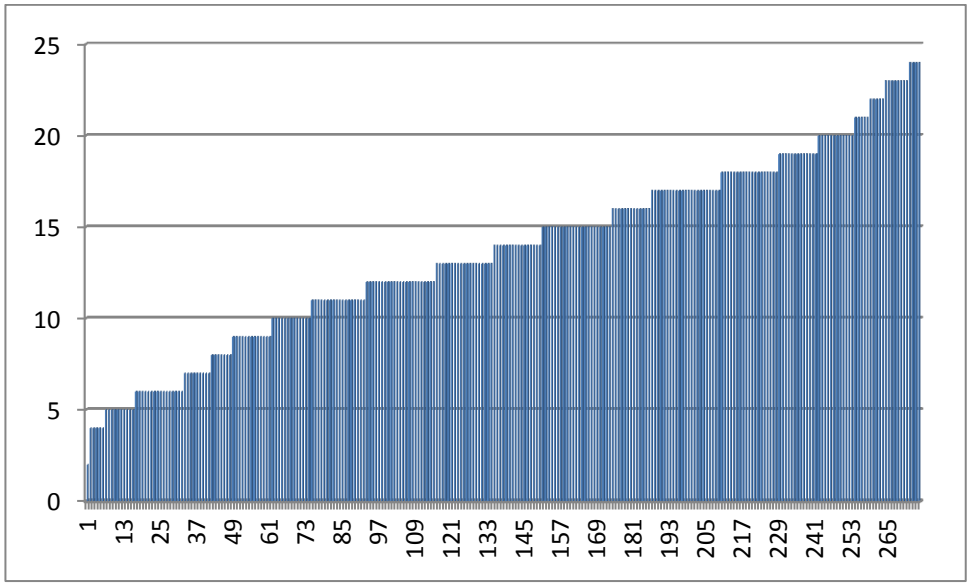
FCS Food Groups	Food	Mean number of days
Cereals	Rice	7.0
	Maize	0.0
	Other cereals	1.0
Roots and tubers	Potatoes, tubers	0.8
Pulses	Beans	0.6
	Nuts	0.3
Vegetables	Vegetables	6.7
Fruits	Fruits	1.6
Meat, poultry, offal	Beef	0.5
	Pork	0.3
	Mutton	0.0
	Poultry	0.2
Eggs	Eggs	0.9
Fish and seafood	Fish	5.2
Milk products	Milk products	1.2
Oil and fats	Oil and fats	5.9
Sugar	Sugar	4.1
Condiments	Condiments	6.9

5.8 Mental Health

Table 30: WHO-5 total numbers of answers by category, for the 275 respondents:

	Over the last two weeks ...	All of the time	Most of the time	More than half of the time	Less than half of the time	Some of the time	At no time
1	... have you felt cheerful and in good spirits ?	20	104	69	45	31	6
2	... have you felt calm and relaxed ?	17	66	87	44	45	16
3	... have you felt active and vigorous ?	51	82	69	52	20	1
4	... did you woke up feeling fresh and rested ?	64	78	58	35	35	5
5	... your daily life has been filled with things that interest you ?	10	34	27	24	20	160

Figure 16: WHO-5 index scores repartition for 275 participants



According to general score:

Regarding mental health status, 41.8% (115) of the respondents (275) show a score less than 13 (corresponding to a maximum of 48% well-being index), which is the threshold for poor well-being. Even when a threshold of 10 is taken (corresponding to a maximum of 40% well-being index), 22.2% (61) of the respondents show very poor well-being. The average score for all the respondents is 13.6 (or 55/100), which is almost equal to the threshold score of 13. The average score for the 115 respondents with a score under 13 is 8.7 (or 35/100).

According to specific scores of "0" or "1":

- 13.5% (37) of the respondents felt cheerful and in a good spirit less than 4 days during the last 14 days.
- 22.2% (61) of the respondents felt calm and relax less than 4 days during the last 14 days.

- 7.6% (21) of the respondents felt active and vigorous less than 4 days during the last 14 days.
- 14.5% (40) of the respondents woke up feeling fresh and rested less than 4 days during the last 14 days.
- 65.5% (180) of the respondents showed that their daily life has been filled with things that interest them less than 4 days during the last 14 days.
- 10.2% (28) of the respondents provided answers only into "Less than half of the time" or "Some of the time" or "At no time" categories, which indicate a weak well-being the half of the time or less, into the last 14 days period.

Results show a general acceptable level of wellbeing, being 41.8% the percentage of respondents who could potentially be affected by depressive mood or stress. Most potential mental health disorders are linked mainly to loss of interest in life, followed by stress and feeling of tiredness. Social interests are weak, probably due to heavy workload at home and in the field, as well as cultural limitations and activities.

5.9 WASH

Data from 273 households was collected. This includes 255 households in both Buddhist and Muslim communities, as well as 18 households in IDP camps and villages hosting IDPs[34]. In the following analysis, a disaggregation is made for questions related to drinking water treatment and latrine use as the situation is quite different in the camps compared to villages (of both ethnicities) due to specific humanitarian service delivery interventions.

As such, for certain figures, three different graphs are presented: one with the global figure for the entire Rathedaung township sample (273 HHs), one graph to represent findings for households in villages (255 HHs including all ethnicities), and one graph to reflect findings for the 18 IDP households in camps and hosting communities. Considering the very limited number of IDP households represented, the findings below in relation to IDPs are notstatistically significant but do provide an indication of trends. No specific disaggregation is made for drinking water sources (Figure 17) as the findings across concerned households remains quite homogeneous.

While all of the households have access to some kind of drinking water source, only 3% have access to a protected water source. The primary water source for the surveyed area was an open pond, in 75% of villages. Alternatively, 20% of communities had access to an open well.

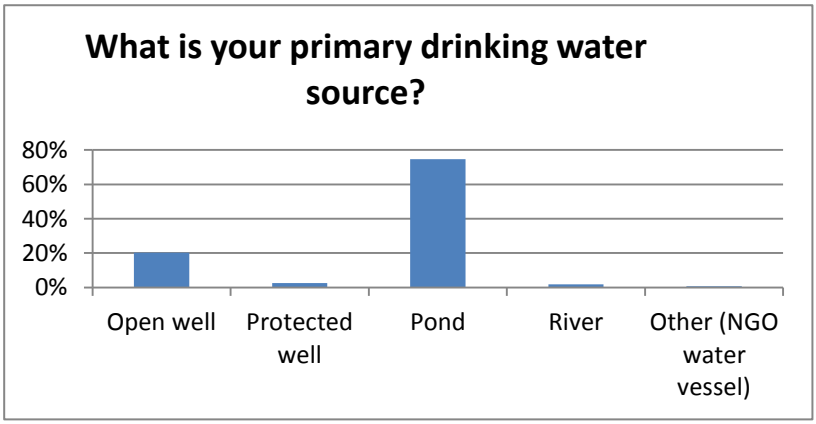
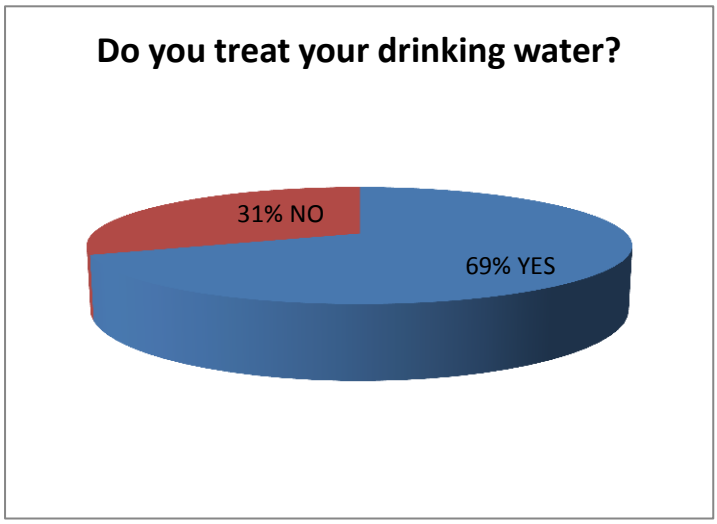


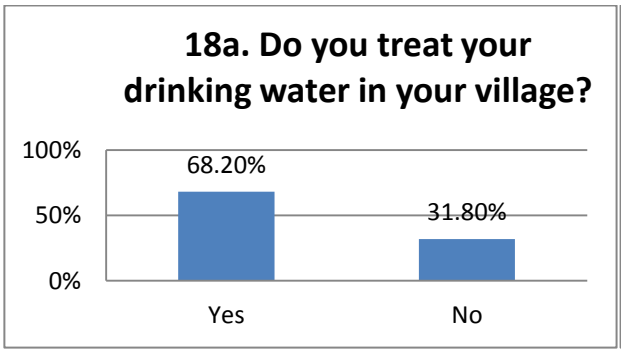
Figure 17: Drinking water source

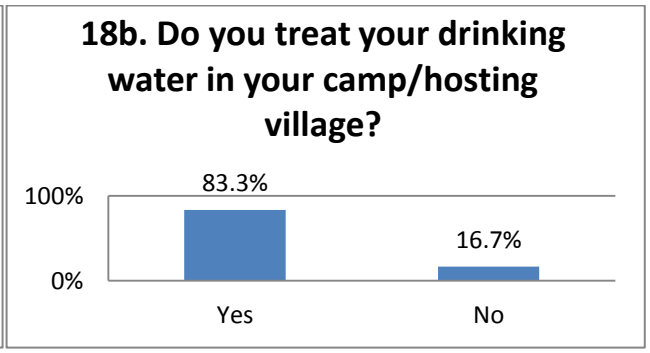
[34] As per the parameters established in the ENA sampling software, not all camps/hosting communities were included in the random cluster sampling. The communities represented include: Ah Nauk Pyin (IDP HHs hosted within the village), Chein Khar Li (including both IDP households in the camp, as well as IDP HHs in the village), Koe Tan Kauk (camp only), and Ahtet Nan Yar (IDP camp, with HHs originally form Pan Kyaine village).

Figure 18: Household Water Treatment



In addition to the fact that the vast majority of households obtain water from an unprotected source, globally only 69% perform some kind of treatment at the household level prior to drinking, such as filtering, chlorinating, sedimentation, and/or boiling. In Rathedaung villages of all ethnicities, almost one out of three households (31.8%) do not treat their drinking water at all. In camps, 83.7% of households do treat their drinking water, largely due to the availability of CWFs provided by WASH actors.

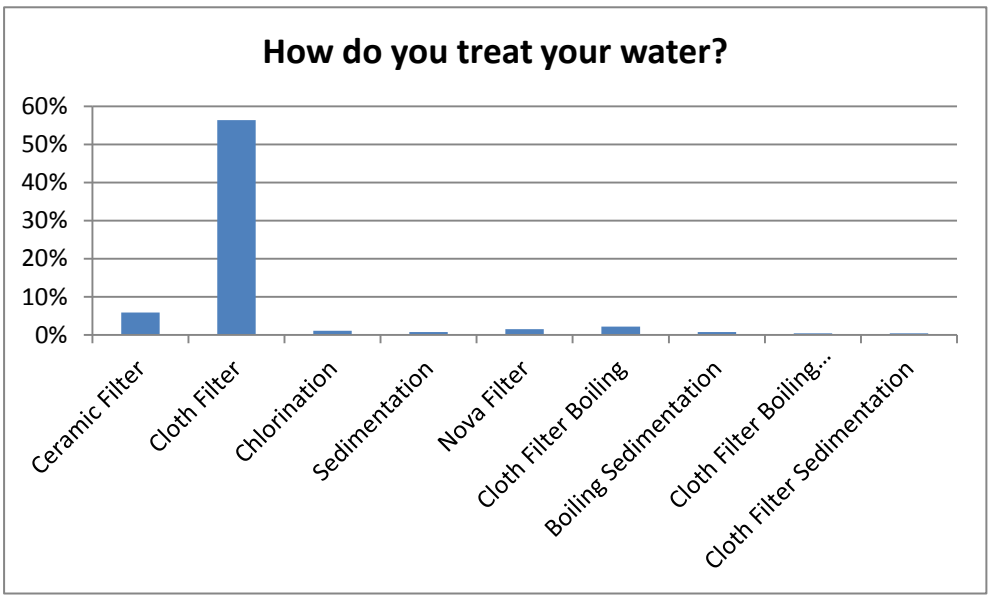


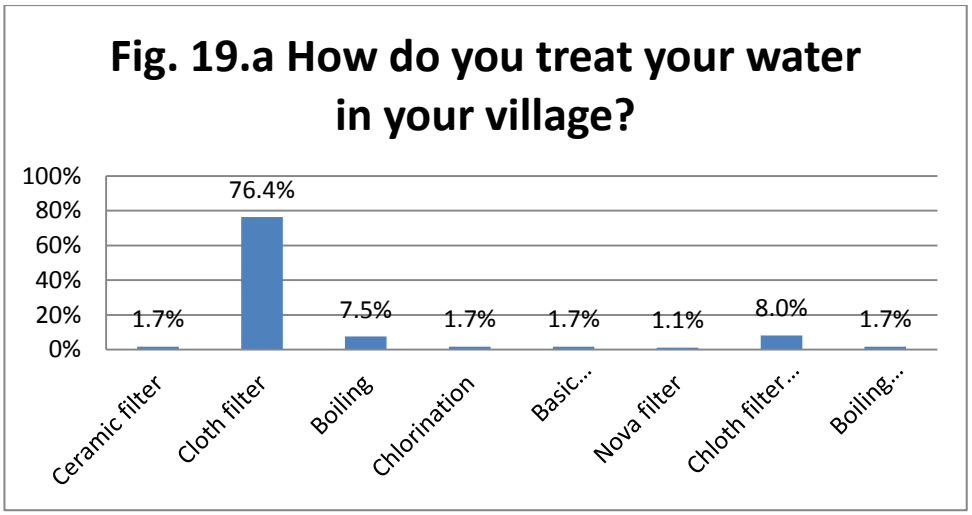


Of those who treat their drinking water, the predominant and traditional method is via cloth filter (56% for the global sample). If only villages are considered, this figure increases to 76.4%. with only 3.4% practicing safer methods such as ceramic water filters (1.7%) or chlorination (also 1.7%). 9.7% of sampled village households use a combined boiling method, including cloth filter + boiling (8%), and sedimentation + boiling (1.7%). 7.5% of village households treat their water through boiling alone. For IDP households in sampled camps and hosting communities, almost all use ceramic water filters (93.3%), while 6.6% reported using cloth filters. This suggests the direct impact that WASH actors' intervention had on treatment practices, as a baseline study conducted by Solidarités International (SI)[35] in 2013 for the same catchment population, before launching their CWF distributions and hygiene promotion campaigns, found that 100% of those households in the 5 camps/hosting villages that treated their drinking waterwere i using only cloth filters for treatment at that time.

[35] *Solidarités International – Baseline data Rathedaung - June 2013*

Figure 19: Water treatment practices (Global)

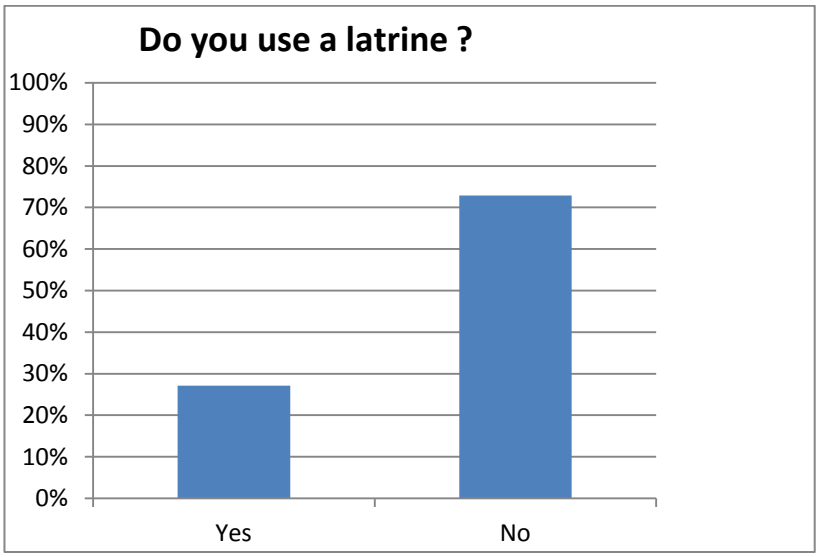


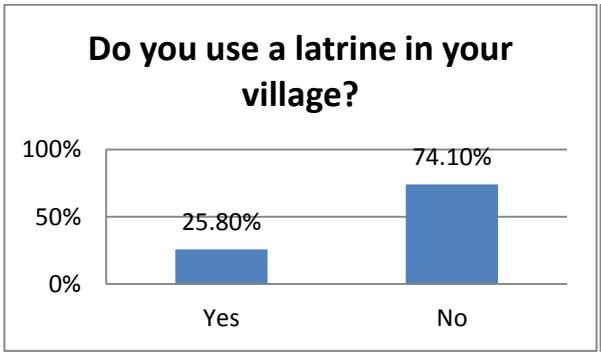


Household latrine coverage is extremely low, with 73% of households in the global Rathedaung sample without access to a latrine.[36] This result suggests that open defecation is commonplace and therefore environmental contamination is present, including potential contamination of unprotected water sources. Interestingly, the data shows that 34% of the population currently shares a latrine with other households. This finding is in part influenced by the structure of latrine provision in the camps, as 100% of those responders residing in IDP camps reported that they share latrines. In camps, latrines are organized as common resources per barrack while in hosting communities latrines are individually built. Across all sampled Rathedaung township villages, one out of four households report sharing latrines with extended families or neighbors.

[36] Comparatively, in the camps 44.4% of households report using latrines which again highlights the impact of WASH actors' interventions.

Figure 20: Latrine Use





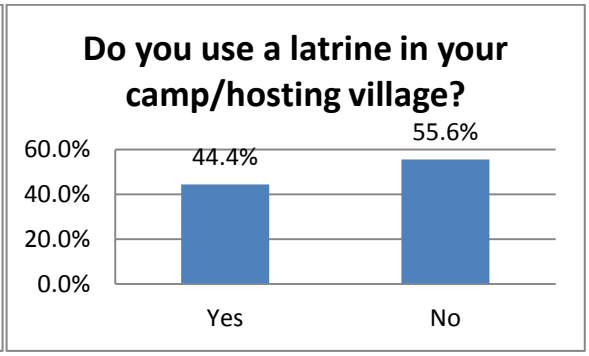
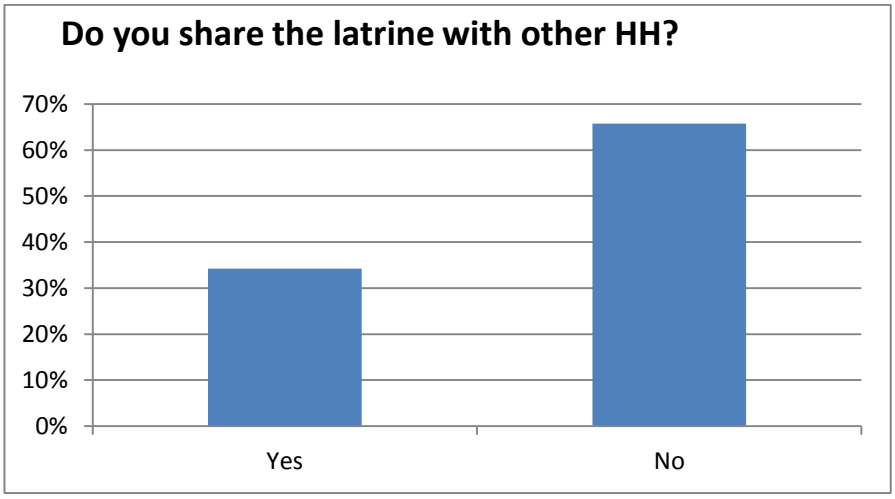
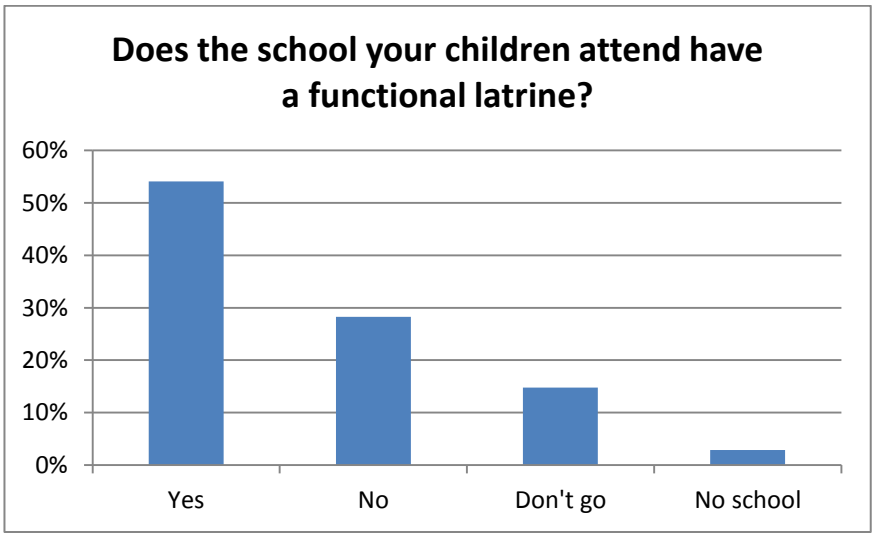


Figure 21: Latrine sharing



In terms of school sanitation, respondents stated that 54% of schools have a latrine. However, 15% of children from the surveyed households do not attend school. Only 3% of this number is due to the fact that there is no school in the village.

Figure 22: School Latrines

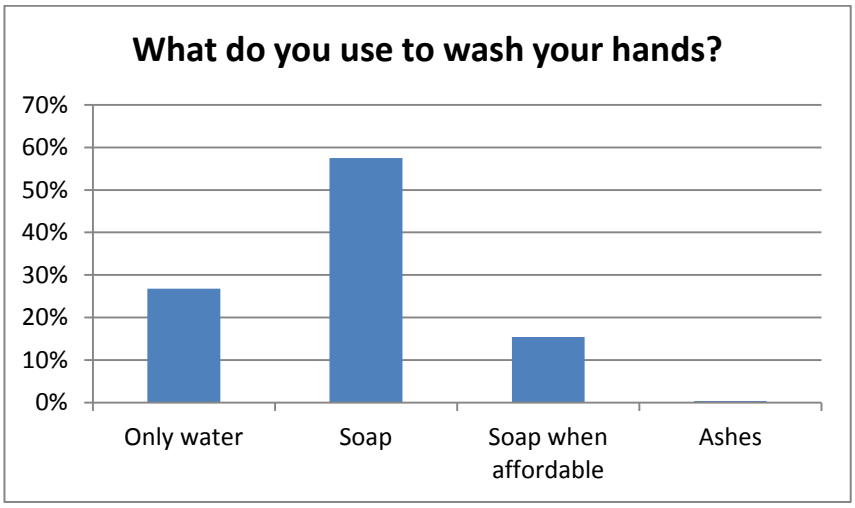


When asked if they washed their hands, 100% of respondents answered yes. There appears to be some understanding of the fecal-oral cycle in that 98% of all surveyed households claimed that they wash their hands before eating. However, only 21% of all households wash after going to the toilet. In addition, 55% of households washed prior to cooking. A significant lack of knowledge of the importance of washing after taking children to the toilet was noted in that only 5% are practicing this.

Figure 23: Hand washing practices

In terms of materials used for hand washing, 73% of all households either use soap (58%) or would use soap (15%) if they could afford it. 27% were only using water to wash their hands and only one out of all the households was using ashes.

Figure 24: Materials for hand washing practices



Only 33% of the total households surveyed were asked about cases of diarrhea in the past 2 weeks, since this data was collected only for those households with children under the age of 5. While the results cannot be considered statistically significant, it still can offer some information on health trends in the covered villages. 14% of households that were surveyed responded that a child under the age of 5 in their family had had episodes of diarrhea in the 2 weeks prior to the survey. All of these households came from villages that were getting their water from an unprotected source and 31% were not treating their water at all prior to drinking. 85% of these respondents claimed that they did not have a latrine and 69% of households were not washing their hands after going to the toilet. There is a clear link between access to clean drinking water, use of a safe latrine and proper hand-washing practices, and good health, free from diarrheal causing conditions, as is corroborated by these findings.

6. LIMITATIONS

- There was no SMART survey baseline to refer to.
- 4 villages were excluded due to the lack of access.
- Data was collected from 48 clusters out of the 50 expected (although still within the acceptable range of 10% admitted by the SMART methodology).
- Only 372 eligible children were found, considerably less than the 627 calculated by ENA according to the parameters chosen in the planning phase for the calculation of the sample size. This is linked to the lack of updated population data, indicating that the percentage of children under five was overestimated. (5.8 per HH)
- Determination of age was only possible to crosscheck with birth certificate, vaccination card and family list in 15% of cases. Thus, the mother/caretaker´s response and verification with the event calendar were the main source of information.
- Sample size for IYCF indicators was small.
- Specific context dynamics challenged the survey.
- Logistics arrangements considering the geographic context as well as timeframe of the study rendered it not possible to repeatedly return to the surveyed cluster once the teams had left, therefore errors were minimized by means of other mechanisms like a close supervision and a thorough cleansing data process.

7. DISCUSSION

The results of this SMART survey provide a snapshot of the situation; it tells us what is happening at the given moment. Extra information on the causes of malnutrition gives an added value by potentially telling us why it is happening and eventually improving programmatic decisions. This cross-sectional survey adds some information on the immediate and underlying causes of malnutrition.

7.1 Malnutrition

The boy/girl ratio and distributions by age and sex were all as expected for a representative sample.

According to the WHO categorization of the public health significance of undernutrition (table 31), the prevalence of GAM in Rathedaung Township, 10.6% (6.7 – 16.0 95% C.I), indicates an alert level. Moreover, the stunting prevalence of 37.9% (31.8 – 44.4 95% C.I) is high. Regarding underweight, the composite of both, the prevalence of 30.4% (24.4 –37.2 95% C.I) indicates very high levels.

Table 31: WHO categorization of the public health significance of undernutrition (1995)

Indicator	Low	Medium	High	Very high
% Stunted	<20	20-29	30-39	≥40
% Underweight	<10	10-19	20-29	≥30
% Wasted	<5	5-9	10-14	≥15

There is no gender difference for the prevalence of SAM. The discrepancy between boys and girls for MAM was proved not significant statistically speaking and therefore further research into other factors would be needed to verify the difference. By age group, there was no difference in SAM prevalence and the 42-59 months children showed a higher MAM rate than the younger ones.

Acute malnutrition expressed by MUAC is lower than the one expressed by z-score with a prevalence of 3.5% (1.7 – 6.9 95% C.I) for MUAC <125 mm and a prevalence of 0.5% (0.1 – 2.1 95% C.I) for MUAC < 115 mm. No difference was shown between boys and girls. By age group, there appears to be a correlation between SAM and MAM in the youngest group 6-17 months.

Although studies based on nutrition surveys from a range of countries have proved there is a strong correlation between weight-for -height and MUAC[37], it is also shown that this relationship changes in different populations due probably to the influence of body shape (in particular the ratio of sitting height to standing height) on weight-for-height measurements[38]. Numerous studies show similar findings, including ACF research based on different nutrition surveys[39]. MUAC seems to be more sensitive than WHZ to high mortality risk children and to select younger children. Both criteria also identify different children with some degree of overlap that varies across populations.

[37] Myatt, et al. 2007. A review of survey data collected between September 1992 and October 2006.
[38] Myatt et al. 2009. The effect of body shape on W/H and MUAC based case definitions of acute malnutrition in Ethiopian children.
[39] Cichon, B. 2012. MUAC versus weigh-for height debate in the Philippines. Field Exchange 42.

In line with the statements above, the results of this survey in Rathedaung Township show there is a significant difference between the prevalence of acute malnutrition based on WHZ and MUAC. In this survey, MUAC tends to identify SAM and MAM children particularly in the younger groups (6-17) whereas WHZ identifies more MAM children in the older groups (42-59 months). The degree of overlap in identifying acutely malnourished children by both criteria MUAC and WHZ is around 24%.

Regarding stunting and underweight, there was no difference between boys and girls. By age group, both indicators appear to correlate.

It is well known the increased risk of death and disease associated with under-nutrition. Any child experiencing a degree of wasting or stunting is at greater risk of dying. The Lancet series on Maternal and Child Nutrition (2008) estimated the likelihood of mortality according to the degree of under-nutrition. This mortality analysis has been recently updated founding similar results[40]. Mortality risks multiply when both wasting and stunting are experienced concurrently. The higher risk of mortality related to severe wasting compared to stunting are well known. Nevertheless, the risks associated to the severe stunting child have not been a particular focus of attention and are not taken into account into the Community Management of Acute Malnutrition (CMAM) approach and should be addressed through multi-sectorial and innovative approaches. It is notable the higher risk of mortality of the severely stunted child compared to the moderately wasted child. Moreover, the study found that a child who **is both stunted and wasted** has the highest hazard of death, **12.3** times, even higher than for severe wasting individually.

When the findings of the mentioned study are confronted with the different rates of malnutrition found in the Rathedaung survey we can further realize the magnitude of the problem.

Table 32: Mortality risk association with malnutrition, and malnutrition rates in Rathedaung survey

Mortality risk association with undernutrition		**Malnutrition prevalence in Rathedaung**
Severely wasted	**11.6** times more likely to die	**1.6%** (0.7-3.8 95% CI)
Moderately wasted	3.4 times more likely to die	**8.9%** (5.8-13.4 95% CI)
Severely stunted	**5.5** times more likely to die	**15.6%** (11.9-20.2 95% CI)
Moderately stunted	2.3 times more likely to die	**22.3%** (18.4-26.7 95% CI)

In the light of these findings, and the rates found in the survey, it is observed that the percentage of children severely stunted (15.6%) is even higher than the percentage of children moderately wasted (8.9%) and indeed also at higher risk of mortality. What´s more, high levels of chronic malnutrition have a direct impact on children's health and sickness resistance and thus increase the vulnerability to acute malnutrition.

It is important to note that the time of the year determines particularly the prevalence of wasting, which has a relatively shorter duration than stunting and is highly variable seasonally. The survey was done in December, which is not typically the time of the hunger gap. The incidence of wasting cases occurring over time and depending on the season should not be neglected. At the time of the survey the prevalence of SAM is below the traditional emergency thresholds.

[40] Olofin et al. 2013. Associations of suboptimal growth with all-cause and cause-specific mortality in children under five years: a pooled analysis of ten prospective studies.

Extrapolation of the number of children suffering from malnutrition for Rathedaung Township:

Based on malnutrition prevalence and children population estimation, the number of children 6-59 months suffering from Acute Malnutrition, Stunting and Underweight has been extrapolated at a given time. Note that for the under five population estimation, a 14% is used instead of the initially 17.34% which seemed to be overestimated. 0.9 is used as the fraction of 6-59 months children within the under 5 age category.

Table 33: Number of children suffering from malnutrition in Rathedaung Township according to the SMART nutrition survey 2014.

Acute Malnutrition		**Stunting**		**Underweight**	
Global Acute Malnutrition	Severe Acute Malnutrition	Global stunting	Severe stunting	Global underweight	Severe underweight
2375	362	8574	3529	6877	2375

Pregnant and Lactating Women- Nutritional status by MUAC

There is no consensus on how to identify PLWs as acutely malnourished. MUAC is generally agreed as the criteria for admission in nutritional programmes, with cut-offs ranging from 210 mm to 230 mm depending on the context. In the present survey 33.7% of the PLWs had a MUAC of less than 230 mm and 9.3% below 210 mm. There was no statistical difference between pregnant and lactating ones.

The nutrition status of the mother is linked to the nutritional status of the newborn. The Lancet series on Maternal and Child Nutrition revealed that maternal under-nutrition is associated with poor reproductive performance, a higher proportion of maternal deaths, a high incidence of low birth weight (LBW) and intrauterine malnutrition. Poor nutrition starts in the uterus. LBW infants born at term are likely to have suffered from intra-uterine growth restriction (IUGR) whose most significant cause is also poor maternal nutrition, thus creating a pernicious cycle that spans generations. These babies have a greater risk of mortality and if they survive, are more likely to experience developmental deficits and to be underweight or stunted in early life.

Moreover, maternal undernutrition influences the quality of care they can provide to their children, putting at stake the important mother-child interactions necessary for a proper growth.

7.2 Morbidity, measles coverage and vitamin A supplementation

It was found that 65% of children had one or more than one episode of acute morbidity within two weeks prior to the survey. The highest percentages of reported illness were ARI (36%) and fever (34%).

The data collection was done during the cold dry season. Diarrhea was 16%, this morbidity is typically higher during the rainy season. Other type of acute illness represented 14%. ARI and diarrhea are potential aggravating factors for acute malnutrition when not properly and rapidly identified and treated. No difference was found between boys and girls, which could have been correlated with a higher prevalence of acute malnutrition in boys that was not significant statistically in isolation of other factors.

Findings revealed a measles vaccination coverage of 59.2% for 9-59 months old children. Vitamin A supplementation in the last six months had occurred in 39.7% of children. The current coverage is below the recommended optimum standards recommended by WHO (≥90%) and may have been influenced by the lack of recent campaigns.

7.3 Infant feeding

It was noticed that breastfeeding is common and widely practiced by all women, as it also indicates the 100% of children ever breastfed. However, other practices fall below adequate standards and must be interpreted cautiously within the context.
The rate of exclusive breastfeeding until 6 months was 20.6% which is poor according to the WHO rating. The average introduction of complimentary foods was 4 months, below the international recommendations of 6 months, right after the exclusive breastfeeding period. The average introduction of complimentary food was found to be even lower, 2. 5 months, in children below 6 months. Besides this average early introduction of complimentary foods, very extreme values were also observed, ranging from 0 months to 18 months.

The indicator of timely complimentary feeding is high (90.5%), but it must be interpreted in the light of the above and other findings. Same observation applies to the indicator on introduction of solid, semi-solid or soft foods, which is high (94.4%). For example, it is noteworthy that if both recommendations of exclusive breastfeeding and introduction of complimentary foods by 6 months are considered, only 9 out of 107 children fulfilled the recommendations, less than 10%.

In conclusion, although these two indicators may show positive rates, when they are contextualized they lose power too. Besides, the limitations of the sample should not be neglected, as for some of the indicators the denominator was small.

On the other side, the high rates of continued breastfeeding at 1 and 2 years are positive. Although not assessed in depth, it seems that these rates are high in both Rakhine and Muslim communities with a trend to shorter weaning period for Muslim women and longer sustained breastfeeding for Rakhine women.

84.3% of children 6-23 months appear to have received a minimum acceptable number of meals. However, regarding the dietary diversity, this percentage represents only 20.8%. Rice porridge was by far the most common food first introduced (78.5%) which interestingly suggests a correlation with the most common IDDS food group consumed (grains, roots and tubers: 84%), very much likely to be a rice-based food too, and remarks the importance of this staple in the diet. Lack of variety in the diet influences the consumption of necessary micronutrients, both in quantity and in quality, necessary during this vulnerable period of growth. The combination of both indicators shows that only 12.4% of children received a minimum acceptable diet.

The effects of a poor diet during the first two years of life highly jeopardizes the normal growth of the child , as shortages and deficiencies in key nutrients can lead to wasting and stunting as well as other developmental and cognitive conditions that could not be later reversed.

Moreover, though not assessed in depth, some cultural beliefs and local practices may be inappropriate. For example, giving chewed rice to the child may pass bacteria from the mother to the child. It is of paramount importance that the knowledge on appropriate IYCF practices by mothers/caretakers needs to be improved.

7.4 Food Security

Household Dietary Diversity Score (HDDS)

The HDDS foods included cereals (100%), condiments (100.0%), vegetables (96%), oils and fats (91%), fish and sea foods (86%). The individual foods from these food groups would most likely have been rice, chillies/chilli paste, salt, a variety of seasonal vegetables (local varieties of carrot, aubergine, peas, cauliflower, watercress…), fish (fresh & dried) and cooking oil.

The highest protein containing food group was fish and sea food. Roots and tubers, pulses, meat (beef, pork, mutton and poultry), eggs and dairy products food groups were consumed in a low proportion (by less than 20% of households).

The mean HDDS score was 6.4, which is above the minimum acceptable standard of 4. A total of 0.7% of households were found to have low dietary diversity (<=3), 55.8% had medium dietary diversity (4-6), and 43.5% had high dietary diversity (>=7).

Caution should be made when interpreting the value of HDDS. The HDDS is a proxy measure of household access to food including socio-economic change (ability to access/purchase food). The HDDS is not intended to be a definitive indicator of the quality of diet as all food groups are weighted equally.
Moreover, this survey was done during the dry season, which is not the one of greatest food shortage: at this period, households have more easily access to rice, vegetables and fish.

Food Consumption Score (FCS)

FCS is a proxy measure of the quality of household diets. The FCS weights food groups differently based on their micronutrient density. The general assumption is that in most circumstances if food(s) from a particular food groups are consumed several times a week then the amount (quantity) of the food group consumed will be adequate.

A total of 96% of households had an adequate FCS, and 4% had a borderline FCS. None of the households had a poor FCS score; This is nearly identical to HDDS score which revealed that 99.3% of households had at least a minimum acceptable score.
The top five FCS food groups consumed (higher mean number of days) in the week prior to the survey were cereals and tubers (7), vegetables (6.7), meat, fish, eggs (6.1), oils (5.9) and sugar (4.1). Among cereals, rice is the one consumed every day. The mean number of days of consumption for the food group “meat/fish/eggs” is high because fish is consumed regularly (meat (non-fish) and eggs: less than 1 day per week).

When the HDDS and FCS food groups are compared (removing condiments from HDDS because it is not included in FCS) they are listed in a very similar order from top to bottom and the correlation is very good. This is an indicator that the same type of food groups are being consumed daily or somewhat frequently over a seven day period. Roots and tubers, pulses, fruits, meat, eggs and dairy product were very few consumed daily or frequently (<2 days from week).

A fair amount of variety of foods within FCS food groups was shown in the FCS. The predominant staple food was rice; potatoes were quite inaccessible during the survey because it was not the season of potato. Taro

was observed to be consumed, it is harvested in November. The predominant protein food was fresh/dried fish and the fat was cooking oil; meat and eggs are not often consumed.

However, these results should be put in perspective with the fact that in Rathedaung Township the peak season for food shortages is between June and August, during the rainy season and just before the harvesting season. The data collection for the present survey took place at the end of the year, in December. Generally, it is recommended to collect HDDS and FCS during the period of greatest food shortage. It would thus be relevant to monitor the area and to carry out similar exercise during the food shortage period.

An in-depth assessment of food security was out of the scope of this survey. However, it is quite likely that since the 2012 crisis, social changes may have influenced the food security and livelihoods of the population. Although not assessed, some coping mechanisms developed by families in order to face poverty were observed during the survey, such as migration of family members and negative consumption strategies such as eating less preferred foods and decreasing quantity (e.g. higher amount of rice but less of fish/vegetables).

7.5 Mental Health

Results show a general acceptable level of wellbeing, being 41.8% the percentage of respondents who could potentially be affected by depressive mood or stress. Most potential mental health disorders are linked mainly to loss of interest in life, followed by stress and feeling of tiredness. Social interests are weak, probably due to heavy workload at home and in the field, as well as cultural limitations and activities.

7.6 WASH

There is a clear link between lack of clean drinking water, proper sanitation and hygiene practices and undernutrition, both in the form of wasting and stunting. The water and sanitation crisis can be considered a driver of the hunger and nutrition crisis. More specifically, the close relation between undernutrition and diarrhoea (a consequence of the lack of sanitation and clean drinking water) is well established: the undernourished are more likely to suffer higher incidences of and increased mortality rates from diarrhoea, while on the other hand those suffering from diarrhoea are more likely to suffer from wasting, as a child affected by diarrhoea will lose appetite, have difficulties eating and will pass water and nutrients in his stool, accelerating the malnutrition process.

The data shows that while all households had access to a water source, only 3% of households in the survey had access to a protected water source and only 18% were treating their water with an effective and safe method (i.e. ceramic filtration, boiling or chlorination). The majority of the population (89%) is practicing open defecation, which is among the main contributing factors for the prevalence of diarrhoea cases in the area. Proper hygiene knowledge is poor in that while respondents seemed to understand the need for proper hand washing, only 21% of all households wash after going to the toilet and 1 out of 3 households do not use soap. The practice of handwashing with soap has a strong evidence base as a key intervention capable of reducing diarrhoeal disease by 30-50% and respiratory infections by 16-23%.[41]

[41] Cairncross S, Hunt C, Boisson S, Bostoen K, Curtis V, Fung I, et al. Water, sanitation and hygiene for the prevention of diarrhoea. Int J Epidemiol. 2010; 39(Sup 1):193-205. [doi:10.1371 /journal.pmed.1000058].

From the survey findings we see that there is an urgent need to motivate the whole community to stop open defecation. Current global best practice is to measure real success by the number of communities which are open defecation free rather than just counting the number of latrines built and/or used.

8. CONCLUSIONS AND RECOMMENDATIONS

In the light of the findings, it can be stated that acute malnutrition rates should be considered though they do not justify an emergency response.

Furthermore, in line with recent research, there is an important need to implement integrated wasting and stunting programmatic interventions. Evidence does not support the current degree of separation of wasting and stunting into acute or chronic conditions or humanitarian and development contexts[42].

There is growing evidence of their associated factors (table 34). Therefore, it is likely that actions addressing these factors would have beneficial effects on wasting and stunting.

Table 34: Immediate "causal" factors shared by wasting and stunting

	Wasting*	Stunting*
Associated factors	Maternal stature (Ozaltin, Hill et al. 2010	Maternal stature (Ozaltin, Hill et al. 2010) Maternal weight gain during pregnancy (WHO 1997)
	Infectious disease (Olofin, McDonald et al. 2013)	Infectious disease (Olofin, McDonald et al. 2013)
	Dietary inadequacy (Arimond and Ruel 2004)	Dietary inadequacy (Arimond and Ruel 2004)
		Zinc inadequacy (Imdad and Bhutta 2011)
	Diarrhoea (Richard, Black et al. 2013)	Diarrhoea (Checkley, Buckley et al. 2008) though not replicated by Richard et al in 2013 (Richard, Black et al. 2013)
	Inappropriate complementary feeding	Inappropriate complementary feeding (Bhutta, Das et al. 2013)
		Environmental Enteric Dysfunction (EED) (Keusch, Rosenberg et al. 2013)
	Intrauterine growth restriction[5] (Christian, Lee et al. 2013)	Intrauterine growth restriction (Black, Victora et al. 2013)

The situation in Rathedaung, where there are no nutrition programs so far and a short history of humanitarian interventions, presents both a challenge and an opportunity to develop this kind of initiative by potential actors.

In order to improve the nutritional status of the population, the priority needs identified linked to the causes of malnutrition should be addressed through multi-sectorial approaches including Nutrition Specific and Nutrition Sensitive interventions (figure 25). Based on this framework, the following recommendations are suggested:

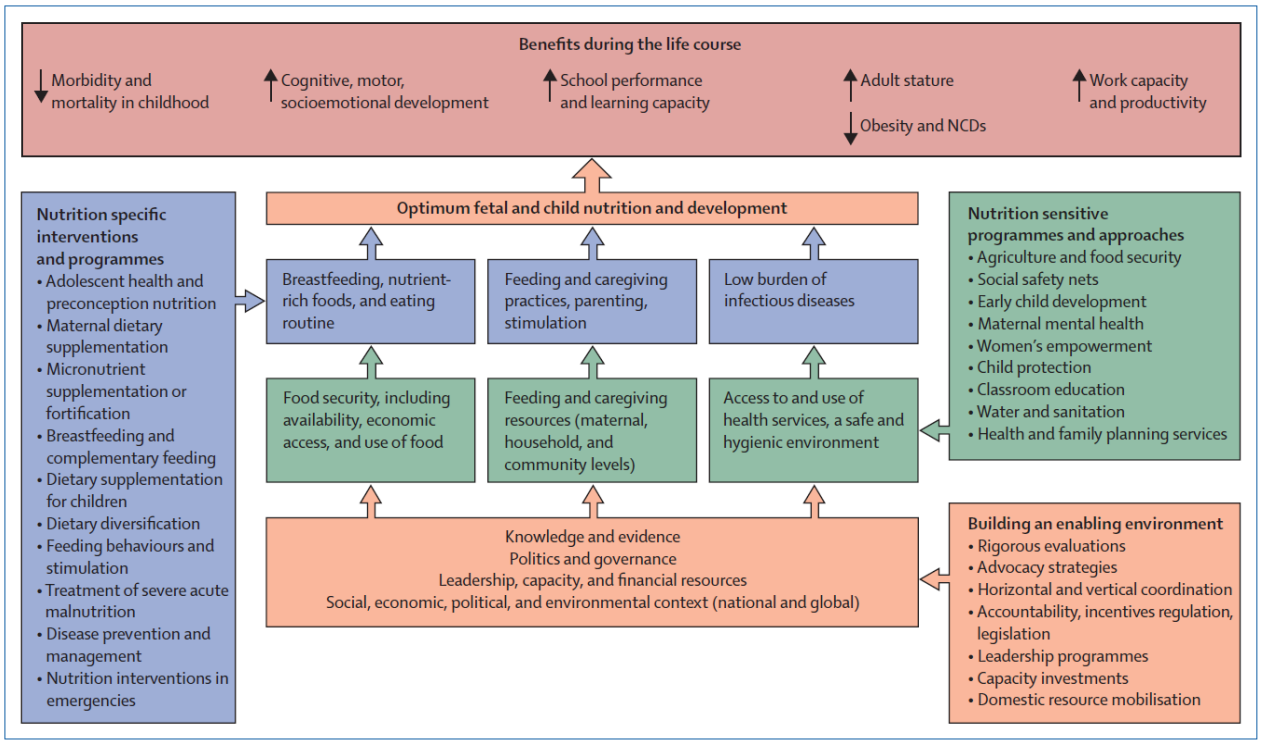
- Coordination and collaboration with the Ministry of Health is essential when designing strategies to address malnutrition in Rathedaung Township.
- A health system strengthening approach through technical support and capacity building in nutrition at health centers and community level is paramount:

[42]ENN Technical briefing paper. July 2014. The relationship between wasting and stunting, policy, programming and research implications

- Build and strengthen the capacity of MoH and other local partners to effectively integrate management of acute malnutrition approach (prevention, detection and treatment) at community and facility level, integrating that treatment with existing maternal and child health services.
- A mechanism for detection, referral and treatment of cases of acute malnutrition, above all SAM cases in a first stage, should be encouraged through existing health services. Although MUAC is easier to use at community level for screenings, both criteria, MUAC and/or WHZ must be used for admission of malnourished children, since they identify different children with a low degree of overlap.
- Wasting treatment may be an important component for stunting prevention. This CMAM approach should not be seen in isolation but as part of a more holistic approach; same infrastructure and resources could be used conjointly to deliver measures addressing stunting, especially during the 1000 days of life (pregnancy to 2 years). An integrated approach linking wasting treatment with stunting prevention through other interventions in IYCF, maternal nutrition and health should be envisaged. IYCF practices must be scaled-up. Since there are no nutritional programmes in place so far, alternative approaches should be considered too. Community based interventions that promote behavioral change and a sense of ownership by the community in the long run are likely to be more sustainable.
- In view of the significance of the importance of maternal nutrition and health, it is highly recommended to approach this issue through nutrition and health education sessions by means of health centers where they exist, community mobilization and/or community awareness at household level. Reproductive health interventions are greatly encouraged.

- To conduct regular SMART surveys to monitor the nutrition situation. The current survey represented the first assessment and established a baseline to refer to. A lesson learnt during the survey recommends the use of a smaller percentage of under fives for the calculation of the sample than the one used for this survey.
- As a result of the limited mental health issues, there is no need to propose a specific program for mental health and psychosocial support. Prevention projects around social activities linked to women's well-being and networking could be therefore considered; standalone or integrated in any other program (like nutrition or food security and livelihoods).
- At this stage no specific recommendation are provided in regard to food security interventions, however a close monitoring will be needed in the area of operation and if possible to carry out similar exercise during the food shortage period of the year.
- Regarding WASH, using tools such as a modified Community Lead Total Sanitation (CLTS), with locally developed solutions that are maintainable within a community's budget, should be prioritized. This can be combined with water safety planning to create both an awareness of the problem of open defecation and other poor hygiene practices, as well as an attitudinal change where people believe avoiding these risks is within their power and best interest.

Figure 25: Framework for action



9. ANNEXES

Annex 1: Assignment of clusters

(List of villages and assumed IDP movements of selected clusters)

Geographical unit	Population size	Cluster
Thar Zay Htaut	803	
Chay Yar Taw	398	
Ding Kyat	399	1
Phyu Chaung	2489	
Min Gan	686	2
Auk Zee Kine	1671	
Nhan Kheen	427	
Ahtet Zee Kine	812	
Nyaung Ban Lae	1414	3
Leik Tauk Tea Su	281	
Kyum Gyi	816	
Kyat Yoe Seik	1264	4
Sar Pyin Gyi	1222	
Sar Pyin Shay	744	
Pan Zinn Maw	632	
Nyaung Pan Gyi (Rakhine)	187	RC
Nyaung Pan Gyi (Muslim)	1970	
U Gar	2359	5
Shwe Long Tin	1680	
Myin Kran Chaung	1294	6
Kan Pyin	1932	
Kut Chaung	1448	7
Ray Peik Sunn	641	
Ku Taung	5596	8,9
Ku Taung Ywa Shay	236	
Anauk Pyin (Muslim)	3002	10
Nay Be seik	534	
Nyaung Pan Hla	261	
Sin Oh	158	
Pan Kyaine (fled to Ahtet Nan Yar IDP)	1590	11
Aung Thar Yar	258	
Pam Phaw Pyin	595	
Kyue Pyin	362	
Kan Pyin	318	
Thit KaToe	835	
Mi Nyo Htaut	685	12
Thar Zay	324	
Inn Nauk Chaung (Ywa Thit)	118	

Kyum Baw Pauk Taw	623	
Ka Nyin Chaung	759	
Alay Chaung	465	
Nat Chaung	516	
Khawe Tauk Chaung	603	13
Hnin Si Gone	453	
Pya Pin Yin	455	
Min Phoo	1073	
Aung Min	299	
Kyae Tapin	597	14
Aung Seik	1012	
Kon Tan (Rakhine)	593	
Nowai	543	
Kon Tan Zay	75	
Yan Aung Pyin	629	
Lone Tin Ywar	422	15
Kyauk Sar Dine	431	
Mee Kyaung Yae Thauk	363	
Baw Htee Gone	409	
Phat Leik	425	
Tha Pya Taw (Muslim)	2160	16
Thazin Myaing	181	
Pa Dauk Myaing	176	
Pyin Shay	97	
Aung Zay Gone	785	
Kan Pyin	184	
Pyin Wam	556	
Saphyo Kyum	414	
Doe Wai Chaung	348	17
Hman Ni Pyin	710	
Kyin Tan	227	
Thein Taung	752	
Kyauk Yan	581	
Maw Htet	328	
Tazaw (Muslim)	659	18
Thin Ganet (Muslim)	1321	
Kwa Sone	1003	
Pauk Pin Yan	181	
Adu Ywar (Muslim)	446	
Than Du Ywa (Muslim)	376	19
Bai Lar Mi (Muslim)	949	
Nilar Baw (Muslim)	1007	
Pyaing Taung (Muslim)	612	
Ahtet Nan Yar	1934	20
Auk Kyaung Taung	946	
Kha Maung Tome	465	

Auk Nan Yar (Muslim)	3376	21,22
Zedibyin (Rakhine)	3467	23
Zedibyin (Muslim)	790	
Thar Yar Gone	298	
Choot Pyin (Rakhine)	212	24
Choot Pyin (Muslim)	1615	
Chin Ywar	2212	
Oat Phaw	904	
Kan Seik	1473	25
Zay Yar Myaing	448	
San Khone Dine (Rakhine)	460	
San Khone Dine (Muslim)	2369	26
Zee Khaung	432	
Thami Hla (New)	384	
Ohn Chaung	946	27
Yet Khu Dine	645	
Arkar Taung	1863	
Yee Myat	701	28
Nyaung Pan Hla	762	
Baw Htee Gone	306	
Aung Myay Gone	716	
Sauk Khat	739	
Prin Taw	1363	RC
Manyin Taung	299	
Kon Tan	632	
Nga San Baw	753	
Ah Myet Taung	1010	29
Yee Soe Chaung	1864	
Kin Poum Chaung	192	
Yee Buat	1043	30
Kyauk Yan Thar Zay	875	
Maung Phyu	488	
Kyauk Gon Buat	269	
Pay Thadu	282	
Thet Pya Kya	317	
Kha Ru Chaung	621	
Yee Kyaung Chaung	1684	31
Aung Taing (Long Chaung)	103	
Kyauk Tan	2223	32
Htee Swae	799	
Aung Thar Zay	475	
La Mote Dine	732	
Ngwar Tinn Kote	580	
Thaung Dayar	1252	33
Laing Gwin Ywa Gyi	1578	
Taung Yin Tan	1756	34

Chaung Wa	801	
Ashay Taung	2705	35
Ashay Myauk	2295	36
Kaw Tan Kauk (Rakhine)	433	
Kaw Tan Kauk (Muslim)	4555	37
Bar Sa Yar	1688	38
Taung Nah Ywar	2050	
Myit Nah Ywar	2688	39
Ching Khali (Rakhine)	652	
Ching Khali (Muslim)	4240	40,41
Doon Peik	1368	
Aung Bala	415	
Sin Pike	1320	42
Pauk Taw Pyin (Tan Aye)	405	
Thayet Chaung	630	
Thayet Pyin	720	
Paung Zarr	550	
Napu Khan	498	43
Kyet Yoe Kon Tam	1219	
Kyum Chaung	694	
Kaung Yee Chaung	607	
Kalar Chaung	1454	RC
Ma Gyi Chaung	921	
Angau Maw	820	
Ma Gyi Chaung Kon Tan	1281	44
Laung Chaung	2059	
Aung Ma	699	45
Than Chaung	828	
Kapaing Chaung/Yee Phyu Kan	982	
Pyin Chaung (in Ahtet Nan Yar IDP)	646	
Nga Gar Mot (Ahtet)	658	46
Nga Gar Mot (Alay)	523	
Nga Gar Mot (Auk)	1110	
Say Ohn Kya	1312	47
Tin Gout	635	
Laung Zin	239	
Lay Gan	1223	
Pauk Taw Gyi	661	
Awa Tar	541	48
Pyar Chaung Gyi	371	
Alay Yar Shay	230	
Pyin Khung Ywar Haung	196	
Pauk Taw Shay	332	
Kyauk Sone	790	
Pyin Khung Ywar Thit	730	
Kar May Khe Mee	451	49

Kar May Kahine	562	
Kyin Thar	1012	
Tun Ya Wai Year Thit	206	
Tun Ya Wai	840	
Saw May	630	RC
Wat Note Thee	315	
Nga Tauk Tu Gyi	540	
Bat Kar Ywar	775	
Nga Tauk Tu Shay (New)	207	
Sae Kar Ywa Haung	428	
Taung Hla Maw	339	
Say Gan	123	
Kan Pyin	134	
Kha Naung Gyi	562	RC
Ywar Thit Kay	572	
Bar Ta Lay	2805	RC
Tha Yet Chaung (Kha Mwe)	1886	
Sa Pha Htar	760	50
Kan Pyin	680	
Lay Gwa Sone Yar Haung	499	
Lay Gwa Sone Yar Thist	558	

Annex 2: Rathedaung Survey Plausibility Report

Plausibility check for: MYA_122014_RTD_ACF_final_dat.as

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

Overall data quality

Criteria	Flags*	Unit	Excel.	Good	Accept	Problematic	**Score**
Flagged data	Incl	%	0-2.5	>2.5-5.0	>5.0-7.5	>7.5	
(% of in-range subjects)			0	5	10	20	**0** (0.8 %)
Overall Sex ratio	Incl	p	>0.1	>0.05	>0.001	<=0.001	
(Significant chi square)			0	2	4	10	**0** (p=0.836)
Overall Age distrib	Incl	p	>0.1	>0.05	>0.001	<=0.001	
(Significant chi square)			0	2	4	10	**0** (p=0.570)
Dig pref score - weight	Incl	#	0-7	8-12	13-20	> 20	
			0	2	4	10	**2** (8)
Dig pref score - height	Incl	#	0-7	8-12	13-20	> 20	
			0	2	4	10	**2** (11)

Dig pref score - MUAC	Incl	#	0-7 0	8-12 2	13-20 4	> 20 10	**2** (9)
Standard Dev WHZ	Excl	SD	<1.1 and	<1.15 and	<1.20 and	>=1.20 or	
.							
.	Excl	SD	>0.9 0	>0.85 2	>0.80 6	<=0.80 20	**2** (0.89)
Skewness WHZ	Excl	#	<±0.2 0	<±0.4 1	<±0.6 3	>=±0.6 5	**0** (-0.11)
Kurtosis WHZ	Excl	#	<±0.2 0	<±0.4 1	<±0.6 3	>=±0.6 5	**0** (0.18)
Poisson dist WHZ-2	Excl	p	>0.05 0	>0.01 1	>0.001 3	<=0.001 5	**5** (p=0.000)
OVERALL SCORE WHZ =			0-9	10-14	15-24	>25	**13** %

The overall score of this survey is 13 %, this is good.

There were no duplicate entries detected.

Percentage of children with no exact birthday: 100 %

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

Line=74/ID=: **WHZ (3.023)**, WAZ (1.721), Weight may be incorrect. Child was overweight .
Line=101/ID=: **WHZ (-4.312)**, Height may be incorrect
Line=115/ID=: HAZ (-4.878), Age may be incorrect
Line=140/ID=: HAZ (-5.517), Age may be incorrect
Line=149/ID=: HAZ (1.791), Age may be incorrect
Line=169/ID=: HAZ (-5.988), Age may be incorrect
Line=195/ID=: **WHZ (-4.133)**, Weight may be incorrect. The child was severely malnourished and referred to IRC mobile clinic.
Line=198/ID=: HAZ (-5.523), Age may be incorrect
Line=211/ID=: HAZ (1.241), Age may be incorrect
Line=242/ID=: HAZ (-5.245), Age may be incorrect
Line=252/ID=: HAZ (1.622), Age may be incorrect
Line=268/ID=: HAZ (1.925), Height may be incorrect
Line=272/ID=: HAZ (-6.746), WAZ (-6.776), Age may be incorrect
Line=283/ID=: HAZ (-5.888), Age may be incorrect
Line=368/ID=: WAZ (1.712), Age may be incorrect

Percentage of values flagged with SMART flags:WHZ: 0.8 %, HAZ: 3.0 %, WAZ: 0.8 %

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: 0.74 (The value should be around 0.85).

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

Age cat.	mo.	boys	girls	total	ratio boys/girls
6 to 17	12	41/43.6 (0.9)	33/42.7 (0.8)	74/86.3 (0.9)	1.24
18 to 29	12	43/42.5 (1.0)	41/41.6 (1.0)	84/84.2 (1.0)	1.05
30 to 41	12	43/41.2 (1.0)	48/40.3 (1.2)	91/81.6 (1.1)	0.90
42 to 53	12	41/40.6 (1.0)	41/39.7 (1.0)	82/80.3 (1.0)	1.00
54 to 59	6	20/20.1 (1.0)	21/19.6 (1.1)	41/39.7 (1.0)	0.95
6 to 59	54	188/186.0 (1.0)	184/186.0 (1.0)		1.02

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

Overall sex ratio: p-value = 0.836 (boys and girls equally represented)
Overall age distribution: p-value = 0.570 (as expected)
Overall age distribution for boys: p-value = 0.993 (as expected)
Overall age distribution for girls: p-value = 0.434 (as expected)
Overall sex/age distribution: p-value = 0.400 (as expected)

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: **8** (0-7 excellent, 8-12 good, 13-20 acceptable and > 20 problematic)
p-value for chi2: 0.018 (significant difference)

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: **11** (0-7 excellent, 8-12 good, 13-20 acceptable and > 20 problematic)
p-value for chi2: 0.000 (significant difference)

Digit preference MUAC:

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

Digit preference score: **9** (0-7 excellent, 8-12 good, 13-20 acceptable and > 20 problematic)
p-value for chi2: 0.002 (significant difference)

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

.	no exclusion	exclusion from reference mean (WHO flags)	exclusion from observed mean (SMART flags)
.			
.			

WHZ

Standard Deviation SD:	0.94	0.94	0.89
(The SD should be between 0.8 and 1.2)			
Prevalence (< -2)			
observed:			
calculated with current SD:			
calculated with a SD of 1:			

HAZ

Standard Deviation SD:	1.30	1.27	1.14
(The SD should be between 0.8 and 1.2)			
Prevalence (< -2)			
observed:	37.9%	37.7%	37.1%
calculated with current SD:	42.8%	42.2%	40.5%
calculated with a SD of 1:	40.6%	40.1%	39.1%

WAZ

Standard Deviation SD:	1.03	0.99	0.97
(The SD should be between 0.8 and 1.2)			
Prevalence (< -2)			
observed:	30.4%		
calculated with current SD:	34.8%		
calculated with a SD of 1:	34.4%		

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

WHZ	p= 0.009	p= 0.009	p= 0.606
HAZ	p= 0.001	p= 0.016	p= 0.206
WAZ	p= 0.000	p= 0.005	p= 0.001

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

Skewness

WHZ	-0.13	-0.13	-0.11
HAZ	-0.39	-0.29	-0.16
WAZ	-0.49	-0.20	-0.38

If the value is:
-below minus 0.4 there is a relative excess of wasted/stunted/underweight subjects in the sample
-between minus 0.4 and minus 0.2, there may be a relative excess of wasted/stunted/underweight subjects in the sample.
-between minus 0.2 and plus 0.2, the distribution can be considered as symmetrical.
-between 0.2 and 0.4, there may be an excess of obese/tall/overweight subjects in the sample.
-above 0.4, there is an excess of obese/tall/overweight subjects in the sample

Kurtosis

WHZ	1.17	1.17	0.18
HAZ	0.95	0.64	-0.18
WAZ	1.63	0.31	-0.05

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

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

WHZ < -2: ID=2.33 (p=0.000)
WHZ < -3: ID=1.45 (p=0.024)
GAM: ID=2.33 (p=0.000)
SAM: ID=1.45 (p=0.024)

```
HAZ < -2: ID=3.26 (p=0.000)
HAZ < -3: ID=2.38 (p=0.000)
WAZ < -2: ID=3.12 (p=0.000)
WAZ < -3: ID=3.38 (p=0.000)
```

Subjects with SMART flags are excluded from this analysis.

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

Are the data of the same quality at the beginning and the end of the clusters?
Evaluation of the SD for WHZ depending upon the order the cases are measured within each cluster (if one cluster per day is measured then this will be related to the time of the day the measurement is made).

```
Time                                          SD for WHZ
point                 0.8 0.9 1.0 1.1 1.2 1.3 1.4 1.5 1.6 1.7 1.8 1.9 2.0 2.1 2.2 2.3
01: 1.00 (n=48, f=0)  #########
02: 1.11 (n=47, f=2)  ##############
03: 0.85 (n=40, f=0)  ##
04: 0.97 (n=34, f=0)  #######
05: 1.02 (n=28, f=0)  #########
06: 1.08 (n=22, f=1)  ############
07: 1.11 (n=19, f=0)  ##############
08: 0.87 (n=16, f=0)  ###
09: 0.83 (n=15, f=0)  #
10: 0.79 (n=15, f=0)
11: 0.66 (n=14, f=0)
12: 0.79 (n=14, f=0)
13: 0.79 (n=12, f=0)
14: 0.62 (n=11, f=0)
15: 1.12 (n=10, f=0)  OOOOOOOOOOOOO
16: 0.50 (n=08, f=0)
17: 0.98 (n=06, f=0)  ~~~~~~~~
18: 0.76 (n=04, f=0)
19: 1.11 (n=03, f=0)  ~~~~~~~~~~~~~
20: 0.01 (n=02, f=0)

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

Analysis by Team

Team	**1**	**2**	**3**	**4**	**5**
n =	65	72	95	71	69

Percentage of values flagged with SMART flags:

WHZ:	1.5	1.4	1.1	0.0	0.0
HAZ:	0.0	4.2	2.1	4.2	4.3
WAZ:	0.0	1.4	0.0	1.4	1.4

Age ratio of 6-29 months to 30-59 months:

	0.71	0.76	0.86	0.77	0.57

Sex ratio (male/female):

	0.91	0.95	1.11	1.29	0.86

Digit preference Weight (%):

.0 :	2	0	12	11	7
.1 :	15	7	14	15	10
.2 :	8	11	12	11	6
.3 :	12	10	9	10	10
.4 :	15	11	11	10	13
.5 :	5	4	8	6	7
.6 :	15	17	8	15	14
.7 :	9	10	11	10	7
.8 :	6	8	7	6	14
.9 :	12	22	8	6	10
DPS:	16	20	6	12	10

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

Digit preference Height (%):

.0 :	2	1	12	8	13
.1 :	9	11	8	10	10
.2 :	20	21	17	15	7
.3 :	17	11	15	14	14
.4 :	9	15	7	8	9
.5 :	5	7	17	11	12
.6 :	8	8	12	3	12
.7 :	18	8	5	21	7
.8 :	9	11	5	4	9
.9 :	3	6	2	4	7
DPS:	20	17	16	18	8

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

Digit preference MUAC (%):

.0 :	3	1	11	6	7
.1 :	14	13	12	7	9
.2 :	3	11	16	11	10
.3 :	15	13	12	7	13
.4 :	6	4	5	6	9
.5 :	6	3	8	11	6
.6 :	12	11	5	14	12
.7 :	6	17	6	8	19
.8 :	12	17	8	14	9
.9 :	22	11	17	15	7
DPS:	19	17	13	12	12

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

Standard deviation of WHZ:

SD	0.89	1.05	0.92	1.06	0.77
Prevalence (< -2) observed:					
%		16.7		12.7	
Prevalence (< -2) calculated with current SD:					
%		15.3		13.1	
Prevalence (< -2) calculated with a SD of 1:					
%		14.1		11.6	

Standard deviation of HAZ:

SD	1.18	1.27	1.26	1.48	1.28
observed:					
%	29.2	37.5	42.1	47.9	30.4
calculated with current SD:					
%	37.3	47.1	41.5	49.7	36.6
calculated with a SD of 1:					
%	35.1	46.4	39.4	49.5	33.0

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

Team 1:

Age cat.	mo.	boys	girls	total	ratio boys/girls
6 to 17	12	6/7.2 (0.8)	5/7.9 (0.6)	11/15.1 (0.7)	1.20
18 to 29	12	7/7.0 (1.0)	9/7.7 (1.2)	16/14.7 (1.1)	0.78
30 to 41	12	8/6.8 (1.2)	8/7.5 (1.1)	16/14.3 (1.1)	1.00
42 to 53	12	8/6.7 (1.2)	8/7.3 (1.1)	16/14.0 (1.1)	1.00
54 to 59	6	2/3.3 (0.6)	4/3.6 (1.1)	6/6.9 (0.9)	0.50
6 to 59	54	31/32.5 (1.0)	34/32.5 (1.0)		0.91

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

Overall sex ratio: p-value = 0.710 (boys and girls equally represented)
Overall age distribution: p-value = 0.766 (as expected)
Overall age distribution for boys: p-value = 0.881 (as expected)
Overall age distribution for girls: p-value = 0.841 (as expected)
Overall sex/age distribution: p-value = 0.600 (as expected)

Team 2:

Age cat.	mo.	boys	girls	total	ratio boys/girls
6 to 17	12	6/8.1 (0.7)	7/8.6 (0.8)	13/16.7 (0.8)	0.86
18 to 29	12	11/7.9 (1.4)	7/8.4 (0.8)	18/16.3 (1.1)	1.57
30 to 41	12	5/7.7 (0.7)	11/8.1 (1.4)	16/15.8 (1.0)	0.45
42 to 53	12	10/7.6 (1.3)	9/8.0 (1.1)	19/15.5 (1.2)	1.11
54 to 59	6	3/3.7 (0.8)	3/3.9 (0.8)	6/7.7 (0.8)	1.00

6 to 59	54	35/36.0 (1.0)	37/36.0 (1.0)	0.95

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

Overall sex ratio: p-value = 0.814 (boys and girls equally represented)
Overall age distribution: p-value = 0.709 (as expected)
Overall age distribution for boys: p-value = 0.459 (as expected)
Overall age distribution for girls: p-value = 0.754 (as expected)
Overall sex/age distribution: p-value = 0.237 (as expected)

Team 3:

Age cat.	mo.	boys	girls	total	ratio boys/girls
6 to 17	12	14/11.6 (1.2)	8/10.4 (0.8)	22/22.0 (1.0)	1.75
18 to 29	12	9/11.3 (0.8)	13/10.2 (1.3)	22/21.5 (1.0)	0.69
30 to 41	12	13/11.0 (1.2)	10/9.9 (1.0)	23/20.8 (1.1)	1.30
42 to 53	12	6/10.8 (0.6)	8/9.7 (0.8)	14/20.5 (0.7)	0.75
54 to 59	6	8/5.3 (1.5)	6/4.8 (1.2)	14/10.1 (1.4)	1.33
6 to 59	54	50/47.5 (1.1)	45/47.5 (0.9)		1.11

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

Overall sex ratio: p-value = 0.608 (boys and girls equally represented)
Overall age distribution: p-value = 0.438 (as expected)
Overall age distribution for boys: p-value = 0.308 (as expected)
Overall age distribution for girls: p-value = 0.744 (as expected)
Overall sex/age distribution: p-value = 0.127 (as expected)

Team 4:

Age cat.	mo.	boys	girls	total	ratio boys/girls
6 to 17	12	7/9.3 (0.8)	9/7.2 (1.3)	16/16.5 (1.0)	0.78
18 to 29	12	12/9.0 (1.3)	3/7.0 (0.4)	15/16.1 (0.9)	4.00
30 to 41	12	9/8.8 (1.0)	12/6.8 (1.8)	21/15.6 (1.3)	0.75
42 to 53	12	10/8.6 (1.2)	5/6.7 (0.7)	15/15.3 (1.0)	2.00
54 to 59	6	2/4.3 (0.5)	2/3.3 (0.6)	4/7.6 (0.5)	1.00
6 to 59	54	40/35.5 (1.1)	31/35.5 (0.9)		1.29

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

Overall sex ratio: p-value = 0.285 (boys and girls equally represented)
Overall age distribution: p-value = 0.452 (as expected)
Overall age distribution for boys: p-value = 0.566 (as expected)
Overall age distribution for girls: p-value = 0.104 (as expected)
Overall sex/age distribution: p-value = 0.025 (significant difference)

Team 5:

Age cat.	mo.	boys	girls	total	ratio boys/girls
6 to 17	12	8/7.4 (1.1)	4/8.6 (0.5)	12/16.0 (0.7)	2.00
18 to 29	12	4/7.2 (0.6)	9/8.4 (1.1)	13/15.6 (0.8)	0.44
30 to 41	12	8/7.0 (1.1)	7/8.1 (0.9)	15/15.1 (1.0)	1.14
42 to 53	12	7/6.9 (1.0)	11/8.0 (1.4)	18/14.9 (1.2)	0.64
54 to 59	6	5/3.4 (1.5)	6/3.9 (1.5)	11/7.4 (1.5)	0.83
6 to 59	54	32/34.5 (0.9)	37/34.5 (1.1)		0.86

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

Overall sex ratio: p-value = 0.547 (boys and girls equally represented)
Overall age distribution: p-value = 0.422 (as expected)
Overall age distribution for boys: p-value = 0.668 (as expected)
Overall age distribution for girls: p-value = 0.303 (as expected)
Overall sex/age distribution: p-value = 0.101 (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: 1.16 (n=09, f=0)  ###############
02: 0.65 (n=08, f=0)
03: 0.38 (n=08, f=0)
04: 0.59 (n=05, f=0)
05: 0.70 (n=05, f=0)
06: 2.09 (n=03, f=1)  ######################################################
07: 0.54 (n=02, f=0)
08: 0.18 (n=02, f=0)
09: 0.71 (n=02, f=0)
10: 1.05 (n=02, f=0)  OOOOOOOOOOO
11: 0.81 (n=02, f=0)  O
12: 0.10 (n=02, f=0)
13: 1.11 (n=02, f=0)  OOOOOOOOOOOOO
14: 0.98 (n=02, f=0)  OOOOOOOO
15: 1.50 (n=02, f=0)  OOOOOOOOOOOOOOOOOOOOOOOOOOOOO
```

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

Team: 2

```
Time                                          SD for WHZ
point                 0.8 0.9 1.0 1.1 1.2 1.3 1.4 1.5 1.6 1.7 1.8 1.9 2.0 2.1 2.2 2.3
01: 0.54 (n=10, f=0)
02: 1.71 (n=10, f=1)  ######################################
03: 0.76 (n=09, f=0)
04: 1.02 (n=08, f=0)  #########
05: 0.91 (n=04, f=0)  #####
06: 1.41 (n=05, f=0)  ##########################
```

```
07: 1.65 (n=05, f=0)  ###################################
08: 1.21 (n=03, f=0)  OOOOOOOOOOOOOOOO
09: 0.94 (n=04, f=0)  ######
10: 0.90 (n=03, f=0)  OOOO
11: 0.31 (n=03, f=0)
12: 0.48 (n=03, f=0)
13: 0.77 (n=02, f=0)
```

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

Team: 3

```
Time                                              SD for WHZ
point                 0.8 0.9 1.0 1.1 1.2 1.3 1.4 1.5 1.6 1.7 1.8 1.9 2.0 2.1 2.2 2.3
01: 1.16 (n=10, f=0)  ###############
02: 1.21 (n=09, f=1)  #################
03: 1.18 (n=09, f=0)  #################
04: 0.64 (n=08, f=0)
05: 0.75 (n=07, f=0)
06: 0.62 (n=06, f=0)
07: 0.96 (n=05, f=0)  #######
08: 0.97 (n=05, f=0)  #######
09: 1.19 (n=04, f=0)  ##################
10: 0.59 (n=04, f=0)
11: 0.64 (n=04, f=0)
12: 1.41 (n=04, f=0)  ##########################
13: 0.60 (n=03, f=0)
14: 0.94 (n=03, f=0)  OOOOOO
15: 0.43 (n=03, f=0)
16: 0.55 (n=03, f=0)
17: 1.31 (n=03, f=0)  OOOOOOOOOOOOOOOOOOOO
18: 0.70 (n=02, f=0)
19: 0.37 (n=02, f=0)
```

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

Team: 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: 1.14 (n=11, f=0)  ##############
02: 1.03 (n=10, f=0)  ##########
03: 0.73 (n=07, f=0)
04: 1.55 (n=07, f=0)  ################################
05: 1.45 (n=05, f=0)  ############################
06: 0.24 (n=04, f=0)
07: 0.44 (n=04, f=0)
08: 1.05 (n=03, f=0)  OOOOOOOOOO
09: 0.66 (n=03, f=0)
10: 0.91 (n=03, f=0)  OOOOO
11: 1.04 (n=02, f=0)  OOOOOOOOOO
12: 0.31 (n=02, f=0)
13: 0.84 (n=02, f=0)  OO
14: 0.26 (n=02, f=0)
15: 1.73 (n=02, f=0)  OOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOO
16: 0.06 (n=02, f=0)
```

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

Team: 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: 0.87 (n=10, f=0)  ###
02: 0.54 (n=10, f=0)
03: 0.49 (n=08, f=0)
04: 0.87 (n=07, f=0)  ###
05: 1.11 (n=06, f=0)  ##############
06: 0.94 (n=04, f=0)  ######
07: 1.25 (n=03, f=0)  OOOOOOOOOOOOOOOOOO
08: 0.36 (n=02, f=0)
09: 0.74 (n=03, f=0)
10: 0.99 (n=02, f=0)  OOOOOOOO
11: 0.16 (n=02, f=0)
12: 0.40 (n=03, f=0)
13: 0.05 (n=02, f=0)
14: 0.17 (n=03, f=0)
15: 0.61 (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)
```

Annex 3: Evaluation of enumerators

Weight:

	Precision: Sum of Square [W1-W2]	Accuracy: Sum of Square [Enum.(W1+W2)-(Superv.(W1+W2)]	No. +/- Precision	No. +/- Accuracy
Supervisor	0.02		2/0	
Enumerator 1	0.15 POOR	0.07 POOR	4/0	4/0
Enumerator 2	0.06 POOR	0.02 OK	3/0	2/0
Enumerator 3	0.07 POOR	0.17 POOR	2/2	3/3
Enumerator 4	17986.60 POOR	18013.40 POOR	2/2	4/1
Enumerator 5	0.09 POOR	0.13 POOR	4/2	4/3
Enumerator 6	0.03 OK	0.03 OK	1/2	1/2
Enumerator 7	22082.00 POOR	22082.20 POOR	3/2	4/2
Enumerator 8	54725.00 POOR	54762.00 POOR	5/1	7/0
Enumerator 9	3.68 POOR	4.08 POOR	3/2	3/2
Enumerator 10	0.04 POOR	0.12 POOR	2/2	4/2
Enumerator 11	1.15 POOR	1.37 POOR	5/0	7/0
Enumerator 12	0.08 POOR	0.10 POOR	1/1	2/2
Enumerator 13	2.60 POOR	2.74 POOR	6/1	7/1
Enumerator 14	0.03 OK	0.05 OK	2/1	4/1
Enumerator 15	0.02 OK	0.08 POOR	2/0	5/0

Height:

	Precision: Sum of Square [H1-H2]	Accuracy: Sum of Square [Enum.(H1+H2)-Superv.(H1+H2)]	No. +/- Precision	No. +/- Accuracy
Supervisor	2.37		6/1	
Enumerator 1	4.18 OK	4.41 OK	6/2	8/1
Enumerator 2	24.65 POOR	20.94 POOR	7/2	7/2
Enumerator 3	2.80 OK	3.67 OK	4/3	4/4
Enumerator 4	6.45 POOR	15.90 POOR	6/3	5/4
Enumerator 5	4.16 OK	4.23 OK	4/4	8/1
Enumerator 6	1.48 OK	7.43 POOR	6/2	8/1
Enumerator 7	9198.28 POOR	9297.71 POOR	5/3	4/5
Enumerator 8	8.37 POOR	6.98 OK	6/2	7/2
Enumerator 9	239.24 POOR	256.45 POOR	4/4	7/2
Enumerator 10	11.45 POOR	6.38 OK	4/5	5/2
Enumerator 11	7.06 POOR	6.37 OK	4/4	6/3
Enumerator 12	10240.00 POOR	10282.20 POOR	0/8	7/2
Enumerator 13	3.73 OK	3.20 OK	5/4	7/2
Enumerator 14	3.13 OK	4.94 OK	4/4	8/1
Enumerator 15	1.62 OK	2.29 OK	5/4	5/3

MUAC:

	Precision: Sum of Square [MUAC1-MUAC2]	Accuracy: Sum of Square [Enum.(MUAC1+MUAC2)-Superv.(MUAC1+MUAC2]	No. +/- Precision	No. +/- Accuracy
Supervisor	192.00		5/4	
Enumerator 1	184.00 OK	546.00 OK	6/2	4/4
Enumerator 2	170.00 OK	516.00 OK	3/5	6/3
Enumerator 3	240.00 OK	464.00 OK	4/3	5/4
Enumerator 4	150.00 OK	294.00 OK	4/5	2/6
Enumerator 5	314.00 OK	540.00 OK	5/3	6/3
Enumerator 6	381.00 OK	767.00 POOR	2/4	5/4
Enumerator 7	23658.30 POOR	18312.30 POOR	4/4	5/4
Enumerator 8	21076.20 POOR	20707.80 POOR	5/3	6/3
Enumerator 9	42689.40 POOR	34955.00 POOR	4/5	5/4
Enumerator 10	52.00 OK	1224.00 POOR	5/3	7/2
Enumerator 11	218.00 OK	550.00 OK	6/3	4/5
Enumerator 12	298.00 OK	3312.00 POOR	6/2	6/2
Enumerator 13	170.00 OK	516.00 OK	0/6	3/6
Enumerator 14	233.00 OK	1625.00 POOR	5/2	8/1
Enumerator 15	87.00 OK	1437.00 POOR	3/6	6/2

For evaluating the enumerators the precision and the accuracy of their measurements is calculated. For precision the sum of the square of the differences for the double measurements is calculated. This

value should be less than two times the precision value of the supervisor.
For the accuracy the sum of the square of the differences between the enumerator values (weight1+weight2) and the supervisor values (weight1+weight2) is calculated. This value should be less than three times the precision value of the supervisor.
To check for systematic errors of the enumerators the number of positive and negative deviations can be used.

Annex 4: Map of Rathedaung Township

Annex 5: Questionnaire

Rathedaung SMART Questionnaire

Refer to Questionnaire Introduction in Supplementary Guide

1. **DEMOGRAPHIC**

DATE: ____/_____/_____ VILLAGE TRACK: _____ VILLAGE: _____

TEAM: _____	**CLUSTER: _____**	**HOUSEHOLD: _____**	**HOUSEHOLD id: _____**

2. **ANTHROPOMETRIC (6-59 months)**

Start with the youngest child first

Child	Sex (M/F)	Age (Months)	Age determined by (must use at least 2 including 1 from 1-6) *1.event calendar 2.CHW 3.vaccination card 4.family list/village track clerk 5.mother 6.birth certificate 7.other*	Weight (kg) ±0.1kg	Height/ Length (cm) ±0.1cm	Edema (Y/N)	MUAC (mm)
1							
2							
3							

3. **ANTHOPOMETRIC PREGNANT and LACTATING WOMAN- Ask for all pregnant and lactating woman in the HH**

Women of child bearing age (approx. 15 to 45 years old). Write P/L	Age (years)	MUAC (mm)
1		
2		
3		

4. **Children MORBIDITY (6-59 months)**

In the past 2 WEEKS has your child/children had any of the following illnesses?

Child	Diarrhoea (Y/N) (minimum 3 watery stools in 24h period)	Fever (Y/N) (body temperature higher than normal including a hot forehead)	ARI (Y/N) (eg. cough, pneumonia, chest indrawing, rapid breathing etc.)	Other (Y/N) (runny nose, scabies, red eye, etc.)
1				

2				
3				

Measles vaccination status and vitamin A supplementation status of the child

Child	**Vitamin A supplementation within the last 6 months for <u>6-59</u> month children** 1=Yes 2=No 3= Do not know (write number)	**Measles Vaccination Status for <u>9-59</u> months children** 1=Yes confirmed by vaccination card 2=Yes but not confirmed by vaccination card 3= No 4= Do not know (write number)
1		
2		
3		

5. <u>CHILD FEEDING PRACTICES</u> (6-23 months)

1. Is your 6-23 MONTH child/children currently exclusively breastfed? ***Exclusively breastfed****: breast milk (including milk expressed) as well as water, ORS, drops, syrups (vitamins, minerals, medicines) but does not allow anything else*	**Child 1** (Y/N)	**Child 2** (Y/N)	**Child 3** (Y/N)

If yes to Q 1, skip to Section 6 Household Food Security

2. Is your 6-23 MONTH child/children currently breastfed as well as given complementary foods? ***Complementary feeding****: breast milk (including milk expressed) as well as any food or liquid including non-human milk and formula*	**Child 1** (Y/N	**Child 2** (Y/N)	**Child 3** Y/N)

If yes to Q 2 skip to Q 4

3. At what age (MONTHS) did your 6-23 MONTH child/children completely stop breastfeeding?	**Child 1** (months)	**Child 2** (months)	**Child 3** (months)

4. At what age (MONTHS) was your 6-23 MONTH child/children introduced to food or other fluid (excluding breast milk, water) for the first time?	**Child 1** (months)	**Child 2** (months)	**Child 3** (months)

5. What was the first food (excluding water, breast milk) introduced to your 6-23 MONTH child/children? ***1****. rice porridge* ***2****. rice powder* ***3****. Small cake/biscuit* ***4****. fruit/juice* ***5****. Maize Quicka* ***6****. other*	**Child 1** (food)	**Child 2** (food)	**Child 3** (food)

Refer to 6. Child Feeding Introduction in Supplementary Guide **6. Did your 6-23 MONTH child/children eat any of the following food groups in**	**Child 1** (Y/N)	**Child 2** (Y/N)	**Child 3** (Y/N)

the PAST 24 HOURS? **For example, from yesterday at ___ o'clock until now, has your 6-23 month child/children consumed____ food group?** *Consumption of any amount of food from each food group is sufficient to 'count'. For example, there is no minimum quantity, except if an item is used as a condiment.*			
A. Grains, roots, tubers or any food made from them: rice, bread, maize flour, tarot, katat, pelopanan etc			
B. Legumes, nuts or any food made from them: lentils, peas, check peas, gram ground nuts, beans (lablab, lima, butter bean etc)			
C. Dairy products: milk (canned, powdered) cheese, yogurt etc **(NO breast milk)**			
D. Flesh foods: meat, fish, poultry, organs, etc			
E. Eggs			
F. Vitamin A rich fruits and vegetables: **Orange inside and dark green:** carrot, pumpkin, sweet potato, mango, dark green vegetable, papayas etc			
G. Other fruits and vegetables bananas, apples, watermelon, corn, eggplant, tomato, potato etc			
H. Sugar : in tea, coffee, Myanmar snacks, packaged snacks, candy, sweet snacks			
I. Oil: groundnut, sesame, palm etc **Fat:** butter, animal fat etc			
J. Infant formula			

7. How many meals did your 6-23 month child/children have in the past 24h (NOT including breast milk)?	**Child 1** (meals)	**Child 2** (meals)	**Child 3** (meals)

6. HOUSEHOLD FOOD SECURITY

For this entire section, if possible, ask the person in the household who does most of the cooking.

Refer to 1. Household Food security Introduction in Supplementary Guide

1. The following includes foods that were consumed by household members in the household. This does NOT include foods purchased and eaten outside of the household by individual members.

Food Items	**A) Was the food consumed in the PAST 24 HOURS (Y/N)**	**B) Number of DAYS the food was eaten in the PAST 7 DAYS (0-7)**
A. Rice: rice, rice noodles etc		
B. Maize: millet, corn, etc		
C. Other cereals: wheat, wheat noodles, bread		
D. Potatoes/tubers: sweet potato, taro, etc		
E. Beans: lablab bean, lima bean, butter bean, etc, lentils, peas, check pea, gram, etc		
F. Nuts: peanut, groundnut, etc		
G. Vegetables: gourd, brinjal, cucumber, tomato, leafy		

vegetable etc		
H. Fruits: banana, orange, apple, pineapple etc		
I. Beef: cows, buffalo		
J. Pork		
K. Mutton: goat, sheep		
L. Poultry: chicken, duck		
M. Eggs: hen, duck, ngone		
N. Fish: fish, prawn, dried fish etc., seafood		
O. Milk/ milk products: milk (canned, powdered), yogurt, cheese		
P. Oil: groundnut, sesame, palm etc **Fat**: butter, animal fat etc		
Q. Sugar: : in tea, coffee, Myanmar snacks, packaged snacks, candy, sweet snacks		
R. Condiments: spices, fish paste, salt etc		

Must ask follow up questions for:

- ***Combination foods such as soups and curries: (vegetable Y/N) + (flesh meat, fish etc Y/N) + (oil Y/N) + (condiment Y/N)***

7. MENTAL HEALTH

Mothers/caretakers with eligible children (6-59 months)

	Over the last two weeks ...	**All of the time** ***(14 days)***	**Most of the time** ***(10 to 13 days)***	**More than half of the time** ***(7 to 9 days)***	**Less than half of the time** ***(4 to 6 days)***	**Some of the time** ***(1 to 3 days)***	**At no time** ***(0 days)***
1	... have you felt cheerful and in good spirits ? *(happy and positive)*	☐ 5	☐ 4	☐ 3	☐ 2	☐ 1	☐ 0
2	... have you felt calm and relaxed ? *(no stress)*	☐ 5	☐ 4	☐ 3	☐ 2	☐ 1	☐ 0
3	... have you felt active and vigorous ? *(body energy)*	☐ 5	☐ 4	☐ 3	☐ 2	☐ 1	☐ 0
4	... did you wake up feeling fresh and rested ? *(sleep well)*	☐ 5	☐ 4	☐ 3	☐ 2	☐ 1	☐ 0
5	... your daily life has been filled with things that interest you ? *(social or funny activities)*	☐ 5	☐ 4	☐ 3	☐ 2	☐ 1	☐ 0

8. WATER and SANITATION (refer to WASH section in Supplementary guide)

1. Do you use a latrine?	1=Yes 2=No	Number

If No to Q1, skip to Q3

2. If yes, do you share this latrine with other HH?	1=Yes 2=No	Number

3. Does the school (not madrassa) your children attend have a functional latrine?	1=Yes 2=No 3= do not go to school	Number

4. What is your primary drinking water source?	1=Borehole 2=Open Well 3=Protected Well 4=Pond 5=River 6=Other :_____	Number

5. Do you treat your drinking water?	1=Yes 2=No	Number

If No to Q5, skip to Q7

6. If yes, how do you treat it?	1=Ceramic Filter 2=Cloth filter 3=Boiling 4=Chlorination 5=Basic sedimentation 6=Other:_____ _____	Number
7. When do you wash your hands?	1= After toilet / latrines 2= Before cooking 3= Before eating 4= Before breastfeeding 5= After taking children to the toilet 6= After handling animals 7= Does not wash their hands 8= Other_____ _____	Number
8. What do you usually use to wash your hands?	1= Only water 2= Soap 3= Soap when I can afford it 4= Ashes 5=other:_____ _____	Number

Annex 6: Statistical calculator for GAM

GAM **10.5%** (6.7-16.0 95% CI)

Total sample size	Prevalence	Design effect	Number of clusters
n	p	Deff	C
372	10.50%	2.01	48

Threshold	t-value	Probability of exceeding the threshold
2.5%	6.97	1.00
5.0%	3.43	**1.00**
7.5%	1.55	**0.94**
10.0%	0.23	**0.59**
12.5%	0.82	**0.21**
15.0%	1.71	**0.05**
17.5%	2.51	0.01
20.0%	3.23	0.00

This means that the probability that the true wasting prevalence value exceeds 5.0% is 100%. Also, within the confidence interval (6.7 - 16.0% CI), we would be 94% sure that our true value is higher than 7.5%, 59% sure that it is above 10.0%, 21% sure it is above 12.5% and only 5% sure that it is above 15.0%.