Final Report

Anthropometric Nutrition And Retrospective Mortality Survey

Saptari District, Nepal
12-24 June 2013

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Acknowledgements

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Acronyms

ACF	Action Contre la Faim
ANC	Antenatal Care
ARI	Acute Respiratory Infection
CB-IMCI	Community Based Integrated Management of Childhood Illness
C.I.	Confidence Interval
CHD	Child Health Division
CMAM	Community-based Management of Acute Malnutrition
DHS	Nepal Demographic and Health Survey
DPT-HepB-Hib	Pentavalent vaccine
DPHO	District Province Health Office
DPT	Diphtheria, Pertussis and Tetanus
ENA	Emergency Nutrition Assessment
EPI	Enlarged Programme of Immunization
FANTA	Food and Nutrition Technical Assistance
FAO	United Nations Food and Agriculture Organization
FCHV	Female Community Health Volunteers
GAM	Global Acute Malnutrition
HAZ	Height for Age index as Z-score
HAM	Height for Age expressed as Median
HH	Household
HDDS	Household Dietary Diversity Score
IDDS	Individual Diet Diversity Score
IMR	Infant Mortality Rate
INGO	International Non- Governmental Organization
IYCF	Infant and Young Child Feeding
MAM	Moderate Acute Malnutrition
MDG	Millennium Development Goal
MCH	Maternal and Child Healthcare
MOH	Ministry of Health
MUAC	Middle Upper Arm Circumference
NCHS	National Centre for Health Statistics
NGO	Non-Governmental Organization
NIP	National Immunization Programme
OPV	Oral Polio Vaccine
ORC	Outreach Clinic
ORS	Oral Rehydration Solution
OTP	Out-patient Treatment Programme
OW	Observed Weight
PHC	Public Health Clinic
SAM	Severe Acute Malnutrition
SC	Stabilization Centre
SD	Standard Deviation
SMART	Standardized Monitoring and Assessment of Relief and Transitions

TYIP	Three Year Interim Plan
U5MR	Under 5 (years old) Mortality Rate
UN	United Nations
UNDP	United Nations Development Programme
UNFPA	United Nations Population Fund
UNICEF	United Nations Children's Fund
WASH	Water, Sanitation and Hygiene
WAM	Weight for Age index as percentage of Median
WAZ	Weight for Age expressed as Z-score
WFP	World Food Programme
WHO	World Health Organization
WHM	Weight for Height index as percentage of the Median
WHZ	Weight for Height index as Z-score

Executive summary

Introduction

The nutrition survey was conducted in Saptari District located in the south-eastern part of Nepal.

There is a need to get hold of nutrition information to establish a clearer estimate of the nutritional situation of the population in Saptari District. Despite the fact that Saptari is renowned for its agricultural output, a high number of malnourished populations still exists. According to the most recent data available from Nepal Demographic and Health Survey (DHS) 2011, Eastern Terai sub region has a GAM prevalence of 10.3% (SAM 2.2%)[1]. Action Contre la Faim (ACF) has supported the government run CMAM program in the district since its initiation in June/July 2012. However, there is lack of district specific information on the nutritional status of the population.

Objective of survey

The objective of the survey was to evaluate the nutritional situation of children aged 6 to 59 months in the Saptari District and to evaluate mortality rate of the population.

Methodology

The survey was conducted in Saptari District during 10 days from 12 to 25 June 2013.

The SMART methodology was used for all the components of the survey from the preparation phase to the report writing. The seven days training phase included a standardization test and a field pilot test pre-survey.

The surveyed populations selected by cluster sampling method were children from 6 to 59 months old for the anthropometric nutrition component and all household members in selected households for the retrospective mortality component. The sample size for each component was calculated with ENA Delta software (November 2012) using the highest sample size for both. The survey was conducted in 58 clusters each consisting of 18 households. The recall period for the mortality was 3 months (85 days) prior to the survey. Data collected were age, height, weight, presence of nutritional oedema and MUAC for the anthropometric nutritional component and the number of deaths in the households within the recall period for the mortality component. A local events calendar was used to assess the age of the child where no birth certificate was available. Questionnaires were sub-translated in Nepali language and the interviews were mainly done in Nepali. The survey teams received 7-day training on SMART methodology, including practical exercises, standardization test and pilot field test.

Main results

Table 1: Summary of key findings

Anthropometry	
Wasting (WHZ)	
Global acute malnutrition	21.0 % (17.4 - 25.3 95% C.I.)

[1] Demographic and Health Survey. 2011. Population Division. Ministry of Health and Population. Government of *Nepal*. Kathmandu.

Moderate acute malnutrition	18.1% (14.7 - 22.1 95% C.I.)
Severe acute malnutrition	2.9 % (1.9 - 4.5 95% C.I.)
Wasting expressed by MUAC	
Global acute malnutrition	7.7 % (5.5 - 10.5 95% C.I.)
Moderate acute malnutrition	6.8 % (5.0 - 9.3 95% C.I.)
Severe acute malnutrition	0.8 % (0.3 - 2.2 95% C.I.)
Stunting (HAZ)	
Global stunting	37.3 % (32.4 - 42.5 95% C.I.)
Moderate stunting	26.3 % (22.6 - 30.3 95% C.I.)
Severe stunting	11.0 % (8.1 - 14.8 95% C.I.)
Underweight (WAZ)	
Global underweight	41.4 % (36.5 - 46.4 95% C.I.)
Moderate underweight	31.6 % (27.3 - 36.2 95% C.I.)
Severe underweight	9.8 % (7.2 - 13.1 95% C.I.)
Morbidity	
Prevalence of illness 2 weeks prior to survey (6-59 months)	50.0 % (n=242)
Proportion of sick children receiving medical treatment	81.8% (n=198)
Infant and Young Child Feeding Practices	
Exclusive breastfeeding (0-5 months)	100% (n=37)
Continued breastfeeding (12-15 months)	90.6% (n=29)
Continued breastfeeding (20-23 months)	83.3% (n=25)
Adequate complementary feeding (breastfed 6-8 months)	35.7% (n=10)
Adequate meal frequency (breastfed 6-23 months)	72.9% (n=97)
Adequate meal frequency (non-breastfed 6-23 months)	58.3% (n=7)
Diet Diversity	
Average score households (HDDS)	5.33 / 12
Average score children 6-59 months (IDDS)	3.98 /8
Mortality	
Crude mortality rate (deaths/10'000 people/day)	0.58 (0.25-1.36) (95% CI)
U5 mortality rate (deaths/10'000 children/day)	2.23 (0.55-8.69) (95% CI)

From the findings of this assessment we can conclude that acute malnutrition prevalence rates in Saptari District are at critical levels and that the situation is in need of continued provision of treatment and prevention of acute malnutrition. Despite implementation of CMAM treatment of SAM the last 12 months, it is suspected that malnutrition rates remain unchanged. Strengthening of preventative actions as well as identification of appropriate treatment and follow-up of MAM is essential to help tackle the critical GAM rates as well as reduce cases falling into SAM.

The problem of chronic malnutrition in Saptari is substantial, calling for interventions targeting maternal nutrition and prevention of low birth weight, and improved IYCF practices, promotion of good sanitation practices and access to safe water, healthy practices and appropriate use of health care services as well as strengthening household food security.

The underweight rate in Saptari district is alarming, calling for strengthening of both curative and preventative interventions. Further exploration of the underlying causes of malnutrition in the District is necessary and a multi-sectoral approach to tackle the situation should be considered.

Breastfeeding practices in Saptari district are inadequate, in particular with regards to complementary feeding. When compared with diet diversity results, there is an indicated need for strengthening of both care practices and caretakers as well as the diversity of food though increasing food security of the households.

While there are indications that the households acknowledge the importance of a varied diet for the youngest children in the households, the overall household diet diversity is precarious.

Although at alert level, the U5MR in the district remains inconclusive based on the results of this survey and more investigation is needed on this.

Recommendations

- To conduct another anthropometric nutrition and retrospective mortality survey during the lean period (February-March or August-September) in the same areas to determine seasonal variations and their effect on the nutritional status on the nutritional status of the children. This survey should also collect data on the nutritional status of pregnant, breastfeeding and lactating women.
- To reinforce existing CMAM programme with regards to admission and treatment of both SAM and MAM, together with a strong component in prevention trough nutrition education and good care practices promotion.
- To consider the provision of supplementary food under a SFP targeting the most vulnerable in the community, pregnant and lactating women and children under 5.
- To have a mid-/long term approach in Saptari District targeting improvement of maternal health and nutrition care, including awareness on nutrition and care practices.
- To consider the provision of nutrition and health education programme targeting behaviour change for pregnant women, lactating mothers and caretakers of children under two years, with a special focus on hygiene and sanitation and appropriate IYCF practices.
- To consider multisectoral programs targeted at food and nutrition security designed to reduce malnutrition for children and households, increasing the sustainability of reduced rates of GAM of children 6-59 months.
- To reinforce a nutrition and food security surveillance in Saptari District to better understand the nutrition and food security situation and all its variations and to target vulnerable groups with timely and appropriate interventions.
- To consider integrated long-term community development programmes in food security and livelihoods, including income generating activities.
- To raise awareness on good water, sanitation and hygiene practices through integration with WASH initiatives.

1. Introduction

ACF started its presence in Nepal in 2005. Following shortage of funds programs were closed it in 2009. Programs were re-launched it in August 2011 through CMAM program in the Saptari District in the eastern part of Nepal. According to DHS 2011[2], which follows the classification of WHO growth standard of 2006, the SAM prevalence in this region is 2.2% and GAM prevalence is 10.3%. Based on local knowledge of the area it is suspected that GAM rate might be higher in the specific targeted district.

In Saptari District, there is a need to get hold of nutrition information to confirm an emergency and/or advocate for a response. There is lack of district specific nutrition information. The data available is through the Demographic Health Survey 2011 and it only gives sub regional data. This has been the standalone basis to calculate the rate of malnutrition in the district and has a huge implication in the program and its performance. There is also a need to have disaggregated information to identify high risk groups, to estimate the number of beneficiaries and to better target a response. Therefore there is a need to have nutrition information to monitor the interventions and to assess its impact.

The timing of the survey was proposed to be during the period May to June, before the start of rainy season (around end of June, July and August). This was considered an ideal month to conduct the survey in the field as it represents the period just before the rainy season (see Appendix 6: Seasonal calendar-Saptari District).

1.1. Context

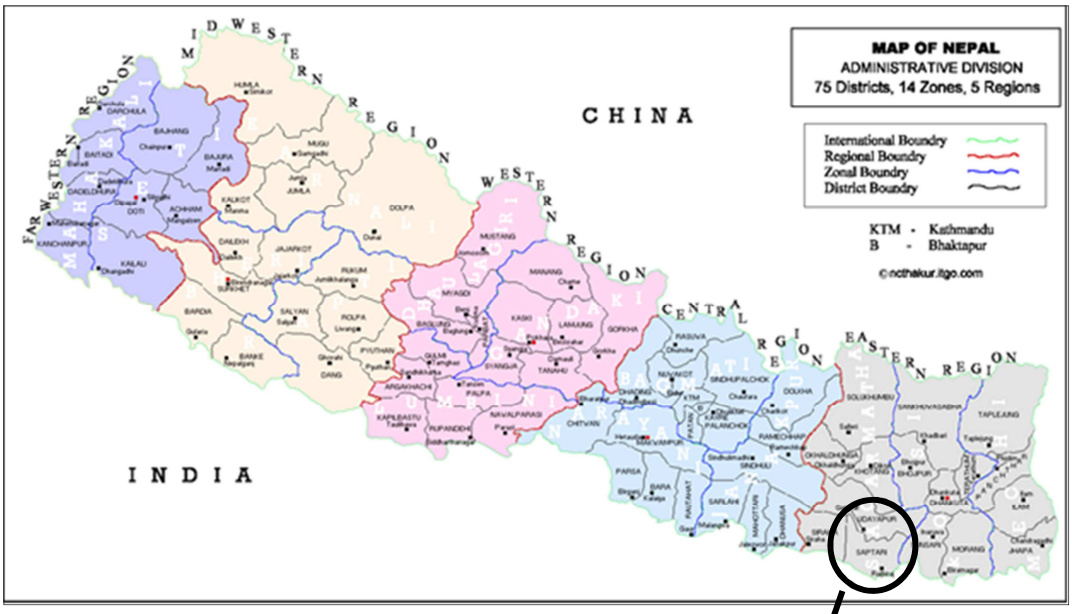
1.1.1. Description of survey area

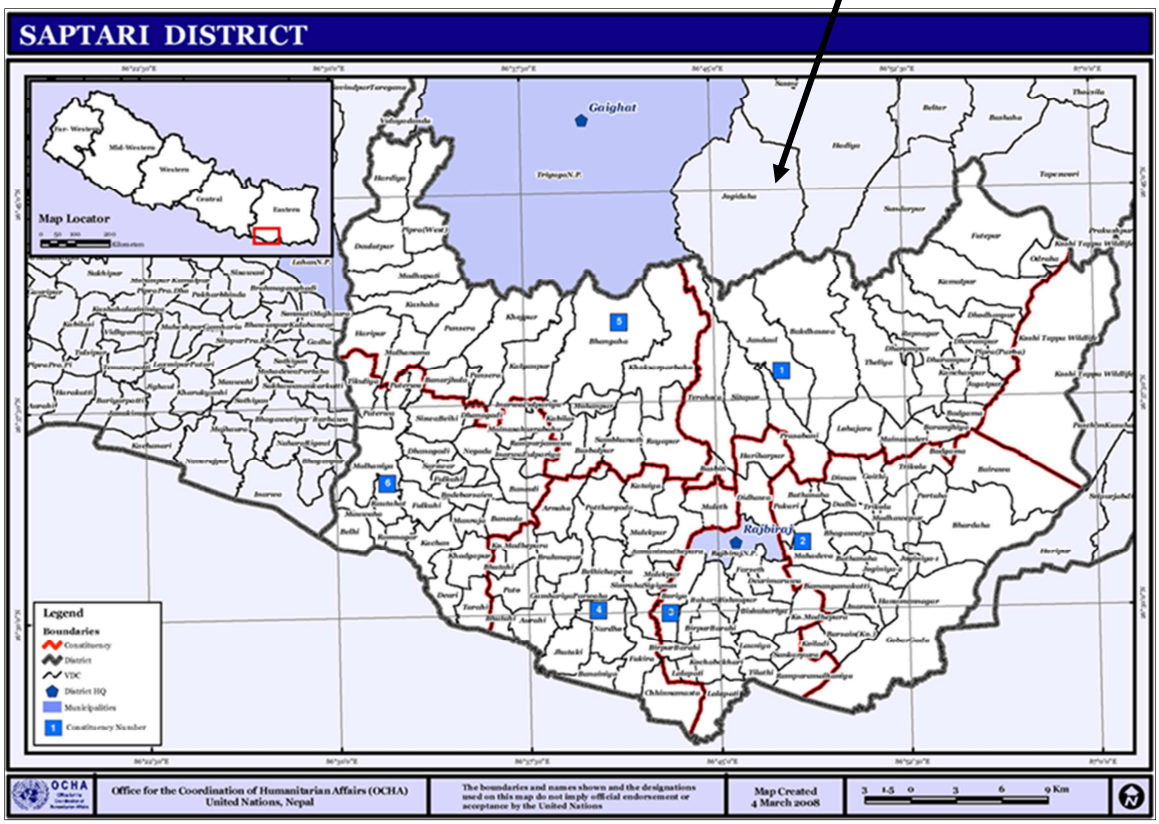
Nepal is a low income, landlocked country of approximately 30 million of inhabitants, surrounded by India and China. Geographically it can be divided in three distinct belts: the mountains in the north, the hills in the middle and the plains of the Teraï in the south. There are five development regions in Nepal: Eastern, Central, Western, Mid-western and Far-western. Nepal is divided into 14 zones and 75 administrative districts. Districts are further divided into smaller units, called village development committees (VDCs) and Municipality. Each VDC is generally subdivided into nine wards with their own well defined geographic boundaries.

Saptari District is located in Sagharmantha Zone in Eastern-Terai sub region. It is bordered by Sunsari and Morang in east, Siraha in West, Udaypur in north and Bihar State of India in south. Saptari occupies an area of 1363 sq. km. It has two belts: inner terai and terai. Almost the population lives in terai region

Figure 1: Map of Nepal and Saptari District

[2] Demographic and Health Survey. 2011. Population Division. Ministry of Health and Population. Government of *Nepal*. Kathmandu.





1.1.2. Demography and Climate

According to the latest district census the total population of the district is 639'284 (excluding institutional population of 1'400, the total population was 637'844)[3]. The population density is 418.4/ sq km. 94.68% of the total population is rural. The district is populated by various tribes and castes. Yadav, Tharu, Muslim, Dhanuk and Teli are some of the main tribes. With regards to language, 75.1% population speaks Maithali.

[3] Saptari District Population Census 2012/13.

The climate can be distinguished in three main periods: rainy season from June to September, the winter from December to February and the dry season from March to May. These seasonal particularities and the geography of the area design the cultivation trends of mainly rice and cereals (wheat, barley and millet)[4].

1.1.3. Education and literacy

Total literacy rate of the district is 49.6% out of which male literacy rate is 63.2% and female literacy rate is 35.5%. 53.6% of women and 27% of men in central terai sub region has no education[5].

With regards to education, government and private educational institution has been established in Saptari. Some technical institutes are helping to produce technical manpower[6].

1.1.4. Economy, livelihoods and food security

With a population of over 30 million and a per capita gross national product of 538.9 USD, Nepal is one of the poorest countries of the world, ranking 145 out of 179 countries in the UNDP world poverty index[7]. Country poverty is root cause for food insecurity, undernutrition, social, education, healthcare and employment deprivations. Low productivity in agriculture is a major contributor to poverty and food insecurity.

Nepalese economy is dominated by agriculture, 65.6 % of total population is directly or indirectly depend on agriculture. Nearly 50 % of the small and marginal farmers and majority of the landless agricultural workers live below the poverty line. Chronic poverty and deep-rooted social divisions and discrimination in terms of caste, ethnicity, gender, culture and religion creates much vulnerability to poverty, food insecurity and malnutrition. Government of Nepal is attaching a high priority to the improvement of food security and nutrition, including food security monitoring and early warning. However, central issues such as unequal access to food, basic services, economic opportunities and perceived inability of poor, marginalized groups are still remaining unaddressed[8].

World Food Program (WFP) is the main provider of food security data and analysis at national level. The definition of levels of food insecurity is felt by some stakeholders to be closer to “rice insecurity”. The social status associated to rice (main staple food of higher castes of society) is to be taken into consideration in the resistance of farmers to plant other crops that have more nutritious value (e.g. millet). According to the WFP, three and half million people in Nepal are considered to be moderately to severely food insecure, with the Terai dominating national agriculture production, yet paradoxically also containing areas of high levels of malnutrition[9].

[4] See Appendix 6: Seasonal calendar – Saptari district

[5] Chapter 2: Housing Characteristics and Household Population. Demographic and Health Survey. 2011. Population Division. Ministry of Health and Population. Government of *Nepal*. Kathmandu.

[6] Rapid Assessment Report Acute Malnutrition in Children under five years in Saptari, Sunsari, and Morang Districts (Eastern Terai Nepal) 19th November – 25th November 2011. ACF Nepal.

[7] UNDP Country profile – Nepal. Url: http://hdrstats.undp.org/en/countries/profiles/NPL.html. Accessed on 02 July 2013.

[8] Assessment of Food Security and Nutrition Situation in Nepal. FAO 2010. Url: ftp://ftp.fao.org/OSD/CPF/Country%20NMTPF/Nepal/thematic%20studies/Food%20Security%20_Final_.pdf Access 03 July 2013.

[9] WFP 2010 Food Security Atlas -Nepal.url: http://www.wfp.org/content/nepal-food-security-atlas-2010. Accessed on 02 July 2013.

In a study estimating the poverty, caloric intake and malnutrition (stunting, underweight and wasting) at the sub district level for Nepal[10] WFP puts the District with a poverty incidence of 24.42%-33.13%.

Agriculture is the main occupation of the people in Saptari. The district has fertile land for agriculture productions. Rice, wheat, maize, oil seeds are some of main crops, nevertheless, fish farming is also one of the agricultural activity in the district. However, the method of farming is traditional. A nationwide assessment of the food security in Nepal conducted by FAO and WFP in 2007[11] highlighted the importance of agricultural modernization in reducing food insecurity in Nepal.

Table 2: Food balance sheet Saptari District [12]

Description	Food	Pulses	Oil seeds	Vegetable+ Potato
Consumable food (MT)	192'825	2'911	2'160	146'452
Indeed in need (MT)	135'149	12'331	6'165	87'326
Saving (MT)	57'675	9'420	-4005	59'126
Percentage	42.7%	76.5%	64.9%	67.7%

Table 3: List of typical foods (seasonally) available in Saptari District

Cereals	Pulse	Vegetables	Green leafy	Nuts and oil seeds	Fruit	Meat product	Milk and product	Fat and edible oil
Paddy Wheat Maize Barley Millet	Lentil Gram Black gram Beans Peas Spotted beans Mung Rajma Red bean (Simi)	Potato Yam Cauliflower Cabbage Radish Pumpkin Brinjal Bamboo shoot Cucumber Bitter guard Chilli Jack fruit tender Broad beans Ladies finger Onion Tomato Snake guard Parwar Ghar tarul Carrot Garlic dry	Spinach Mustard leaf Amaranth (latte) Bethe leaves Coriander leaves Garlic leaves Khole garden cress Radish leaves Mint Pumpkin leaves Leaves product Gundruck Maseura	Almond Coconut Ground nut Linseed seeds Mustard seeds Sunflower Sesame seeds	Apple Apricot Banana Grape Guava Papaya Jackfruit Lemon Mango Lichi Melon musk Orange Junar Pine-apple Pomegra-nate Pear	Buff Goat Chicken Duck Pork Pigeon Fish Egg	Bafflo Cow Goat Skimmed milk Curd Paneer	Butter Ghee Cow Buffalo Vegetable ghee Mustard oil Sunflower oil Coconut oil Seasome oil Lin seed

[10] Nepal Poverty Map : Poverty Incidence at the Ilaka Level. World Food Program. Url: http://un.org.np/node/10125 Accessed on 06 July 2013.
[11] Special report: FAO/WFP Food Security Assessment Mission to Nepal. FAO Global Information and Early Warning System on Food and Agriculture, 25 July 2007.
[12] Saptari District Agriculture Office Report (2011/12).

1.1.5. Water and sanitation

The basic determinants for better health, such as access to safe water, and sanitation, are still in a critical state in Nepal. The majority of communities in rural areas of Nepal either lack basic sanitation facilities or the existing facilities are in unusable and unsafe conditions.

At District level water coverage in 72%[13].

Table 4: Coverage per type of eater point, Saptari District 2011

Type of water point	Coverage (%)
Public taps	0.7%
Private taps	2.3%
Public tube wells	33.6%
Springs	61.6%
Dug well	0%

According to reports from local actors[14], the sanitation situation of Saptari district is poor and with an estimated latrine coverage of about 27% at district level. The majority of households in the rural areas of Saptari are reported to not have a latrine with most of the people defecating openly, either along the river sides, in the forest or in paddy fields.

According to the latest national demographic survey[15], 41.0% of people in urban settings have access to water from improved source compared to 17.5% in rural areas and water treatment is conducted among 20.5% in urban and only 5.5% of urban households. National data further suggest that although hygiene practices such as hand washing are at acceptable levels, hand washing using soap and water is at only 43.2% in rural areas, compared to 75.6% in urban areas in the country.

1.1.6. Health

Saptari District has 117 governmental health institutions at various levels providing primary health care services, in addition to a system of health community volunteers[16]. From 2008, the treatment provided in health posts and sub-health posts are free of charge for the beneficiary. Only specific or non-available medicines have to be purchased in pharmacy or private health facility.

Table 5: Health facilities by numbers, Saptari District

Type of health facility	Number
Hospital GoN	1
PCC	4
Health post	9
Sub-health post	103
PHC/ORC clinic	407
EPI Clinic	459
Female Community Health Volunteers	1074

Health and nutrition program of the district is led by District Public Health Office (DPHO) under Ministry of Health and Population (MOHP).

[13] Nation Wide Coverage and Functionality Status of Water Supply and Sanitation in Nepal. March 2011.
[14] Sabal-Nepal. Url: http://www.sabalnepal.org.np/front/index.php?action=about&content_id=19 Accessed on 05 July 2013.
[15] Chapter 2: Housing Characteristics and Household Population. Demographic and Health Survey. 2011. Population Division. Ministry of Health and Population. Government of *Nepal*. Kathmandu.
[16] District Health Profile 2011/12.

1.1.6.1. Morbidity

The CB-IMCI program is an integrated package that addresses the management of diseases such as pneumonia, diarrhoea, malaria and measles, as well as manluntrition, among children aged 2 to 5 years. These programs follows WHO guidelines on standard ARI case management. The program includes the involvement of FCHV in detection and treatment, in addition to treatment in government health facilities.

Intestinal worms, diarrhoea and respiratory tract infections (ARI and others) constitue a major public health problem in the area.

Table 6: The top ten reported diseases in Saptari District 2011/12[17]

Disease	%
Intestinal worms	9.4
Presumed non-infectious diarrhoea (persistent)	8.8
Impetigo/boils/furunculosis	8.1
Pyrexia of unknown origin	7.9
ARI/Lower respiratory tract infection	7.1
Gastritis	5.7
Scabies	5.5
Headache	5.2
Upper respiratory tract infection	4.9
Amoebic dysentery/Amoebiasis	4.8

1.1.6.2. Vaccination

The National immunization Programme (NIP) – also known as Enlarged Programme for Immunization (EPI) - is responsible for immunization coverage in the country. Immunization services are provided through the fixed (health facilities) as well as outreach sessions. All children should receive the suggested number of doses of BCG, DPT-HepB-Hib, OPV, and measles vaccines during their first year of life. Similarly, all women of childbearing age should complete 5 doses of TT vaccine during their reproductive life. JE vaccine is available in the routine immunization programme only in districts with high risk of Japanese encephalitis transmission. All of the vaccines in the routine immunization schedule are provided free of cost in all public health facilities in Nepal [18].

Recent district data suggest that vaccination status of children and women of childbearing age in Saptari District is good, with a coverage of 102 for BCG, 97 for DPT-Hep b-Hib 3, 91 for Measles and 88 for TT2 and TT3 + Pregnant women[19]

1.1.7. Nutrition

Nepal is on track to reach MDG 4: reducing child mortality, to which improved nutrition has contributed towards reducing. However, stunting remains high and wasting rates have remained almost unchanged over the last decade 57% of children were stunted in 2001 compared to 41% in 2011, and 43% of children were underweight in 2001 compared to 29% in 2011. However, the proportion of children who are wasted decline slightly from 13 % in 2006 to 11 % in 2011, with 3 %

[17] District Health Profile 2011/12 and Annual report. District Public Health Office. Saptari, Rajbiraj.
[18] WHO SEARO- Nepal Country Programme-National immunization programme (NIP). Report 2012. Url: http://www.nep.searo.who.int/EN/Section4/Section29/Section89.htm. Accessed on 03 July 2013.
[19] See footnote reference *District Health Profile 2011/12 and Annual report* above.

severely wasted at national level[20].

Table 7: Summary table of malnutrition rates by sub regions (2011)

	Acute malnutrition (wasting) Weight-for-height		Chronic malnutrition (Stunting) Height-for-age		Underweight Weight-for-age	
Sub region	**Severe % below -3SD**	**Global % below -2SD**	**Severe % below -3SD**	**Global % below - 2SD**	**Severe % below -3SD**	**Global % below - 2SD**
Eastern mountain	0.7	8.4	16.3	45.0	4.9	23.5
Central mountain	2.8	7.9	14.2	45.5	7.6	34.7
Western mountain	4.4	13.2	24.3	59.5	13.2	42.0
Eastern hill	1.3	10.5	17.2	45.5	5.8	28.5
Central hill	2.7	15.0	11.2	31.3	5.1	22.5
Western hill	1.0	7.6	12.6	36.0	3.8	16.8
Mid-western hill	1.9	8.0	23.4	51.7	11.5	37.1
Far-western hill	2.5	13.7	26.9	57.5	14.9	39.7
Eastern terai	***2.2***	***10.3***	***10.5***	***31.4***	***5.5***	***24.0***
Central terai	3.2	10.4	19.5	40.5	10.7	32.0
Western terai	5.1	15.2	17.8	39.9	8.1	34.4
Mid-western terai	3.4	13.9	14.1	43.5	7.5	32.1
Far-western terai	3.4	7.9	4.9	31.5	2.4	24.7

The Ministry of Health and Population (MoHP) is the lead government agency for nutrition in Nepal. The Nutrition Section of the Department of Health Services, MoHP has developed the National Nutrition Policy and Strategy (in 2004 and revised in 2008) including infant and young child feeding, overseen by the Child Health Division (CHD). The policy still requires greater advocacy and implementation at all levels. Nutrition is one of the top priorities in the Three Year Interim Plan (TYIP) for the government; a Multi-Sectorial Nutrition Plan is now approved and endorsed by the national Planning Commission.

Saptari District is burdened with children suffering from Severe Acute Malnutrition with GAM of 10.3% (2.2% SAM). Prior to ACF intervention, the District Health Office of Saptari had no nutrition activities other than growth monitoring where underweight (weight for age) is monitored during vaccination days. The district health staff had not undergone any nutrition trainings so far, the knowledge on Acute Malnutrition and CMAM were completely new to them. In less than a year of intervention ACF has treated more than 2000 severely malnourished children, which represent more than 100% of total children planned for that period of time in the programme. The high rate of admissions was justified by an underestimated number of SAM children within the district due to lack of district specific data. Almost one year after its implementation, the programme is showing high quality of services with cured rates above SPHERE standards (89.1%) and very low rates of defaulter (7.7%).The programme has been generally well accepted in the community. Almost (95%) of all health staff identified (volunteers, medical staff, health workers) were trained on detection, prevention and treatment of severe acute malnutrition. Recently a SQUEAC investigation was conducted in proposed survey district- Saptari showing coverage of 41% (for a 9 month old CMAM program).

[20]District Health Survey Data: stunting, wasting and underweight 2001, 2006 and 2011.

According to the latest District Health report (2011/2012), the coverage of vitamin-A supplementation and deworming treatment for children 6-59 months and 12-59 months was 100%. 82.9% of the households in the Eastern-terai subregion reportedly used iodized salt in 2011[21].

1.1.8. Relief and intervention

The following local and international organisational actors are currently active in the Saptari District:

Table 8: UN agencies, INGO and NGO actors currently active Saptari District by area of intervention

Area of Intervention	Name of NGO
Agriculture	VDS Nepal
Agriculture and cooperative	MCDC
Child development	Seto Gurans
Concern of people	Civil Society
Health and education	Saptari community development center Nepal (SCDC)
Health and emergency	Nepal red Cross Society (NRCS)
Health, education, agriculture, WASH	Save the Saptari
Health, education, infrastructure development	Rural reconstruction Nepal (RRN)
Health, education, women development	UNICEF
Health, family planning, safe abortion	FPN
Human rights	Human Development and Empowerment Centre (HUDEC)
Human rights	Human Right and Community Development Academy Nepal (HUCODAN)
Human rights	Human Right Consciousness and Development Centre (HUCODEC)
Human right, women rights	Setu Development Forum
Health	Yart Nepal
Renewable energy	Energy (DDC)
Reproductive health	PAHRI
Reproductive health and population	UNFPA
WASH and emergency	KVS
WASH, education	Sabal Nepal
WASH, health	LGCDP
Women development	Single Women

2. Survey objectives

[21] Chapter 11: Nutrition of Children and Women. Demographic and Health Survey. 2011. Population Division. Ministry of Health and Population. Government of *Nepal*. Kathmandu.

2.1. General objective

To evaluate the nutritional situation and mortality rate of children aged 6 to 59 months in Saptari District, Nepal.

2.2. Specific objectives

- To estimate the prevalence of acute malnutrition among children from 6 to 59 months old according to weight for height and MUAC
- To estimate prevalence of stunting and underweight in children aged 6 to 59 months.
- To estimate retrospective morbidity rates in children 6 to 59 months during the 15 days preceding the survey.
- To estimate exclusive breastfeeding practices for children under 6 months[22]
- To estimate continued breastfeeding practices for children aged at 1 year (12 to 15 months), and 2 years (20 to 23 months)[1].
- To estimate the Household Dietary Diversity Score of households with children under 5.
- To estimate Individual Dietary Diversity Score in children aged 6 to 59 months.
- To estimate the retrospective mortality rate (crude and under-5 mortality rate) during 85 days preceding the survey

The rationale of conducting a combined anthropometry and mortality survey is linked the need for empirical basis for advocacy purpose and to establish a baseline for comparison. ACF has been supporting local CMAM implementation in the Saptari District since its start in June 2012. The intervention was based on rapid assessment information and very limited local data on the malnutrition or mortality levels are available. The mortality data would also complement the surveillance system already in place by the Nepalese health authorities.

3. Survey methodology

3.1. Type of survey

The survey was conducted in Saptari District during 10 days from 12 to 24 June 2013. This represented the period just before the rainy season (end-June to August)[23]. Previous SMART surveys in Nepal have also usually taken place around the same time which will be an advantage if comparing the data with findings from other CMAM pilot districts (Kanchanpur: June 2005 again in May-June 2008).

No up-to-date exhaustive population data was available and households in the selected survey area were not located in a way that they could be visited systematically. Therefore the SMART two-stage cluster sampling method was used for the nutrition anthropometric and retrospective mortality surveys.

The surveys included:

- Anthropometric data collection for 6-59 months old children with included data collection for

[22] Indicators for assessing infant and young child feeding practices – UNICEF/WHO – 2008.
[23] See appendix 6 : Seasonal calendar – Saptari District.

IYCF practices for 0 to 23 months children
- Mortality questionnaire for the sampled HHs population
- Dietary Diversity Score and health data collection for adults and children 6-59 months

Children of 6-59 months old constituted the population of the surveys as they are considered the most vulnerable population group. For the nutrition anthropometric survey incorporating data also on IYCF and DDS 502 children and 1037 households were planned as sample. For the mortality survey a population of 720 and 161 households was planned as sample.

3.2. Population surveyed

The target population for the anthropometric nutrition survey was children aged 6 to 59 months as they represent the most vulnerable group to malnutrition. IYCF data concerned children aged 0-23 months.

Mortality rate was evaluated for all households regardless if they had or not children 6 to 59 months.

HDDS was only collected for household with children 6 to 59 months.

3.3. Sampling method

The first step consisted of the assignment of clusters and has been done using ENA software, version Delta (November 2012). We estimated the average number of household which could be surveyed per day per team and this number was equivalent to one cluster.

The average number of households which could be surveyed per day per team was estimated to 18. This number was equivalent to one cluster. This estimation was based on expected time spent for: travelling time to the cluster, daily breaks and lunch time, presentation and selection of 1st household, anthropometric and retrospective-mortality interviews and anthropometric measurements.

Table 9: Calculation of daily household coverage/team

Calculation of HH coverage/day		
Event	**Time to dedicate**	**Total time remaining**
Time per day for field work	From 7:00 until 18:00 = 11 hours	660
Travel time to cluster location	45’ x 2 (go and return) = 1,5 h	570
Two breaks of 10’ plus 1 hour lunch break	10’ x 2 + 60’ = 80’	490
Presentation to village leader and selection of the 1st HH	30’	460
Time to dedicate per HH and reach the next	20’ for survey measurements and questionnaire + 5’ walk to	0

	next HH= 25'	
Total of HH's to be covered in one day :	**18**	

Number of clusters needed to have to complete the entire required households in our survey area was then determined. The number of clusters was obtained by dividing the total number of households to survey (n=1037) by the number of HHs achievable per cluster in one day (n=18). From this calculation, the total number of clusters needed was 58. The individual population size of all wards in the Saptari district and the identified required number of clusters was then entered in ENA Delta software (Nov 2012) which assigned the 58 clusters according the probability-proportional-to size (PPS)[24].

The last population census of Saptari district was done by the national Central Bureau of Statistics (CBS) in 2011[25]. The census data is detailed up to ward level. For each ward, the data provides the number of households and the number of inhabitants. According to the census the total population of the Saptari District is 637'844[26]. The population under 5 years in Saptari District in 2011 is reported at 75'876 or 11.9%[27]. The average HH size in the district was reported to 4.98 according to latest available data from 2011[28].

A sub regional health survey conducted in 2011[29] in East-Terai found GAM prevalence of 10.3% and SAM prevalence of 2,2% (using WHO standards). However, higher than expected admission records from CMAM-implementation in 2012-13 indicate that malnutrition prevalence may be higher than estimated in the 2011 survey.

The crude death rate (CDR) in Nepal was last reported at 6.75/1'000 population/year in 2012[30]. No local data on crude death rate is available. The CDR gives the average annual number of deaths during a year per 1,000 populations at midyear; also known as crude death rate. The death rate, while only a rough indicator of the mortality situation in a country, accurately indicates the current mortality impact on population growth. This indicator is significantly affected by age distribution, and most countries will eventually show a rise in the overall death rate, in spite of continued decline in mortality at all ages, as declining fertility results in an aging population

The available CDR needed to be converted from deaths/1000/year to deaths/10'000 population/day in order to enter it into the ENA Delta software (Nov 2012). This was done by dividing numerator by 12 (1/12th the number of deaths will occur in one month as in one year) [31] and further divide this sum by 30.4 (average number of days/month) multiplied by 10[32] :

[24] See Appendix 2 : Assignment of clusters

[25] National Population Census 2011: HH and population by sex at ward level

[26] Excluding an Institutional population (e.g. hospitalized persons etc.) of 1'440 at the time of the census. These are not included in sample population as it is not possible to determine in which ward they reside.

[27] Saptari District Profile 2013/13. Central Bureau of Statistics. National Planning Commission Secretariat. Governments of Nepal.

[28] Nepal Population Report- 2011. Ministry of Health and Population. Population Division. Kathmandu, Nepal.

[29] Chapter 11; Nutrition of Children and Women. Demographic and Health Survey. 2011. Population Division. Ministry of Health and Population. Government of *Nepal*. Kathmandu.

[30] CIA World Factbook – Nepal. url: https://www.cia.gov/library/publications/the-world-factbook/geos/np.html. Accessed on 26 June 2013.

[31] The John Hopskins and the international Federation of Red Cross and Red Crescent Societies: Epidemiology and surveillance.

[32] SMART Methodology. Version 1. April 2006.

CDR 6.75 deaths /1'000 population/ year
12 months
Equals
CDR (0.56 deaths /1'000 population/ month) x 10
30.4 days
Equals
CMR 0.18 deaths /10'000 population/ day

Following this conversion, the estimated CDR was therefore is set to 0.18 /10'000 /day.

The sample size for Saptari District was calculated by ENA Delta software (November 2012) using the figures shown below:

Table 10: Parameters used for survey design

Type of survey	Parameters	Figures	Justification
Nutrition	Expected malnutrition prevalence	13%	Demographic and Health Survey data: stunting, wasting and underweight 2011[33]
	Desired precision	3.5%	Considering both future comparison and advocacy purpose and advocacy purposes
	Design effect (DEFF)	1.3	Corresponds to a relatively homogenous population
	Sample size	1037	Generated by ENA Delta software (November 2012)
	Number of clusters	58	Based on 18 HH that can be completed each day per team
Mortality	Under 5 population	12%	Saptari District profile 2011/13[34]
	Average HH size	4.98	National Population Census 2011[35]: HH and population by sex at ward level
	Recall period	85 days	*Holli Purnima* 27 march 2013[36]
	Expected mortality rate	0.18 deaths/10'000/day	CDR 6.75 deaths/1'000 population/year (CIA World Factbook – Nepal 2012[37]
	Desired precision	0.40%	Relatively short recall period to avoid recall bias

[33] Chapter 11: Nutrition of Children and Women. National Population and Housing Census 2011 (NPHC2011). National Census 2011 Citizen Observation Committee (NCOC 2011).
[34] Saptari District Profile 2013/13. Central Bureau of Statistics. National Planning Commission Secretariat. Governments of Nepal.
[35] Nepal Living Standards Survey 2010/2011. Statistical Report Vol1. Central Bureau of Statistics. National Planning Commission Secretariat. Governments of Nepal. November 2011.
[36] Celebration of the light celebrated locally on 27 March 2013, a major event which the population of the area remember easily.
[37] CIA World Factbook – Nepal. url: https://www.cia.gov/library/publications/the-world-factbook/geos/np.html. Accessed on 26 June 2013.

	Design effect	1.3	Corresponds to a relatively homogenous population
	Estimated non-respondent HH	10%	Security and accessibility generally good. Adding a margin for underestimation of risk for non-responding HH.
	Sample size	161	Generated by ENA Delta software (November 2012)

A cluster sampling was conducted for Saptari District.

The first stage sampling corresponding to the cluster selection was also done with ENA Delta software (November 2012) among the list of wards. In Nepal, the country is administratively divided into zones subdivided into districts, which are again subdivided into village development committees (VDCs) each consisting of wards with definite boundaries. Saptari District consists of 114 VDCs, each subdivided into 9 wards, and Rajbiraj Municipality, divided into 10 wards. The recent national guideline for conducting nutrition and mortality surveys also states that first stage cluster selection should correspond to the wards from the census data in Nepal.

The second stage sampling corresponding to the household selection was done according to the geographical organization and the number of houses using systematic random sampling. The method is described in section 3.4. below.

As it was impossible to survey the total population, a total of 58 clusters in Saptari District was estimated by ENA Delta software (November 2012) give a reasonable estimation of the malnutrition prevalence. The selected clusters were hence sufficient to represent the total population of Saptari District, the geographical area to be surveyed.

Given that the number of households to be visited for the nutrition anthropometry section of the survey was substantially higher than the number of HHs to be visited for the retrospective mortality section, it was decided as per standard SMART methodology to use the higher household number (anthropometry) for the definition of households to be visited for both anthropometry and mortality. The total sample size was therefore 1'037. With the given estimation of 18 households/day and the definition of 58 clusters, the survey was scheduled to take 10 days with 6 survey teams.

3.4. Household and individual selection

In each selected Ward one or more member(s) of the community helped the teams by providing information about its geographical organization and number of households.

A household was defined as *'all people eating from the same pot'*[38].

3.4.1. Household selection

- If houses were near each other, and less than 150 in number, the survey team gave a number to each house, then divided the total number of households by 18 (the number of households needed in each cluster) to find the sample interval. They selected randomly a number between one and the number of the sample interval. This number corresponded to the first HH surveyed. The second household surveyed corresponded to the first HH

[38] World Food Program household definition.

number + the sample interval. The same procedure was followed until the team reached 18 HH in total.

- If the houses were scattered throughout a large area, and /or they were more than 150 in number, the following method was applied:

o The cluster was divided into segments including the same number of households (around 150 households). If the number of households in each section were about the same size, simple random selection was used selecting a segment. If the numbers of households in each segment varied in size, PPS method was used with random systematic selection of segment.
Example:

Section	Number of HHs	Cumulative number of HHs
A	120	1 – 120
B	137	121 – 257
C	158	258 – 415
D	99	415 – 514

Then they used a random number table (here considering three digits numbers) to select a number between 1 and the total number of households. The segment containing this number was the segment selected to be the surveyed area

o The selection of households from this segment was done following the same method described above for small population.

3.4.2. Individual selection:

All children aged 6 to 59 months in the selected household were included in the survey for the anthropometric and additional data.

Infants less than 6 months present within the selected households were also included, but only for the IYCF data.

3.4.3. Special cases:

No children under age 5 in the households: The household remained a part of the "sample" that contributed zero children to the nutritional anthropological part of the survey. The household was however included for the mortality survey and IYCF data collection.

Absent child: If a child lived in a house but was not present at the time of the survey, he/she was recorded on the data sheet. The team returned at the end of the day to take the child's measurements. If the child was still absent, *he/she was not replaced* and an ID number was given to him/her.

Refusal to participate: If the residents of a household refused to participate in the survey or could not participate because of important reasons, a record of the household was done explaining that the household could not be visited. The household was not replaced by another household; the team went to the next household according to the rules. In case of refusal from the parents to include their child in the survey, he/she was not replaced; an ID number was also given to him/her.

Empty house: The team returned at the end of the day. If no one was still present, neighbors were asked about the household (in order to complete the mortality data questionnaire). *The household was never substituted by another one.*

Orphan children taken in by a family: Child was considered as part of the household and included in the survey. It was similar for children who were under care (living permanently) of their grandparents.

Disabled child: Child was included if they are aged 6-59 months. If it was not possible to measure their height and/or weight due to deformity or other abnormality, they were given an ID number and data were recorded as missing. In both cases, a note is made that the child is disabled. For people with left arm handicap, the MUAC was done on the right arm.

Polygamous family: Families were counted as one household as long as they are living together and sharing a common cooking pot. If polygamous families form different households based on the household definition they were be treated as separate households.

Building with several households selected: One household was randomly chosen to be surveyed.

Compound with several households selected: One household was randomly chosen to be surveyed.

Child in a centre/hospital/NRH: If a child had been admitted to a hospital or feeding centre, the team were instructed to go to the centre and measure the child where possible. This is critical as such a child is very likely to be severely or moderately malnourished. If it is impossible to visit the centre the child will be included in the datasheet and a note added that the child was in a centre/hospital/NRH and probably severely malnourished. In reality, the child may or may not be severely malnourished. If there were a large number of such children, and the centres/hospital/NRH cannot be visited to complete the measurements, then two rates of severe malnutrition would be calculated, one assuming that these children are all severely malnourished, and the other excluding these children from the survey.

Severely malnourished children: Were referred to the nearest nutritional centre or health facility.

3.5. Data collected

All questionnaires were translated in Nepali language, and the interviews were conducted in Nepali (see appendices 8-10).

Mortality and HDDS/IDDS questionnaires were filled before the anthropometric questionnaire.

Questions regarding health status and IYCF were asked before taking the mothers and children's measurements.

3.5.1. Data linked to anthropometry

The anthropometric data was collected for children aged 6 to 59 months.

The nutrition status is evaluated through the anthropometric measurement of height, weight, MUAC, the examination of presence or absence of bilateral edema, as well as the sex and age for children.

Sex: coded "M" for male and "F" for female.

Age: expressed in months, obtained either with the birth date (known by the parents and/or written on the vaccination card and/or birth certificate), either with the local calendar of events (Appendix

9: Local Events Calendar- Saptari District). Children between 65 and 110 cm will be enrolled whenever it is not possible to estimate their age.

Weight: children are measured naked with a 25 kg Salter scale having a 100 g precision.

Height: measured with locally-made measuring-board (from the Shore model), with a 1 mm precision. Children less than 87 cm are measured lying, those more than 87 cm are measured standing. A stick marked at 87 cm is used to determine if children are more or less than 87 cm.

Bilateral edema: only pitting bilateral edema starting on the feet are significant of a nutritional problem. It is evaluated by pressing during 3 seconds with both thumbs simultaneously on the top of both feet. Edema is considered positive if the thumb print stays (is pitting) on both feet for a minute. It is coded "Y" (for yes) if positive and "N" (for no) if it is negative.

MUAC: measured on the left arm using a graduated ribbon (ACF MUAC tape), at mid-distance between the shoulder and the elbow. The arm is stretched and relaxed during measurement. It is measured in mm, at a 1 mm precision.

3.5.2. Data linked to health

Morbidity:

The surveyors asked the caretaker if the child was sick during the past 15 days, and if yes, what the signs were. The answer is coded:

1= Not sick
2= Fever
3= Diarrhoea (defined as more than 3 liquid stools per day)
4= Acute Respiratory Infection (defined as fast/short breathing and cough)
5 = Malnutrition (bilateral oedema and/or wasting)
6 = Accident
7 = Other (specify)
8 = Unknown

Health care seeking practice

If the child was sick (previous answer 1 to 8), the surveyors asked the caretaker where did they seek care. The answer is coded:

0 = No care / nothing (stayed at home)
1 = Ilaka health complex / community clinic
2 = Health centre (NGO)
3= Community volunteer
4 = Private clinic
5 = Religious healer
6 = Other (specify)
N/A= Not sick

3.5.3. Data linked to Infant and Young Child Feeding practices

For infants under 6 months:

Exclusive breastfeeding: the caretaker was asked *"what do you feed your child?"*

The answer is coded “Y” if the child is exclusively breastfed, “N” otherwise.

For infants under 24 months (0-23 months):

Continued breastfeeding: the caretaker was asked *“what do you feed your child?”* The answer is coded “Y” if the child is currently breastfed, “N” otherwise.

3.5.4. Data linked to Diversity Dietary Score

For households with children under 5; the respondent was asked what the household members ate during the last 24 hours.
Answers were recorded as a score (see questionnaire in Appendix 9: DDS questionnaire) according to the type of foods eaten:
HDDS: for the household members excluding children under 5. The maximum total score is 12.
IDDS: only for children under 5. The maximum total score is 8.

3.5.5. Data linked to retrospective mortality survey

The recall was on a period of 3 months (85 days) preceding the mid-line of the survey. In all selected households (with or without children under 5), the following information were collected:

- Total number of household members present on the day they are surveyed, including children under 5.
- Total number of members who joined the household during the recall period, including children under 5, excluding births.
- Total number of members who left the household during the recall period, including children under 5, excluding deaths.
- Total number of births during the recall period.
- Total number of deaths during the recall period, including children under 5.
- The cause of death(s) if any; they are coded:
  1 = Diarrhoea (more than 3 loose stools/day)
  2 = Fever
  3 = Measles
  4 = Difficulty to breath
  5 = Malnutrition
  6 = Accident/Injury
  7 = Other (specify)

3.6. Indicators and cut-off points used

3.6.1. Weight for height index

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 (NCHS reference and WHO standards data[39]). This curve has a normal shape and is characterized by the median weight (value separating the population into two groups of the same size) and its standard deviation (SD). The

[39] NCHS: National Centre for Health Statistics (1977) NCHS growth curves for children birth-18 years. United States. Vital Health Statistics 165, 11-74.

weight-for-height index of a child from the studied population can be expressed either as a percentage of the median or as a Z-score.

The expression of the weight-for-height index as a percentage of the median measures the difference between the observed weight value (OW) and the median weight (MW) of the reference population, for children of the same height: WHM = (OW / MW) * 100.

The expression of the weight-for-height index as a Z-score (WHZ) compares the observed weight (OW) of the surveyed child to the mean weight (MW) of the reference population, for a child of the same height. The Z-score represents the number of standard deviations (SD) separating the observed weight from the mean weight of the reference population: WHZ = (OW - MW) / SD.

WHO recommends the use of Z-scores as it is considered more reliable in terms of statistical theory.

Definition of acute malnutrition[40] according to weight-for-height index (W/H), expressed as a Z-score or as a percentage of the median:

Table 11: Definition of acute malnutrition according to weight-for-height index (W/H), expressed as a Z-score or as a percentage of the median

Moderate Acute Malnutrition (MAM)	
Z-score / SD	W/H <-2 z-score and ≥ -3 z-score and absence of bilateral oedema
% of the median	W/H < 80% and ≥70% and absence of bilateral oedema
Severe Acute Malnutrition (SAM)	
Z-score / SD	W/H <-3 z-score and/or bilateral oedema
% of the median	W/H <70% and/or bilateral oedema
Global Acute Malnutrition (GAM)	
Z-score / SD	W/H <-2 z-score and/or bilateral oedema
% of the median	W/H <80% and/or bilateral oedema

The weight-for-height index in Z-score is calculated on the field for each child, in order to refer malnourished cases to the appropriate centre.

The weight-for-height index as a Z-score will be calculated according to WHO standards, as well as NCHS reference.

Bilateral pitting 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, and referred immediately to the nearest centre.

3.6.2. Height for age index

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 his/her height-for-age with NCHS reference or 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:

[40] Use and interpretation of anthropometric indicators of nutritional status, Bulletin of the WHO, 64 (6): 929-941 (1986) WHO: World Health Organization, WHO growth curves for children, 2005.

Table 12: Definition of chronic malnutrition according to height-for-age index (H/A), expressed as a Z-score

Definition	Index
Not stunted	≥ -2 z-score
Moderate stunting	-3 z-score ≤ H/A < -2 z-score
Severe stunting	< -3 z-score

3.6.3. Weight for age index

Weight-for-age is thus a composite index, which reflects both wasting and stunting, or any combination of both. In practice about 80% of the variation in W/A is related to stunting and about 20% to wasting. It is not a good indication of recent nutritional stress.

It is used because it is an easy measurement to take in practice, and can be used to follow individual children longitudinally in the community.

3.6.4. MUAC index

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 a risk of mortality. The MUAC is taken for every child, but is an indicator of malnutrition only for children equal or taller than 65 cm. Both MUAC cut-offs recommended by WHO and used at national level are as in the table below:

Table 13: WHO and national MUAC cut-off points for children 6-59 months

National cut-offs	WHO recommended cut-offs	CLASSIFICATION
	> 135 mm	Normal
	125-135 mm	At risk of malnutrition
110-124 mm	115-124 mm	Moderate malnutrition
<110 mm	<115 mm	Severe malnutrition

3.6.5. Morbidity

Prevalence of reported illness in the two weeks prior to the interview is calculated as well as the symptom breakdown percentages.

Presentation of results for the prevalence of reported illness

	6-59 months
Fever	%
Diarrhoea	%
Acute respiratory infection	%
Measles	%
Malnutrition	%
Accident	%
Other	%
Unknown	%

Health care practices in case of illness are also reported as following:

Presentation of results for health care practices

6-59 months	
No care / nothing (stayed at home)	%
Ilaka health complex / community clinic	%
Health post	%
Sub-health post	%
Community volunteer	%
Private clinic	%
Religious healer	%
Other	%

3.6.6. Exclusive breastfeeding [41]

WHO recommends exclusive breastfeeding for 6 months[42]. This practice requires that the infants receive breast milk including milk expressed or from a wet nurse. It allows also the infant to receive ORS, drops and syrups (vitamins, minerals, medicines) but nothing else. The indicator for exclusive breastfeeding under 6 months is based on 24 hours recall and corresponds to the proportion of infants 0-5 months of age who are fed exclusively with breast milk.

Proportion of infants 0-5 months of age who are fed exclusively with breast milk:

$$\frac{\text{Infants 0-5 months of age who received only breast milk during the previous day}}{\text{Infants 0-5 months of age}}$$

3.6.7. Continued breastfeeding[43]

WHO recommends carrying on breastfeeding until 23 months as from 6 months, infants has to take additional foods alongside continued breastfeeding. The indicator of continued breastfeeding is based on 24 hours recall and corresponds to the proportion of children at 1 year (12-15 months of age) and 2 years old (20-23 months) who are still breastfed.

It is calculated at the age of 1 year and before 2 years, and corresponds to the:

Proportion of children 12-15 months of age who are fed with breast milk:

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

Proportion of children 20-23 months of age who are fed breast milk:

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

3.6.8. Complementary feeding[44]

UNICEF and WHO recommend that the child has to be exclusively breastfed from birth to 6 months of age and then starts receiving complementary food at 6 months while continuing to be

[41] Indicators for assessing Infant and Young Child Feeding practices – Conclusion of consensus meeting held 7 to 8 November 2008 in Washington DC, USA - FANTA/UNICEF/WHO/IFPRI

[42] WHO (2001): The optimal duration of exclusive breastfeeding. Report of an Expert Consultation.

[43] See footnote reference *Indicators for assessing Infant and Young Child Feeding practices* above.

[44] See footnote reference *Indicators for assessing Infant and Young Child Feeding practices* above.

breastfed. The indicator for introduction of solid, semi-solid or soft foods is in fact one of the two parts of the previous composite indicator for timely complementary feeding.

The indicator for introduction of solid, semi-solid or soft foods is therefore the proportion of infants 6-8 months of age who receive solid, semi-solid or soft foods. It is based on 24 hours recall.

Proportion of infants 6-8 months of age who receive solid, semi-solid or soft foods:

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

3.6.9. Meal frequency[45]

It is the 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 6-8.9 months
- 3 times for breastfed children 9-23.9 months
- 4 times for non-breastfed children 6-23.9 months

"Meals" include both meals and snacks (other than trivial amounts), and frequency is based on caregiver report. It is recommended that the indicator be further disaggregated and reported for the following age groups: 6-11.9 months, 12-17.9months, 18-23.9months of age.

3.6.10. Dietary Diversity Score (DDS)[46]

At household level (HDDS):
24 hours recall of the consumption of 12 food groups eaten by the household (score based on simple sum of food groups). It is a proxy indicator of household food access/consumption.

At individual level (IDDS):
24 hours recall of the consumption of 8 food groups eaten by children from 6 to 59 months in selected households. It is a proxy indicator of nutrient/dietary adequacy.

[45] See footnote reference *Indicators for assessing Infant and Young Child Feeding practices* above.
[46] Household Dietary Diversity Score (HDDS) for measurement of household food access: Indicator guide, v2 – Anne Swindle and Paula Bilinski – FANTA – September 2006.

Minimum dietary diversity is also calculated. It is the proportion of children 6-23 months of age who receive foods from 4 or more food groups:

$$\frac{\text{Children 6-23 months of age who received foods from} \geq 4 \text{ food groups during the previous day}}{\text{Children 6-23 months of age}}$$

The consumption of at least 4 groups on the previous day would mean that the child had a high likelihood of consuming at least one animal-source food and at least one fruit or vegetable that day besides a staple food.

3.6.11. Retrospective mortality rate

The mortality rate is good indicator of the overall health condition of a population. Different mortality rates can be determined depending on the objectives of the survey. In this retrospective mortality survey, the crude mortality rate (CMR) for the population and the under-five mortality rate (U5MR) for children 0 to 59 months were determined. The CMR and the U5MR are defined respectively as the number of people within the total population and the number of under-five children within the under-five population who die over a specified period. These mortality rates are expressed in relation to 10'000 persons (or under-five children) and per day and are computed by ENA delta software.

The CMR is calculated using the formula:
CMR = Number of deaths /](Total population/10'000) x time interval]

The total population is the population present at the mid-point of the time interval. It is computed as the total number of people present at the time of the survey in the household (current household members) + ½ total deaths + ½ persons present at the beginning of the recall period but gone at the time of the survey – ½ persons arriving during the recall period and present at the moment of the survey – ½ the number of births during the recall period.

The time interval referred to as the recall period is the length of time within which the interviewees are asked to state if any deaths have occurred.

The U5MR is calculated using the formula:
U5MR = Number of deaths of children under-5 / [(Population of under-5/10'000) x time interval]

The total population of children under-five is equivalent to the total number of children aged under-five years present at the time of the survey in the households + ½ total deaths of under-five children + ½ under-five children present at the beginning of the recall period but gone at the time of the survey – ½ under-five children arrived during the recall period and present at the time of the survey – ½ birth during the recall period.
Stillbirths that occur during the recall period were not recorded so were not counted.
Cut-off points for the mortality rates' interpretation are as following:

Table 14: Alert and emergency cut-off points for the U5MR and CMR according to The ACC/SCN reference[47]

U5MR	CMR	CLASSIFICATION
≥ 2 deaths per 10'000 children per day	≥ 1 death per 10'000 persons per day	Alert rate
≥ 4 deaths per 10'000 children per day	≥ 2 deaths per 10'000 persons per day	Emergency rate

[47] Health and nutrition information systems among refugees and displaced persons. Workshop report on refugees nutrition, ACC.SCN, Nov.95. ou Moren 1995.

3.7. Training and supervision

To reduce total time spent in the field for the survey 6 survey teams were recruited. Each team consisted of 4 members: 1 team leader responsible for anthropometric measurements together with 2 measurers and 1 team member responsible for Diet Diversity Score and retrospective mortality and questionnaires. In addition the survey has 1 Supervisor and 1 Data entry officer. To help ensure capacity building of local health authorities as well as high quality of implementation by the whole survey team, it was decided to design roles as team leaders to government CMAM monitors and data entry officer to the existing ACF Supervisor. Another factor for this decision was time constraints for the preparations before the training and implementation of the survey. Survey supervisor and measurers for the survey were hired externally. Each survey team included men and women for gender equality. The survey teams received thorough training by the ACF Program manager prior to the implementation of field activities. A programme manager ensured adequate training and support to teams in all aspects of the survey preparation and implementation.

The training of the survey team was carried out over 7 days. The first 3 days of the training covered the definition of terms, sampling methods, use of questionnaires and all forms, interview skills, anthropometric measurement procedures, identification of malnutrition signs (mainly bilateral pitting oedema) and communication management during measurement. A practical session on anthropometric measurements involving children 6-59 months was conducted on days 3 of the training. A standardization test was conducted on the fourth day in order to evaluate the accuracy and the precision of the surveyors in taking the anthropometrics measurements. This timing allowed identification of optimal team composition.. A pilot-survey consisting of 6 clusters (one for each team) was conducted by the team in identified nearby surroundings on the fifth day, in order to evaluate their work in real field conditions. A review of team's measuring skills and understanding of the monitoring methodology was organized on day six.

One field guidelines document with instructions and a materiel kit was provided to each team and Supervisor.

3.8. Ethical considerations

The following ethical issues were considered in the implementation of the survey:

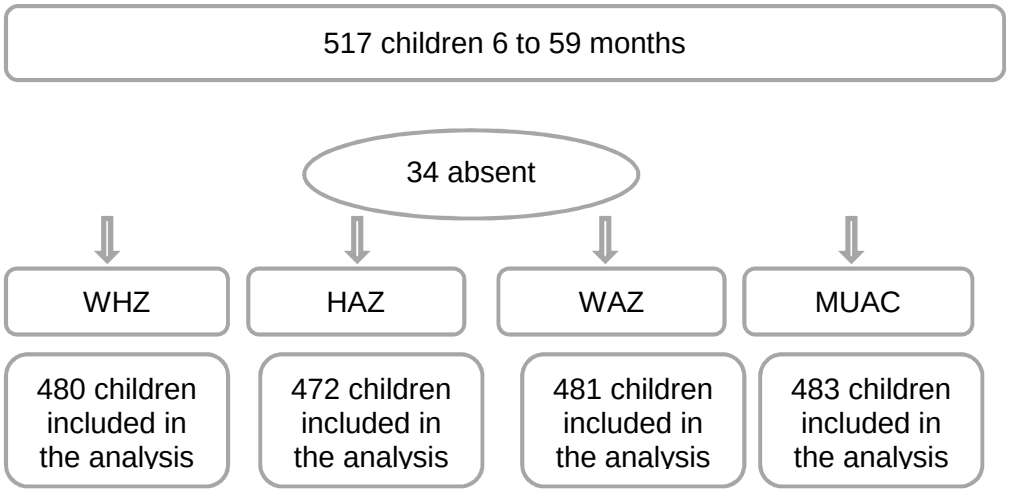
1. Provision of sufficient information to local authorities about the survey. Such information included the purpose and objectives of the survey, the nature of the data collection procedures, the targeted subgroups in the community.
2. Verbal consent was be obtained from all adult participants and parents guardians for children in the survey. Every individual had the right to refuse to participate in the survey.
3. The confidentiality of survey data was protected by ensuring that information leading to identification of individuals was not shared, especially in the communities.

4. Results

4.1. Sample description

An initial sample of 517 children aged between 6 and 59 months were included in the nutrition anthropometric survey. Among them 34 were absent at the time of the survey. A total of 3 physically disabled children were found and included in survey as some or all anthropometric measurements were possible.

Figure 2: Sample profile



Data was entered into ENA Delta software (November 2012) to determine indicators of WHZ, MUAC, WAZ and HAZ using WHO 2006 Standards. Accepted range of Z-scores from observed mean was pre-set to – 3 to 3 for WHZ, HAZ and WHZ. Following SMART methodology, analysis was run with exclusions of flagged data.

One child was excluded from WHZ analysis due to missing height measurement. A total of nine children were excluded from HAZ analysis due to probable error in age determination and/or missing height measurement. Two children were excluded from analysis of WAZ due to probable error in age determination.

Table 15: SMART flags

Nutritional indices	Number of children measured with complete data	Number of children excluded	Number of children included in the final analysis
WHZ	481	1	480
HAZ	481	9	472
WAZ	483	2	481
MUAC	483	0	483

Table 16: Distribution of age and sex of sample

AGE (mo)	Boys no.	%	Girls no.	%	Total no.	%	Ratio Boy:girl
6-11	34	51.5	32	48.5	66	12.8	1.1
12-23	56	47.1	63	52.9	119	23.0	0.9
24-35	57	47.9	62	52.1	119	23.0	0.9
36-47	57	50.9	55	49.1	112	21.7	1.0
48-59	47	46.5	54	53.5	101	19.5	0.9
Total	251	48.5	266	51.5	517	100.0	0.9

The observed overall sex/age distribution was as expected (p=0.586).

Figure 3: Population histogram per age and gender

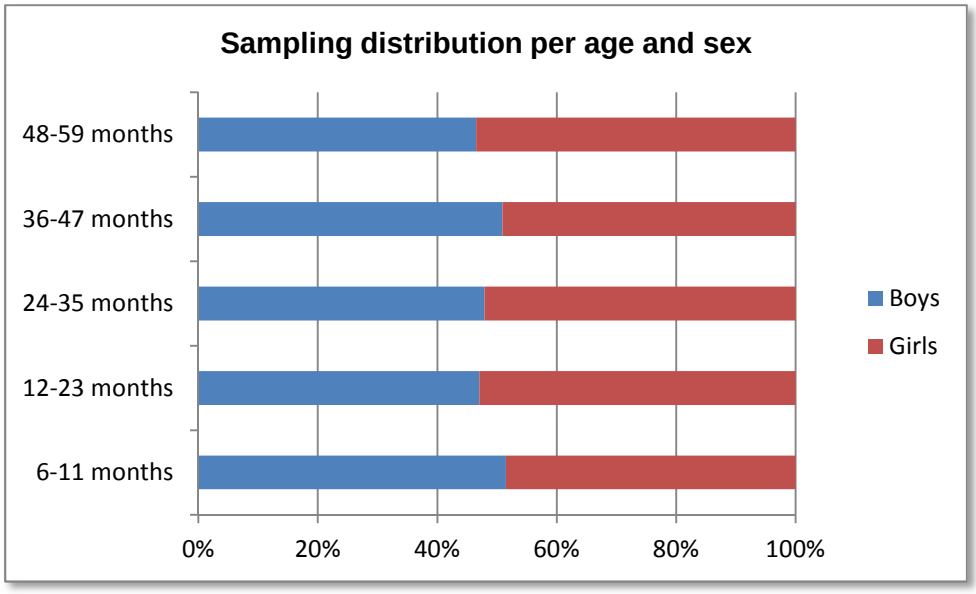
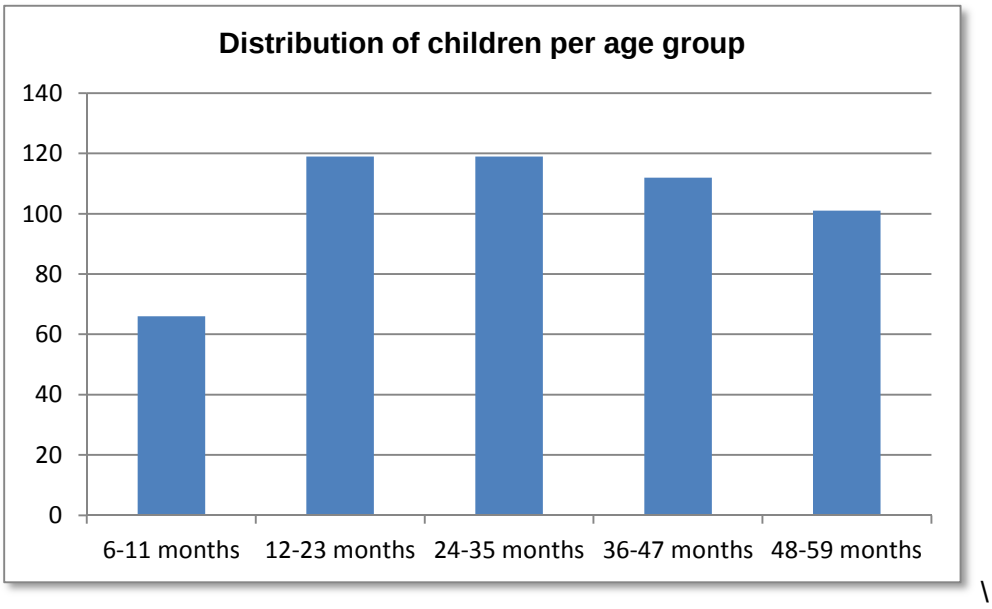


Figure 4: Distribution of children per age group (n=517)



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4.2. Anthropometric results

4.2.1. Prevalence of acute malnutrition expressed in Z-score

The weight-for-height analysis was done for a total of 480 children. One child was excluded from the analysis due to physical deformity of legs, making measurement of height unreliable.

The observed rate of global acute malnutrition in Saptari District is 21.0% (17.4 - 25.3, 95% C.I.).

The prevalence of moderate acute malnutrition is 18.1 % (14.7 - 22.1, 95% C.I.) and the prevalence of severe acute malnutrition is 2.9 % (1.9 - 4.5, 95% C.I.).

Table 17: Prevalence of acute malnutrition based on weight-for-height z-scores (and/or oedema)

and by sex

	All n = 480	Boys n = 231	Girls n = 249
Prevalence of global malnutrition (<-2 z-score and/or oedema)	(101) 21.0 % (17.4 - 25.3 95% C.I.)	(46) 19.9 % (15.5 - 25.2 95% C.I.)	(55) 22.1 % (17.1 - 28.0 95% C.I.)
Prevalence of moderate malnutrition (<-2 z-score and >=-3 z-score, no oedema)	(87) 18.1 % (14.7 - 22.1 95% C.I.)	(39) 16.9 % (12.3 - 22.7 95% C.I.)	(48) 19.3 % (14.7 - 24.8 95% C.I.)
Prevalence of severe malnutrition (<-3 z-score and/or oedema)	(14) 2.9 % (1.9 - 4.5 95% C.I.)	(7)3.0 % (1.6 - 5.7 95% C.I.)	(7) 2.8 % (1.4 - 5.5 95% C.I.)

No cases with nutritional oedema were found in our sample.

Table 18: Prevalence of acute malnutrition by age, based on weight-for-height z-scores and/or oedema, Saptari District, June 2013

		Severe wasting (<-3 z-score)		Moderate wasting (>= -3 and <-2 z-score)		Normal (> = -2 z score)		Oedema	
Age (mo)	**Total no.**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**
6-11	62	1	1.6	4	6.5	57	91.9	0	0.0
12-23	110	2	1.8	33	30.0	75	68.2	0	0.0
24-35	113	5	4.4	19	16.8	89	78.8	0	0.0
36-47	102	4	3.9	11	10.8	87	85.3	0	0.0
48-59	93	2	2.2	20	21.5	71	76.3	0	0.0
Total	480	14	2.9	87	18.1	379	79.0	0	0.0

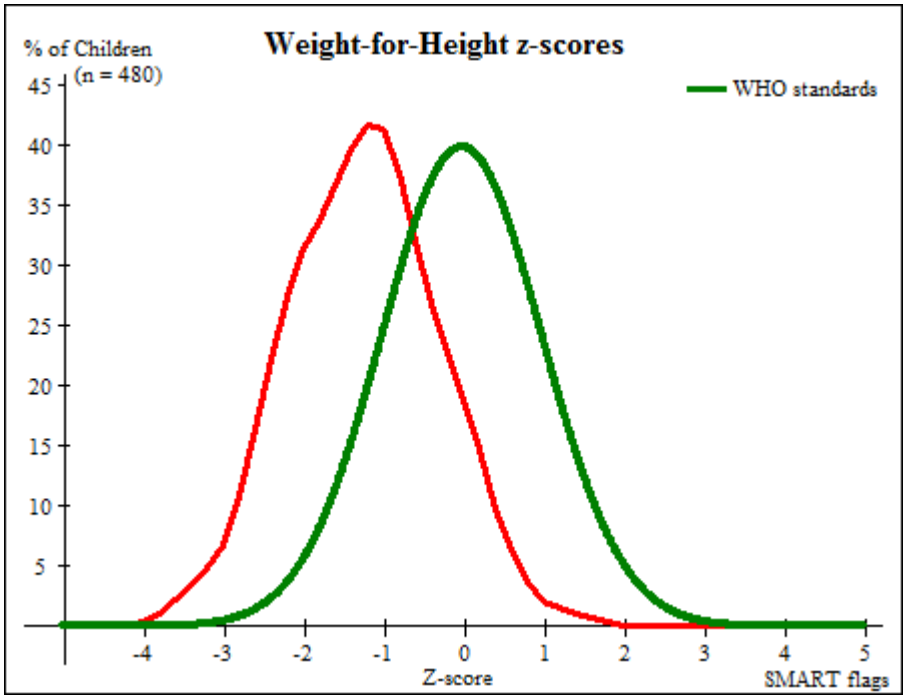
Table 19: Distribution of acute malnutrition and oedema based on weight-for-height z-scores

	<-3 z-score	>=-3 z-score
Oedema present	Marasmic kwashiorkor No. 0 (0.0 %)	Kwashiorkor No. 0 (0.0 %) (1.0
Oedema absent	Marasmic No. 14 (2.9 %)	Not severely malnourished No. 467 (97.1 %)

The WHZ distribution curve of our sample is shifted to the left of the WHO standard curve, indicating that all the children in the population, and not only those below a given cut-off, are affected[48].

Figure 5: Weight-for-height Z-core distribution curve, WHO standards 2006

[48] Rose G. (2001): Sick individuals and sick populations. International Journal of Epidemiology 30: 427-32.



4.2.2. Prevalence of acute malnutrition expressed by MUAC

A total of 483 children were included in the analysis of mid-upper arm circumference (MUAC).

The global acute malnutrition rate measured by MUAC only is 7.7% (5.5 - 10.5 95% C.I.), with moderate acute malnutrition prevalence of 6.8 (5.0 - 9.3 95% C.I.) and severe acute malnutrition prevalence of 0.8% (0.3 - 2.2 95% C.I.).

Table 20: Prevalence of acute malnutrition based on MUAC cut off's (and/or oedema) and by sex

	All n = 483	**Boys** n = 232	**Girls** n = 251
Prevalence of global malnutrition (< 125 mm and/or oedema)	(37) 7.7 % (5.5 - 10.5 95% C.I.)	(12) 5.2 % (3.3 - 8.1 95% C.I.)	(25) 10.0 % (6.8 - 14.4 95% C.I.)
Prevalence of moderate malnutrition (< 125 mm and >= 115 mm, no oedema)	(33) 6.8 % (5.0 - 9.3 95% C.I.)	(11) 4.7 % (2.9 - 7.6 95% C.I.)	(22) 8.8 % (5.9 - 12.7 95% C.I.)
Prevalence of severe malnutrition (< 115 mm and/or oedema)	(4) 0.8 % (0.3 - 2.2 95% C.I.)	(1) 0.4 % (0.1 - 3.1 95% C.I.)	(3) 1.2 % (0.4 - 3.7 95% C.I.)

Table 21: 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.**	**%**
6-11	64	3	4.7	7	10.9	54	84.4	0	0.0

12-23	110	1	0.9	16	14.5	93	84.5	0	0.0
24-35	114	0	0.0	7	6.1	107	93.9	0	0.0
36-47	102	0	0.0	3	2.9	99	97.1	0	0.0
48-59	93	0	0.0	0	0.0	93	100.0	0	0.0
Total	483	4	0.8	33	6.8	446	92.3	0	0.0

Further analysis shows that prevalence of acute malnutrition using MUAC reduces proportionally with height.

One child with MUAC <115 mm was not classified as severely malnourished by the weight-for-height index.

While more than half of the sample (69,1%) did not fall under acute malnutrition using MUAC criteria only, a substantial part (23.2%) were showed being at risk, mainly among the children with low height (<75 cm).

Table 22: Prevalence of acute malnutrition according to MUAC classification using height cut-offs, WHO standards

MUAC (mm)	**Definition**	**Total**		**Length/Height (cm)**						**Height not available (disabled)**	
				<75		**≥75-<90**		**≥90**			
		n=482		**n=106**		**n=203**		**n=173**		**n=1**	
		No	%	No	%	No	%	No	%	No	%
<115	**Severe acute malnutrition**	4	0.8	4	3.8	0	0.0	0	0.0	0	0.0
≥115-<125	**Moderate acute malnutrition**	33	6.8	18	17.0	14	6.9	1	0.6	0	0.0
≥125-<135	**At risk of acute malnutrition**	112	23.2	44	41.5	51	25.1	17	9.8	0	0.0
≥135	**Not at risk**	333	69.1	40	37.7	138	68.0	155	89.6	1	100.0

4.2.3. Prevalence of chronic malnutrition (stunting)

A total of 472 children were included in the analysis. Out nine excluded children, one child was disabled with no possibility of height measurement and eight children were flagged with aberrant height for their age, probably due to incorrect age estimation.
The global stunting rate is 37.3 % (32.4 - 42.5 95% C.I.)

Moderate stunting prevalence is 26.3 % (22.6 - 30.3 95% C.I.) and severe stunting prevalence is 11.0 % (8.1 - 14.8 95% C.I.).

Table 23: Prevalence of stunting based on height-for-age z-scores and by sex

	All n = 472	**Boys** n = 223	**Girls** n = 249
Prevalence of stunting (<-2 z-score)	(176) 37.3 % (32.4 - 42.5 95% C.I.)	(86) 38.6 % (31.8 - 45.8 95% C.I.)	(90) 36.1 % (29.3 - 43.6 95% C.I.)
Prevalence of moderate	(124) 26.3 % (22.6 - 30.3 95% C.I.)	(57) 25.6 % (20.8 - 31.0 95% C.I.)	(67) 26.9 % (21.4 - 33.3 95% C.I.)

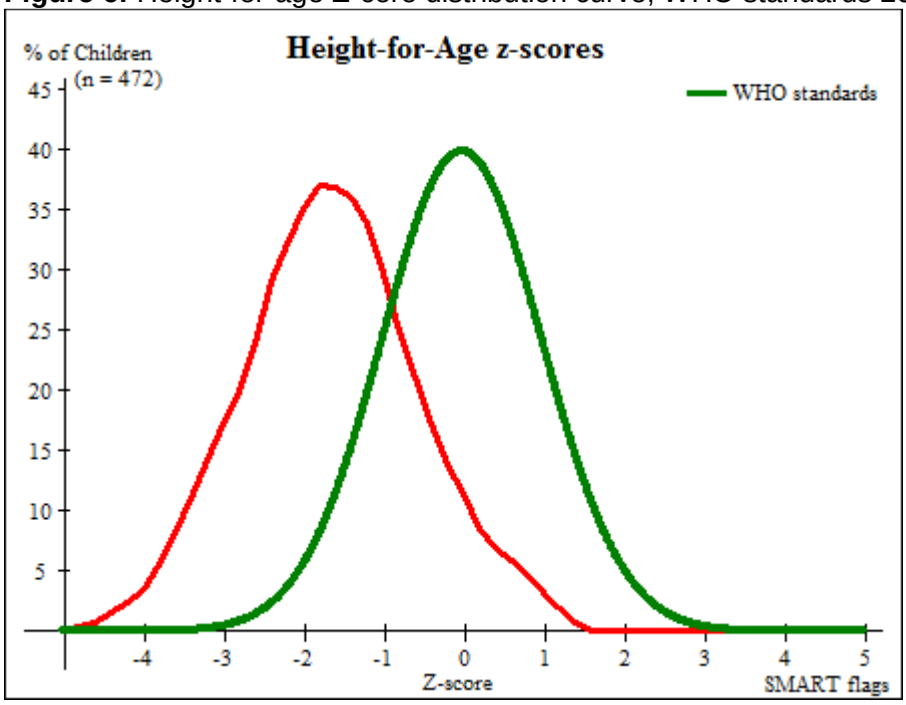
stunting (<-2 z-score and >=-3 z-score)			
Prevalence of severe stunting (<-3 z-score)	(52) 11.0 % (8.1 - 14.8 95% C.I.)	(29) 13.0 % (8.8 - 18.8 95% C.I.)	(23) 9.2 % (5.9 - 14.1 95% C.I.)

Table 24: Prevalence of stunting by age based on height-for-age z-scores

		Severe stunting (<-3 z-score)		Moderate stunting (>= -3 and <-2 z-score)		Normal (> = -2 z score)	
Age (mo)	**Total no.**	**No.**	**%**	**No.**	**%**	**No.**	**%**
6-11	60	5	8.3	14	23.3	41	68.3
12-23	110	11	10.0	26	23.6	73	66.4
24-35	111	17	15.3	28	25.2	66	59.5
36-47	99	9	9.1	29	29.3	61	61.6
48-59	92	10	10.9	27	29.3	55	59.8
Total	472	52	11.0	124	26.3	296	62.7

The HAZ distribution curve of our sample is shifted to the left of the WHO standard curve, indicating that all the children in the population, and not only those below a given cut-off, are affected.

Figure 6: Height-for-age Z-core distribution curve, WHO standards 2006



4.2.4. Prevalence of underweight

481 children were included in the analysis. Two children were registered with aberrant height for their age, probably due to incorrect age estimation.
The global underweight rate is 41.4% (36.5 - 46.4 95% C.I.).

Moderate underweight prevalence is 31.6 % (27.3 - 36.2 95% C.I.) and severe underweight prevalence is 9.8 % (7.2 - 13.1 95% C.I.).

Table 25: Prevalence of underweight based on weight-for-age z-scores by sex

	All n = 481	**Boys** n = 231	**Girls** n = 250
Prevalence of underweight (<-2 z-score)	(199) 41.4 % (36.5 - 46.4 95% C.I.)	(90) 39.0 % (31.9 - 46.5 95% C.I.)	(109) 43.6 % (37.2 - 50.2 95% C.I.)
Prevalence of moderate underweight (<-2 z-score and >=-3 z-score)	(152) 31.6 % (27.3 - 36.2 95% C.I.)	(64) 27.7 % (22.4 - 33.8 95% C.I.)	(88) 35.2 % (29.1 - 41.9 95% C.I.)
Prevalence of severe underweight (<-3 z-score)	(47) 9.8 % (7.2 - 13.1 95% C.I.)	(26) 11.3 % (7.8 - 16.0 95% C.I.)	(21) 8.4 % (5.1 - 13.4 95% C.I.)

Table 26: 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.**	**%**
6-11	63	4	6.3	15	23.8	44	69.8	0	0.0
12-23	109	13	11.9	35	32.1	61	56.0	0	0.0
24-35	114	15	13.2	30	26.3	69	60.5	0	0.0
36-47	102	9	8.8	28	27.5	65	63.7	0	0.0
48-59	93	6	6.5	44	47.3	43	46.2	0	0.0
Total	481	47	9.8	152	31.6	282	58.6	0	0.0

Table 27: 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	480	-1.24±0.92	1.13	36	1
Weight-for-Age	481	-1.77±0.95	1.21	34	2
Height-for-Age	472	-1.65±1.07	1.30	36	9

* contains for WHZ and WAZ the children with oedema.

4.3. Morbidity

383 children were included in the analysis. Data from absent children (n=34) was not collected due to risk of reduced accuracy of information.

4.3.1. Prevalence of reported illness in children 6-59 months

The prevalence of illness in children 6-59 months (n=483) within 15 days prior to the survey is 50.1% (n=242). Multiple cases of illness during the recall period were reported in five children (three cases of diarrhoea and respiratory infection and one case of diarrhoea and measles).

Table 28: Results for illness breakdown in children 6 to 59 months

Illness	%	No. cases
Fever	50.0%	121
Diarrhoea	16.5%	40
Acute respiratory infection	20.2%	49
Measles	1.2%	3
Malnutrition	0.8%	2
Accident	0.0%	0
Other	11.2%	27
Unknown	0.0%	0

'Other illness' represents 11.3% (n= 27). Findings were as described below.

Table 29: Results for breakdown 'other' illness

'Other' illness specification	%	No. cases
Abscess	11.1%	3
Abdominal pain	3.7%	1
Common cold	18.5%	5
Dysentery	7.4%	2
Ear infection	11.1%	3
Jaundice	3.7%	1
Mouth ulcer	3.7%	1
Skin allergy	7.4%	2
Skin infection -scabies	3.7%	1
Skin infection-not specified	11.1%	3
Vomiting	11.1%	3
Wound	7.4%	2

4.3.2. Results for health care seeking practices

In the case of reported illness, health care treatment was reported sought in 81.8% of the cases (n=198). 69.3% (n=165) of illnesses are treated in private clinics.

Health care by community volunteer or religious healers was not reported.

Table 30: Results for health seeking practices for children 6 to 59 months

Health care	%	No. cases
No care	18.2%	44
Ilaka health center (/OTP center)	6.6%	16
Sub-health post	4.1%	10
Community volunteer	0.0%	0

Private clinic[49]	68.2%	165
Religious healer	0.0%	0
Other	2.9%	7

In 2.9% (n=7) of the cases, health care was sought in other facilities than listed in morbidity questionnaire, such as the Zonal Hospital (n=3), dispensary (n=2) and India (n=2).

Table 31: Results for breakdown of 'other 'health care seeking practices in for children 6 to 59 months

Other' health care	%	No. cases
Dispensary	28.6%	2
India	28.6%	2
Zonal Hospital	42.9%	3

4.3.3. Relationship between acute malnutrition and morbidity

No significant link was found between malnutrition and sickness.

Table 32: Relationship between global acute malnutrition (WHO standards 2006) and morbidity in children 6 to 59 months

	Sick n=238	Not sick n=279
GAM	24.8% (n=59)	15.1% (n=42)

Table 33: Relationship between morbidity and global acute malnutrition (WHO standards 2006) in children 6 to 59 months

	GAM n=101	Normal n=416
Sick (%)	58.4% (n=59)	43.0% (n=179)

4.4. Breastfeeding and feeding practices

A total of 211 infants and children aged 0-23 months were included in the sample for analysis of Infant and Young Child Feeding Practices (IYCF). 13 infants and children were absent and therefore not included in the analysis.

4.4.1. Breastfeeding practices

37 infants aged 0-5 months were included in sample for analysis of exclusive breastfeeding. Two infants were absent and therefore excluded from the analysis.

The rate of exclusively breastfed children aged 0 to 5 months is 100% (n=37).

[49] In the district these clinics are found to be run by the government staffs running them on side or retired doctors.

The rate of continuous breastfeeding at 12 months (12-15 months) is 90.6% (n=29).

The rate of continuous breastfeeding at 2 years (20-23 months) is 83.3% (n=25).

Table 34: Results for breastfeeding practices

Indicator	%	No. cases
Exclusively breastfed (0-5 months) (n=37)	100%	(n=37)
Continuous breastfeeding at 1 year (12-15 months) (n=32)	90.6%	(n=29)
Continuous breastfeeding at 2 years (20-23 months) (n=30)	83.3%	(n=25)

4.4.2. Feeding practices

The prevalence of complementary feeding in children aged 6 to 8 months is 34.5% (n=10), with a rate of adequate meal frequency of 41.4% (n=12).

72.9% (n=97) of breastfed children aged 9 to 23 months receive adequate meal frequency per day.

93.1% (n=164) of children aged 6 to 23 months receive continued breastfeeding. Out of the remaining non-breastfed children aged 6-23 months, 58.3 % (n=7) receive the adequate meal frequency per day.

Table 35: Results for feeding practices

Indicator	%	No. cases
Complementary feeding		
Adequate complementary feeding - Infants 6-8 months (n=29)	34.5%	(n=10)
Meal frequency - breastfed children		
Adequate meal frequency - Infants 6-8 months (≥2 meals/day) (n=29)	41.4%	(n=12)
Adequate meal frequency - Children 9-23 months (≥3meals/day) (n=133)	72.9%	(n=97)
Meal frequency non-breastfed children		
Adequate meal frequency - Children 6-23 months not breastfed (≥4 meals/day) (n=12)	58.3%	(n=7)

4.5. Diet Diversity Score

34 households with children aged 6 to 59 months were found with absent children and/or caretaker and were not included in the analysis.

483 households with children aged 6 to 59 months participated in the sample for Household Diet Diversity Score (HDDS). 19 out of these households contained children still exclusively breastfed. 464 households were therefore included in the analysis for Individual Diet Diversity Score (IDDS)

4.5.1. Results at household level (HDDS):

The average score of the HDDS is 5.33, which fall within the category of 'medium' score.

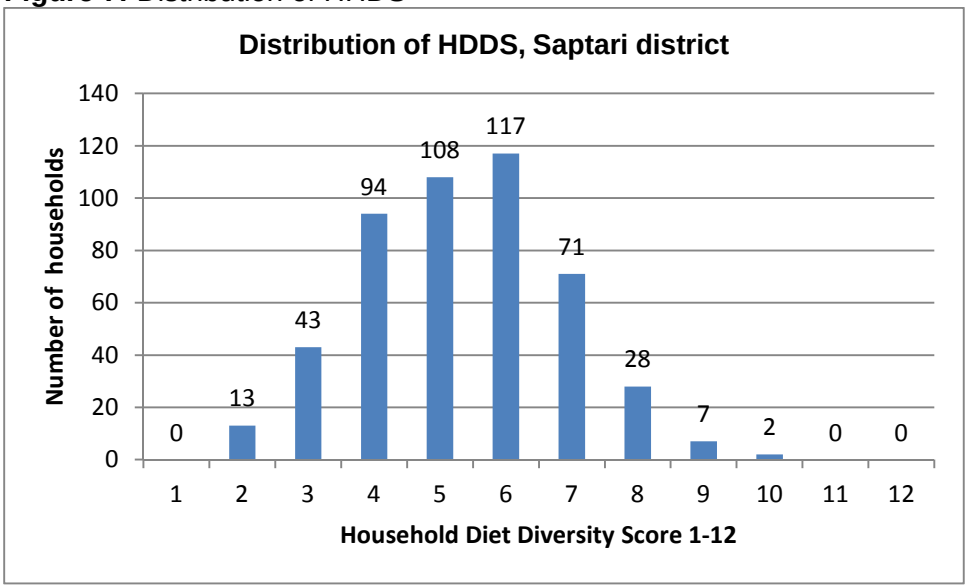
67.1% (n=324) have scores categorized as 'medium' and 1.9 % (n=9) of the households have scores categorized as 'high'.

Table 36: Results for HDDS

Score	n	%	Average
Low: 0-4 points	150	31.1%	3.54
Medium 5-8 points	324	67.1%	6.06
High: 9-12 points	9	1.9%	9.22
Total	483	100.00%	5.33

Further breakdown of scores shows that 225 (46.6%) of the households have HDD scores within or above average (6 or more).

Figure 7: Distribution of HHDS



4.5.2. Results at individual level (IDDS):

The average diet diversity score at individual level for children aged 6 to 59 months is 3.98, which fall within the category of 'medium' score.

11.4% (n=53) have scores categorized as 'low'. 78.0% (n=362), have scores categorized as 'medium'. 10.1% (n=49) of the children have scores categorized as 'high'.

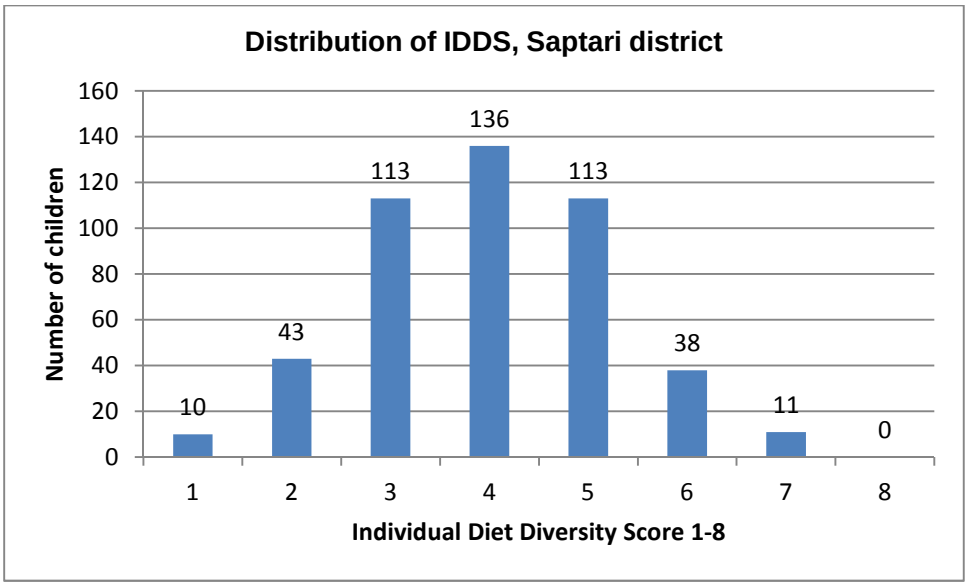
Table 37: Results for IDDS

Score	n	%	Average
Low:0-2 points	53	11.4%	1.81

Medium: 3-5 points	362	78.0%	4
High: 6-8 points	49	10.6%	6.22
Total	464	100.0%	3.98

Further breakdown of scores shows that 64.2% (n=298) of the children aged 6 to 59 months have IDD scores of the minimum standard of 4 or more.

Figure 8: Distribution of IDDS in children 6-59 months, Saptari District June 2013

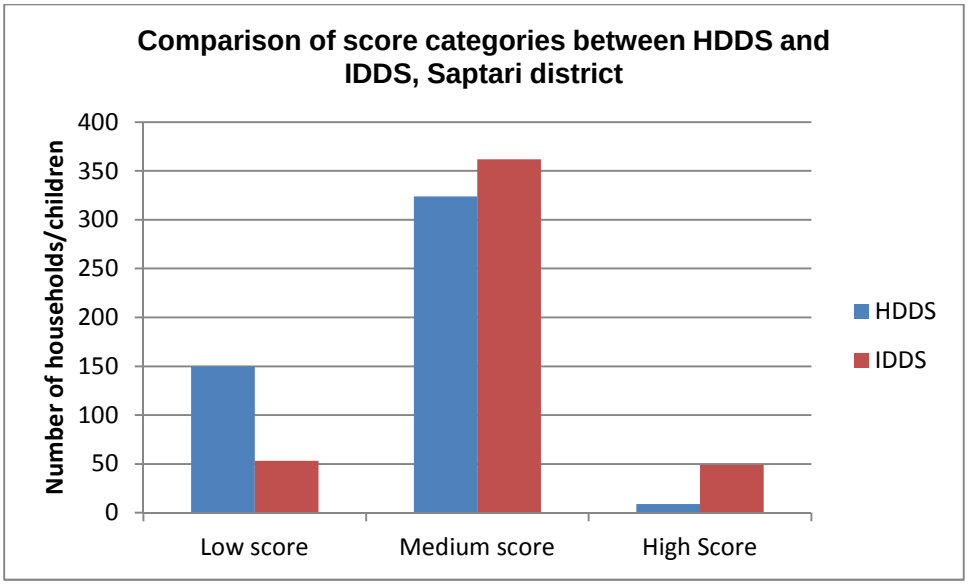


A comparison between feeding practices and diet diversity score shows that out of breastfed children, 10.3% (n=3) of infants aged 6-8 months and 48.5% (n=47) of the children aged 9 to 23 months receiving minimum frequency of meals daily also receives food from the minimum of 4 or more food groups. 66.7% (n=8) of non-breastfed children aged 6 to 23 months are receiving a minimum frequency of meals daily as well as food from the minimum 4 or more food groups.

Table 38: Percentage of children with minimum meal frequency and receiving food from the minimum of ≥ 4 food groups

Indicator	%	No. cases
Breastfed children		
Infants 6-8 months (≥2 meals/day) (n=29)	10.3%	3
Children 6-23 months (≥3meals/day) (n=97)	48.5%	47
Non-breastfed children		
Children 6-23 months not breastfed (≥4 meals/day) (n=12)	66.7%	8

Figure 9: Comparison of category distribution between HDDS and IDDS



4.6. Demographic data/characteristics of households

The retrospective mortality survey covered a total of 971 individuals in 174 households. The average household size was 5.58 and the proportion of children under five years was 10.4% (n=101).

Table 39: Demographic characteristics

Characteristics	
HH size	
Mean	5.58
Median	5
Mode	5
Range	1-13
Proportion U5 (%)	10.40% (n=101)

Table 40: People who joined or left household and number of births and deaths during recall period

	n
Population	
Total	971
Joined the household	81
Left the household	168
U5	
Total	101
Left the household	11
Joined the household	21
Death	
Total	5
U5	2

4.7. Retrospective mortality rate

Crude mortality rate (CMR) is 0.59 (0.25-1.37 95% CI) deaths/10'000 people/day. Design effect is 1.00.

Under five year old mortality rate (U5MR) is 2.12 (0.52-8.24) (95% CI) deaths/10'000 children/day. Design effect is 1.00

Table 41: Crude mortality rate (CMR) and under five mortality rate (U5MR

Indicator	Result Saptari District
CMR (total deaths/10,000 people / day)	0.58 (0.25-1.36) (95% CI)
U5MR (deaths in children under five/10,000 children under five / day):	2.23 (0.55-8.69) (95% CI)

4.7.1. Cause of death in persons aged five years or more

A total of three persons aged five years or more died during the recall period.

Table 42: Cause of death for people aged five years or more

Cause of death	n=3	%
Diarrhoea	0	0.0%
Fever	0	0.0%
Measles	0	0.0%
Difficulty breathing/chest infection	0	0.0%
Malnutrition	0	0.0%
Accident/injury	0	0.0%
Other	3	100.0%

All causes of death were registered as 'other', more specifically as epilepsy, hypertension and natural death at old age.

Table 43: Results for breakdown of cause of death 'other' in people aged five years or more

Cause of death 'other'	n=3	%
Epilepsy	1	33.3%
Hypertension	1	33.3%
Natural death	1	33.3%

4.7.2. Cause of death in children aged less than five years

A total of two children aged below five years died during the recall period. One child died from vehicle accident and one child died from 'other' cause, namely stillbirth.

Table 44: Cause of death for children aged less than five years

Cause of death	n=2	%

Diarrhoea	0	0.0%
Fever	0	0.0%
Measles	0	0.0%
Difficulty breathing/chest infection	0	0.0%
Malnutrition	0	0.0%
Accident/injury	1	50.0%
Other	1	50.0%

Table 45: Results for breakdown of cause of death 'other' in children aged less than five years

Cause of death 'other'	n=1	%
Stillbirth	1	100.0%

5. Limitations

Children aged 6 to 59 months were found absent visiting mother's family in 22 of 34 cases of absence. This was due to the on-going 'marriage season' at the time of survey implementation, leading to increased movements within the households. Still, with 483 children included in our analysis out of the target sample population of 502, the sample coverage was 96.2%.

The presence of birth certificates, vaccination cards etc. was very low in all households. In the absence of this, survey teams found it consistently difficult to determine the near exact age of the child, even when using local events calendar. Reported prevalence of stunting and underweight should therefore be interpreted with caution as most the child's age is determined using the local events calendar in a majority of the children.

Although short, the absence of a specific event marking the beginning of the 15 days morbidity recall period could be a potential source of bias as starting point remains vague for some respondents. In addition, the disease symptoms for morbidity remained quite subjective and might therefore have led to some misclassification bias.

Bias related to the interview setting is a common issue. In the case of this survey, some oral translation of interview questions from Nepali to local language was necessary for certain respondents. Hence, some caution in the interpretation of results of Infant and Young Child Feeding practice and Diet Diversity Score data is advised.

The standardization test showed poor results for some surveyors in measurements, in particular for some cases of height and more so for MUAC measurements. Caution should therefore be made in the interpretation of the results, in particular with regards to severe acute malnutrition measured my MUAC. Due to time constraints, a new standardization test was not conducted. Increased quality of measurements was ensured by practice through active screening during pilot-survey day, as teams were rotating for this exercise. In addition, plausibility checks were closely monitored and teams received close supervision on a regular basis while conducting their field work.

6. Discussion

6.1. Data quality anthropometry

Entered data was either double-entered or cross checked for any errors.

Flagged data are at 0.2%.for WHZ, 1.9% for HAZ and 0.4% for WAZ. Most of the flagged data were related to outliers in age, confirming the highlighted issues with correct age determination.

The observed overall sex ratio (p=0.509) shows that girls and boys in our sample are equally represented. Overall age distribution was as expected (0.799). We can thus assume that our sample is representative of the survey's target population.

The plausibility check shows that the overall score of the survey is 'good' (score=7%). The SD of the WHZ is at 0.92, which is within the normal range (0.8-1.2). Digit preference score for all measurements is 'good' (score=8). Skewness is within normal range at 0.05 for WHZ and 0.08 for HA, indicating a symmetrical distribution of the cases. Z. Kurtosis is -0.15 for WHZ and -0.17 for HAZ, agreeing with a normal distribution.

Poisson distribution for WHZ is larger than usual (p=0.010), demonstrating a tendency of "pockets" of malnutrition. A suggested explanation for this may be that the population is more heterogeneous than first expected, with differences in caste levels (affecting socioeconomic status) and religious affiliation (family size affecting socioeconomic status) within the population affecting the nutritional status of the population.

6.2. Anthropometry

Our survey demonstrates MAM rates of 18.1% (14.7 - 22.1 95% C.I.) and SAM rates of 2.9 % (1.9 – 4.5 95% C.I.). The GAM rate is 21.0 % (17.4 - 25.3 95% C.I.), indicating a nutritional situation at 'critical' level according to WHO Expert Committee classification of wasting[50] :

Table 46: WHO crisis classification using rates of global acute malnutrition

Severity	Prevalence GAM
Acceptable	<5%
Poor	5-9%
Serious	10-14%
Critical	≥15%

The data from this survey is the first recent data available at District level. Sub-regional prevalence figures from 2011[51] indicated a GAM rate at 10.3% (SAM 2.2%), substantially below our findings. The data demonstrates that moderate malnutrition may be substantially higher than previously observed. This highlights the need to maintain and reinforce CMAM as well as implementation of preventative activities in the area. This highlights the need to maintain and reinforce CMAM as well as continued strengthening of the implementation of preventative activities in the area.

When measured by MUAC only, GAM rates are at 7.7 % (5.5 - 10.5 95% C.I.). MAM prevalence is 6.8 % (5.0 - 9.3 95% C.I.) and SAM prevalence is 0.8 % (0.3 - 2.2 95% C.I.). As mentioned under limitations of the survey in section 6 above, caution should be made in the interpretation of these results.

[50] "Management of Nutrition in Major Emergencies". WHO, 2003.

[51] Demographic and Health Survey. 2011. Population Division. Ministry of Health and Population. Government of *Nepal*. Kathmandu.

It is in fact widely acknowledged that the two anthropometric indicators of severe acute malnutrition, namely low MUAC and low WHZ, only partly identify the same children. Furthermore, recent reviews of the available evidence unveiled the existence of major uncertainties regarding whether they indicate different physiologies, and which categories of children are the most in need of standard nutritional rehabilitation programmes. In fact, it has been shown in many different settings that low MUAC values are more common among children who have failed to adequately grow in height, among girls, and most importantly among the youngest children, calling into question its validity. On another hand, the association between low WHZ and a higher proportion of legs in the total body size, as well as the absence of robust evidence on the prognosis of children with a low WHZ, but with a MUAC above the usual cut-offs, has led some experts to assume that they could be less in need. However, till now, both are acknowledge by WHO (latest 2013 updates) as defining SAM.

This huge difference in MUAC and WHZ-based estimates has important operational implications. Current active screening in the Saptari community is based on MUAC measurements and presence and/or presence of nutritional odema. Given the discrepancy of prevalence of acute malnutrition when measured by WHZ and MUAC it is suggested that a substantial proportion of acutely malnourished children in the community might not be detected and referred to OTP center for admission and treatment. Nevertheless, these figures are consistent with current admission trends in the CMAM program currently running in the District, showing that 46.3% of admissions so far have been by WHZ criteria with a MUAC $\geq$115 mm. It has been recently advocated by some experts that only MUAC (and oedema) should be used for admission in emergency feeding programs. However, the evidence behind this proposition is fragile and the observed discrepancy between both indicators, as well as the rates of admission in the nutritional programmes, invites us to caution this.

In particular, the extra risk of the exclusion of children with normal MUAC but with low WHZ needs to be acknowledged, in particular in communities were stunting is widespread, in order to ascertain that the treatment will not be refused to those who actually most need it.

The prevalence of underweight is 41.4 % (36.5 - 46.4 95% C.I.), well above critical threshold of $\geq$30%[52]. The underweight status reflects both past (chronic) and/or current (acute) undernutrition and lies well above the 2011 sub regional estimation of 24.0%.

Sub-regional data from 2011 indicates global stunting rate of 31.4% for the Eastern Terai region. The survey shows a global stunting prevalence of 37.3 % (32.4 - 42.5 95% C.I.) just below the critical threshold of >40%[53], suggesting that chronic malnutrition is still a serious problem in the area. The figures follow the expected pattern with the lowest prevalence in the younger age groups, peaking at the age of 36-47 months. There is a known correlation between low birth weight and stunting. Stunting often starts before birth and is caused by poor maternal nutrition, poor feeding practices, poor food quality as well as frequent infections which can slow down growth[54]. A recent study[55] acknowledges that undernutrition during pregnancy, affecting fetal growth, and the first 2 years of life is a major determinant of both stunting of linear growth and subsequent obesity and non-communicable diseases in adulthood

A rapid assessment conducted by ACF in the district in 2011 indicated that early marriage, difficult access to balanced food, high workloads, unawareness, and poor sanitation and hygiene seems to be the major contributing factors to the poor nutritional status of women of reproductive age at first and then equally to their children. DHS findings from 2011 support the correlation between poor

[52] See WHO 2003 footnote above.
[53] See WHO 2003 footnote above.
[54] Improving Child Nutrition: The achievable imperative for global progress. Unicef 2013.
[55] Maternal and child undernutrition and overweight in low-income and middle-income countries. Black R.e. et al. Maternal and Child Nutrition1. Lancet series published 6 June 2013.

nutritional status of pregnant women and risk of stunting. Also poor household food security is shown to affect stunting in Nepal with children in the poor households twice as likely to be stunted as children in wealthy households. Studies of factors correlated with malnutrition in Nepal[56] also shows that malnutrition not necessarily results from a lack of food production, but rather it is caused by a range of social problems and the inherent low status of women in Nepalese society.

6.3. Morbidity and health care seeking practices

The health status of children induces a nutritional stress, and the nutritional status worsens health outcome, placing children in a vicious cycle leading to death when proper actions are not engaged.

The morbidity rate is elevated with half of the children (50.0%) experiencing some type of illness the past 2 weeks. Some children also experienced several cases of illness during the recall period. This indicates that the situation in the area is precarious. Fever (50.0%), diarrhoea (16.5%) and acute respiratory infections (20.2%) attribute to the majority of cases. There is a known "seasonality" of these diseases, with a typical increase of cases during the rainy season (see Appendix 6: Saptari Seasonal calendar).

Diarrhoea has a major impact on the nutritional status of a child, potentially leading to loss of weight and deterioration of nutritional status. The impact of a poor water, sanitation and hygiene situation can be reflected in the high incidences of diarrhoea cases (16.5%) and the many skin disease cases as well as cases of dysentery reported under the 'other 'category.

Health seeking practices are encouraging, with a high proportion of the caretakers (81.8%) seeking health care in case of a child's illness. Health posts and sub-health posts are represented, but the use of private clinics is by far the most widespread (68.2%). Based on local knowledge, it is suggested that the background for this is a perception among the population that the quality of service and medications is higher in private clinics than government health facilities (wherein basic treatment is free of cost). It is estimated that around two-third of total costs of the health care is associated with the government sector, 25 per cent covered the costs of services by private facilities and another 10 per cent services provided by NGOs and by donors directly.

No cases of medical care by FHCV were registered, indicating that this component of the BC-IMCI is under-used in the population. Also, a substantial proportion of the caretakers (18.2%) did not seek any treatment for their child. The reasons for this remain uncertain, as government health services are provided for free and travel distances not substantial in the area. In a few cases, medical treatment was sought in India, which is geographically easily accessible in the south of the District.

6.4. Feeding practices

Exclusive breastfeeding prevalence (infants 0-5 months) is high at 100%. %. Compared with the national average of 69.6%, is suspected that exclusive breastfeeding was over-reported among the respondents of the survey. Plausible reasons for this could be misinterpretation of question posed by interviewer or a wish to comply with known best practice.

[56] Women and Nutrition in Himalayan Region: A Case Study. Pant, B. R., 2008. ENVIS Bulletin on Himalayan Ecology 16(1), 18-27.

Prevalence of continued breastfeeding at 1 year (children 12-15 months) is at 90%, which is above the reported national average of 65.2%. Continued breastfeeding rate at 2 years (children 20-23 months) is 83.3%, slightly below national average (92.6%)[57].

While the above rates are satisfactory, only 34.5% of breastfed infants aged 6-8 months receive complementary feeding, substantially below the reported national average of 65.5%%. Only 41.4% of these children receive adequate meals per day against reported national coverage of 60.2%[58].

72.9% of breastfed children aged 9 -23 months receive adequate number of meals per day, which is in line with the sub-regional rate of 73.5%. For non-breastfeeding children aged 6-23 months, only 58.3% receive adequate number of meals per day against a national average of 75.8%.

The national DHS 2011 report suggests that the proportion of breastfed children who receive adequate complementary feeding meals per day increases with the caretaker's education and wealth. Overall, although continued breastfeeding practice is widespread, the complementary feeding practice results suggest a need for a greater focus on the caretaker and IYCF practices to help fight malnutrition. In the latest Maternal and Health Series published by The Lancet in June 2013, is suggested that "Continued investments in nutrition-specific interventions to avert maternal and child undernutrition and micronutrient deficiencies through community engagement and delivery strategies that can reach poor segments of the population at greatest risk can make a great difference. If this improved access is linked to nutrition-sensitive approaches—ie, women's empowerment, agriculture, food systems, education, employment, social protection, and safety nets—they can greatly accelerate progress in countries with the highest burden of maternal and child undernutrition and mortality"[59].

6.5. Diet diversity

The average HHDS score is at 'medium 'level with an average score of 5.33. However, 31.06% of the households still have 'low' food diversity.

The average IDDS score for children aged 6 to 59 months is at 3.98, also categorised at 'medium 'level. 74.9% of the children had 'medium' diet diversity, having received food from 3-5 food groups during the 24 hours recall period, with 11.4% of the children scoring as 'low'. 33.8% of the children had scores below the average.

64.2 % of the children had consumed food from the minimum standard of 4 food groups or more. This may indicate that even with amarginal food diversity at household level, households recognize the importance of providing a diverse diet for their children. DHS 2011 sub-regional data indicates a lowed food diversity score at 27.4%. Comparison of these figures should be done with caution as timing and food availability at time of data collection as well as data collection methodology might make the data less comparable.

It is important to note that when interpreting diet diversity scores that they do not indicate the quantity of food consumed. Also, the diet may vary across seasons and some foods may be available at affordable costs and larger quantities in certain periods. It should also be emphasized in this regards that the timing of our DDS data collection coincides with the start of the harvest season where fruits and vegetables typically becomes more available to the population. It is therefore suspected that the diet diversity scores achieved are at its highest levels when compared

[57] Chapter 11; Nutrition of Children and Women. Demographic and Health Survey. 2011. Population Division. Ministry of Health and Population. Government of *Nepal*. Kathmandu.

[58] See footnote *DHS 2011* above.

[59] Evidence-based interventions for improvement of maternal and child nutrition: what can be done and at what cost? Bhutta Z.A. et al. Maternal and Child Nutrition2. Lancet series published 6 June 2013.

to the year overall. The analysis of diversity scores would therefore suggest that a diversification of the diet of households as well as children should be a priority. DHS 2011 report also acknowledges that provision of food from four food-groups or more was particularly low in the *Terai* ecological zone compared to the national average.

When comparing breastfeeding practices and IDDS, the analysis demonstrates that only 10.3% of breastfed infants aged 6-8 month receiving complementary feeding and the minimum meal frequency (≥2 meals/day) were actually receiving food from the minimum standard of 4 or more food groups. This is in line with national average of 11.4%, suggesting inadequate complementary feeding practices. Less than half, 48.5%, of the breastfed children aged 9 to 23 months receiving complementary feeding and minimum meal frequency (≥3 meals/day) were receiving food from 4 food groups or more. For non-breastfed children aged 6 to 23 months, the coverage was 66.7%. See Appendix 11 for an illustration of this analysis.

A study of the correlation of diet diversity and stunting in among children in rural Bangladesh[60] concluded that reduced dietary diversity is a strong predictor of stunting. The inclusion of a variety of food groups into complementary foods may be essential to improve child nutritional status. The findings of this analysis and previous research reinforce the notion that improved food variety may indeed reflect a greater likelihood of meeting daily energy and nutrient requirements, which would result in improved nutritional status among young children.

6.6. Mortality

Nepal has registered important progress in relation U5MR. While the CMR is below critical levels at 0.59 deaths/10'000 population/day, U5MR is slightly above 'alert' level at 2.23 deaths/10'000 children/day. However, a wide confidence interval (0.55-8.69 95% CI) makes it difficult to draw a conclusive analysis from this result. Of the two reported cases of deaths among children aged less than five years none of the morbidities could be related to cause of death among children under five years in the mortality section of the survey.

Conclusions

From the findings of this assessment we can conclude that acute malnutrition prevalence rates in Saptari District are at critical levels and that the situation is in need of continued provision of treatment and prevention of acute malnutrition. Despite implementation of CMAM treatment of SAM the last 12 months, it is suspected that malnutrition rates remain unchanged. Strengthening of preventative actions as well as identification of appropriate treatment and follow-up of MAM is essential to help tackle the critical GAM rates as well as reduce cases falling into SAM.

The problem of chronic malnutrition in Saptari is substantial, calling for interventions targeting maternal nutrition and prevention of low birth weight, and improved IYCF practices, promotion of good sanitation practices and access to safe water, healthy practices and appropriate use of health care services as well as strengthening household food security.

[60] Low dietary diversity is a predictor of child stunting in rural Bangladesh. JH Rah et al. European Journal of Clinical Nutrition (2010) 64, 1393–1398.

The underweight rate in Saptari district is alarming, calling for strengthening of both curative and preventative interventions. Further exploration of the underlying causes of malnutrition in the District is necessary and a multi-sectoral approach to tackle the situation should be considered.

Breastfeeding practices in Saptari district are inadequate, in particular with regards to complementary feeding. When compared with diet diversity results, there is an indicated need for strengthening of both care practices and caretakers as well as the diversity of food though increasing food security of the households.

While there are indications that the households acknowledge the importance of a varied diet for the youngest children in the households, the overall household diet diversity is precarious.

Although at alert level, the U5MR in the district remains inconclusive based on the results of this survey and more investigation is needed on this.

Recommendations

- To conduct another anthropometric nutrition and retrospective mortality survey during the lean period (February-March or August-September) in the same areas to determine seasonal variations and their effect on the nutritional status on the nutritional status of the children. This survey should also collect data on the nutritional status of pregnant, breastfeeding and lactating women.
- To reinforce existing CMAM programme with regards to admission and treatment of both SAM and MAM, together with a strong component in prevention trough nutrition education and good care practices promotion.
- To consider the provision of supplementary food under a SFP targeting the most vulnerable in the community, pregnant and lactating women and children under 5.
- To have a mid-/long term approach in Saptari District targeting improvement of maternal health and nutrition care, including awareness on nutrition and care practices.
- To consider the provision of nutrition and health education programme targeting behaviour change for pregnant women, lactating mothers and caretakers of children under two years, with a special focus on hygiene and sanitation and appropriate IYCF practices.
- To consider multisectoral programs targeted at food and nutrition security designed to reduce malnutrition for children and households, increasing the sustainability of reduced rates of GAM of children 6-59 months.
- To reinforce a nutrition and food security surveillance in Saptari District to better understand the nutrition and food security situation and all its variations and to target vulnerable groups with timely and appropriate interventions.
- To consider integrated long-term community development programmes in food security and livelihoods, including income generating activities.
- To raise awareness on good water, sanitation and hygiene practices through integration with WASH initiatives.

Appendices

Appendix 1: Plausibility Report

Plausibility check for: NPL_1306_Saptari_ACF_Data_Final version.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**
Missing/Flagged data (% of in-range subjects)	Incl	%	0-2.5 0	>2.5-5.0 5	>5.0-10 10	>10 20	**0** (0.2 %)
Overall Sex ratio (Significant chi square)	Incl	p	>0.1 0	>0.05 2	>0.001 4	<0.000 10	**0** (p=0.509)
Overall Age distrib (Significant chi square)	Incl	p	>0.1 0	>0.05 2	>0.001 4	<0.00 10	**0** (p=0.799)
Dig pref score - weight	Incl	#	0-5 0	5-10 2	10-20 4	> 20 10	**2** (8)
Dig pref score - height	Incl	#	0-5 0	5-10 2	10-20 4	> 20 10	**2** (8)
Standard Dev WHZ	Excl	SD	<1.1 0	<1.15 2	<1.20 6	>1.20 20	**0** (0.92)
Skewness WHZ	Excl	#	<±1.0 0	<±2.0 1	<±3.0 3	>±3.0 5	**0** (0.05)
Kurtosis WHZ	Excl	#	<±1.0 0	<±2.0 1	<±3.0 3	>±3.0 5	**0** (-0.15)
Poisson dist WHZ-2	Excl	p	>0.05 0	>0.01 1	>0.001 3	<0.000 5	**3** (p=0.010)
Timing	Excl	Not determined yet 0		1	3	5	
OVERALL SCORE WHZ =			0-5	5-10	10-15	>15	**7** %

At the moment the overall score of this survey is 7 %, this is good.

There were no duplicate entries detected.

Missing data:

WEIGHT: Line=9/ID=15, Line=45/ID=4, Line=46/ID=3, Line=64/ID=4, Line=77/ID=8, Line=78/ID=6, Line=87/ID=10, Line=92/ID=5, Line=93/ID=6, Line=164/ID=3, Line=227/ID=5, Line=236/ID=3, Line=266/ID=9, Line=311/ID=4, Line=312/ID=8, Line=335/ID=5, Line=336/ID=6, Line=345/ID=9, Line=360/ID=6, Line=397/ID=1, Line=398/ID=5, Line=401/ID=2, Line=420/ID=1, Line=426/ID=9, Line=427/ID=14, Line=437/ID=4, Line=443/ID=4, Line=450/ID=2, Line=461/ID=3, Line=462/ID=2, Line=464/ID=6, Line=501/ID=5, Line=513/ID=17, Line=517/ID=6
HEIGHT: Line=9/ID=15, Line=45/ID=4, Line=46/ID=3, Line=64/ID=4, Line=77/ID=8, Line=78/ID=6, Line=87/ID=10, Line=92/ID=5, Line=93/ID=6, Line=124/ID=5, Line=164/ID=3, Line=227/ID=5,

Line=236/ID=3, Line=261/ID=4, Line=266/ID=9, Line=311/ID=4, Line=312/ID=8, Line=335/ID=5, Line=336/ID=6, Line=345/ID=9, Line=360/ID=6, Line=397/ID=1, Line=398/ID=5, Line=401/ID=2, Line=420/ID=1, Line=426/ID=9, Line=427/ID=14, Line=437/ID=4, Line=443/ID=4, Line=450/ID=2, Line=461/ID=3, Line=462/ID=2, Line=464/ID=6, Line=501/ID=5, Line=513/ID=17, Line=517/ID=6

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=14: HAZ (2.592), Age may be incorrect
Line=76/ID=10: HAZ (2.891), Age may be incorrect
Line=211/ID=3: HAZ (1.509), Age may be incorrect
Line=223/ID=1: WAZ (1.367), Weight may be incorrect
Line=226/ID=4: HAZ (1.386), Age may be incorrect
Line=281/ID=1: HAZ (-6.897), WAZ (-5.771), Age may be incorrect
Line=343/ID=10: **WHZ (1.845)**, Weight may be incorrect
Line=470/ID=7: HAZ (-4.779), Height may be incorrect
Line=488/ID=4: HAZ (1.952), Age may be incorrect
Line=489/ID=5: HAZ (1.662), Age may be incorrect
Line=507/ID=3: HAZ (-4.688), Age may be incorrect

Percentage of values flagged with SMART flags:WHZ: 0.2 %, HAZ: 1.9 %, WAZ: 0.4 %

Age distribution:

Month 6 : ##########
Month 7 : ###########
Month 8 : ########
Month 9 : ##############
Month 10 : ##################
Month 11 : #######
Month 12 : #################
Month 13 : ####
Month 14 : #######
Month 15 : ########
Month 16 : ##########
Month 17 : ###############
Month 18 : ########################
Month 19 : #####
Month 20 : ######
Month 21 : #####
Month 22 : ###########
Month 23 : ########
Month 24 : ##################
Month 25 : #####
Month 26 : #######
Month 27 : #####
Month 28 : ######

Month 29 : #######
Month 30 : ####################
Month 31 : ##########
Month 32 : #######
Month 33 : #########
Month 34 : ################
Month 35 : #######
Month 36 : ################################
Month 37 : ######
Month 38 : ########
Month 39 : ###########
Month 40 : ########
Month 41 : ####
Month 42 : ####################
Month 43 : ######
Month 44 : #######
Month 45 : ####
Month 46 : ###
Month 47 : ####
Month 48 : ################################
Month 49 : ####
Month 50 : ####
Month 51 : ################
Month 52 : ######
Month 53 : ########
Month 54 : ############
Month 55 : ######
Month 56 : #########
Month 57 : #####
Month 58 : #

Age ratio of 6-29 months to 30-59 months: 0.82 (The value should be around 1.0).

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

Age cat.	mo.	boys	girls	total	ratio boys/girls
6 to 11	6	34/29.4 (1.2)	32/31.1 (1.0)	66/60.5 (1.1)	1.06
12 to 23	12	56/57.3 (1.0)	63/60.7 (1.0)	119/118.1 (1.0)	0.89
24 to 35	12	57/55.5 (1.0)	62/58.9 (1.1)	119/114.4 (1.0)	0.92
36 to 47	12	57/54.7 (1.0)	55/57.9 (0.9)	112/112.6 (1.0)	1.04
48 to 59	12	47/54.1 (0.9)	54/57.3 (0.9)	101/111.4 (0.9)	0.87
6 to 59	54	251/258.5 (1.0)	266/258.5 (1.0)		0.94

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

Overall sex ratio: p-value = 0.509 (boys and girls equally represented)
Overall age distribution: p-value = 0.799 (as expected)
Overall age distribution for boys: p-value = 0.769 (as expected)
Overall age distribution for girls: p-value = 0.961 (as expected)
Overall sex/age distribution: p-value = 0.586 (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** (0-5 excellent, 6-10 good, 11-20 acceptable and > 20 problematic)
p-value for chi2: 0.002 (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: **8** (0-5 excellent, 6-10 good, 11-20 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: **8** (0-5 excellent, 6-10 good, 11-20 acceptable and > 20 problematic)
p-value for chi2: 0.003 (significant difference)

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

.	no exclusion	exclusion from reference mean	exclusion from observed mean

.		(WHO flags)	(SMART flags)	
WHZ				
Standard Deviation SD:		0.93	0.93	0.92
(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:		1.18	1.15	1.07
(The SD should be between 0.8 and 1.2)				
Prevalence (< -2)				
observed:	37.2%	37.1%	37.3%	
calculated with current SD:	37.5%	36.9%	37.1%	
calculated with a SD of 1:	35.4%	35.0%	36.2%	
WAZ				
Standard Deviation SD:		0.97	0.97	0.95
(The SD should be between 0.8 and 1.2)				
Prevalence (< -2)				
observed:				
calculated with current SD:				
calculated with a SD of 1:				

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

WHZ	p= 0.748	p= 0.748	p= 0.857
HAZ	p= 0.002	p= 0.010	p= 0.348
WAZ	p= 0.229	p= 0.229	p= 0.581

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

Skewness

WHZ	0.11	0.11	0.05
HAZ	0.14	0.32	0.08
WAZ	-0.09	-0.09	-0.02

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

Kurtosis

WHZ	-0.02	-0.02	-0.15
HAZ	1.23	0.67	-0.17
WAZ	0.57	0.57	0.08

(Kurtosis characterizes the relative peakedness or flatness compared with the normal distribution, positive kurtosis indicates a relatively peaked distribution, negative kurtosis indicates a relatively flat distribution)
If the value is:
-above 2 it indicates a problem. There might have been a problem with data collection or sampling.
-between 1 and 2, the data may be affected with a problem.
-less than an absolute value of 1 the distribution can be considered as normal.

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

WHZ < -2: ID=1.48 (p=0.010)
WHZ < -3: ID=0.77 (p=0.896)
GAM: ID=1.48 (p=0.010)
SAM: ID=0.77 (p=0.896)
HAZ < -2: ID=1.42 (p=0.020)
HAZ < -3: ID=1.24 (p=0.105)
WAZ < -2: ID=1.59 (p=0.003)
WAZ < -3: ID=1.06 (p=0.355)

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 point	SD for WHZ 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: 1.02 (n=55, f=0)	#########
02: 0.87 (n=50, f=0)	###
03: 0.95 (n=52, f=0)	######
04: 0.86 (n=46, f=0)	###
05: 0.88 (n=40, f=0)	###
06: 0.78 (n=37, f=0)	
07: 0.79 (n=35, f=0)	
08: 1.00 (n=32, f=0)	#########
09: 1.22 (n=27, f=0)	###################
10: 1.07 (n=23, f=1)	###########
11: 0.99 (n=23, f=0)	########
12: 0.76 (n=18, f=0)	
13: 0.97 (n=15, f=0)	OOOOOOO
14: 0.88 (n=09, f=0)	~~~
15: 0.63 (n=09, f=0)	
16: 1.28 (n=06, f=0)	~~~~~~~~~~~~~~~~~~~
17: 1.17 (n=02, f=0)	~~~~~~~~~~~~~~~

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

Analysis by Team

Team	**1**	**2**	**3**	**4**	**5**	**6**	
n =	79	107	106	69	74	82	
Percentage of values flagged with SMART flags:							
WHZ:	3.9	10.2	8.2	4.5	1.4	17.1	
HAZ:	10.5	10.2	9.2	4.5	2.7	18.6	
WAZ:	5.3	8.1	9.2	3.0	1.4	17.1	
Age ratio of 6-29 months to 30-59 months:							
	0.68	0.88	0.89	0.53	1.11	0.86	
Sex ratio (male/female):							
	0.80	0.95	1.00	0.97	0.68	1.34	
Digit preference Weight (%):							
.0 :	11	9	10	6	14	10	
.1 :	11	10	7	13	12	16	
.2 :	12	8	16	9	5	10	
.3 :	14	11	6	10	8	10	
.4 :	11	9	9	18	10	9	
.5 :	12	18	21	9	7	14	
.6 :	5	7	7	7	8	9	
.7 :	4	6	6	4	3	6	
.8 :	13	14	7	7	16	7	
.9 :	8	7	9	15	16	10	
DPS:	11	12	16	13	15	10	Digit preference score (0-5 excellent, 5-10 good, 10-20 acceptable and > 20 problematic)
Digit preference Height (%):							
.0 :	21	11	21	8	18	6	
.1 :	5	11	8	12	18	10	
.2 :	16	10	10	11	11	14	
.3 :	12	13	10	14	11	16	
.4 :	11	12	13	9	5	14	
.5 :	4	9	8	9	11	4	
.6 :	7	12	9	12	10	13	
.7 :	8	7	11	5	3	10	
.8 :	5	4	6	12	8	6	
.9 :	12	9	2	9	5	7	
DPS:	17	9	16	9	16	13	Digit preference score (0-5 excellent, 5-10 good, 10-20 acceptable and > 20 problematic)
Digit preference MUAC (%):							
.0 :	16	19	13	6	10	19	
.1 :	5	10	7	16	11	9	
.2 :	8	8	15	12	12	13	
.3 :	7	12	10	3	8	7	
.4 :	9	5	11	7	14	4	
.5 :	17	14	7	10	14	7	
.6 :	11	10	10	19	15	13	
.7 :	11	4	8	10	8	17	
.8 :	7	11	12	9	4	7	
.9 :	11	6	5	6	4	4	
DPS:	12	14	10	16	12	16	Digit preference score (0-5 excellent, 5-10 good, 10-20 acceptable and > 20 problematic)
Standard deviation of WHZ:							
SD	0.88	0.98	0.93	0.87	1.02	0.83	

Prevalence (< -2) observed:
% 20.5
Prevalence (< -2) calculated with current SD:
% 21.3
Prevalence (< -2) calculated with a SD of 1:
% 20.8

Standard deviation of HAZ:

SD	1.29	1.13	1.10	1.09	1.15	1.21
observed:						
%	31.6	45.9	24.5	37.9	37.0	48.6
calculated with current SD:						
%	29.3	44.6	29.5	39.4	36.4	47.9
calculated with a SD of 1:						
%	24.2	43.9	27.6	38.4	34.4	47.5

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

Team 1:

Age cat.	mo.	boys	girls	total	ratio boys/girls
6 to 11	6	9/4.1 (2.2)	4/5.2 (0.8)	13/9.3 (1.4)	2.25
12 to 23	12	4/8.0 (0.5)	6/10.0 (0.6)	10/18.0 (0.6)	0.67
24 to 35	12	9/7.7 (1.2)	12/9.7 (1.2)	21/17.5 (1.2)	0.75
36 to 47	12	6/7.6 (0.8)	14/9.6 (1.5)	20/17.2 (1.2)	0.43
48 to 59	12	7/7.5 (0.9)	8/9.5 (0.8)	15/17.0 (0.9)	0.88
6 to 59	54	35/39.5 (0.9)	44/39.5 (1.1)		0.80

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

Overall sex ratio: p-value = 0.311 (boys and girls equally represented)
Overall age distribution: p-value = 0.165 (as expected)
Overall age distribution for boys: p-value = 0.077 (as expected)
Overall age distribution for girls: p-value = 0.322 (as expected)
Overall sex/age distribution: p-value = 0.008 (significant difference)

Team 2:

Age cat.	mo.	boys	girls	total	ratio boys/girls
6 to 11	6	4/6.1 (0.7)	10/6.4 (1.6)	14/12.5 (1.1)	0.40
12 to 23	12	16/11.9 (1.3)	14/12.6 (1.1)	30/24.4 (1.2)	1.14
24 to 35	12	11/11.5 (1.0)	10/12.2 (0.8)	21/23.7 (0.9)	1.10
36 to 47	12	13/11.3 (1.1)	15/12.0 (1.3)	28/23.3 (1.2)	0.87
48 to 59	12	8/11.2 (0.7)	6/11.9 (0.5)	14/23.1 (0.6)	1.33
6 to 59	54	52/53.5 (1.0)	55/53.5 (1.0)		0.95

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

Overall sex ratio: p-value = 0.772 (boys and girls equally represented)
Overall age distribution: p-value = 0.181 (as expected)
Overall age distribution for boys: p-value = 0.503 (as expected)

Overall age distribution for girls: p-value = 0.187 (as expected)
Overall sex/age distribution: p-value = 0.046 (significant difference)

Team 3:

Age cat.	mo.	boys	girls	total	ratio boys/girls
6 to 11	6	8/6.2 (1.3)	3/6.2 (0.5)	11/12.4 (0.9)	2.67
12 to 23	12	14/12.1 (1.2)	14/12.1 (1.2)	28/24.2 (1.2)	1.00
24 to 35	12	11/11.7 (0.9)	13/11.7 (1.1)	24/23.5 (1.0)	0.85
36 to 47	12	13/11.5 (1.1)	5/11.5 (0.4)	18/23.1 (0.8)	2.60
48 to 59	12	7/11.4 (0.6)	18/11.4 (1.6)	25/22.8 (1.1)	0.39
6 to 59	54	53/53.0 (1.0)	53/53.0 (1.0)		1.00

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

Overall sex ratio: p-value = 1.000 (boys and girls equally represented)
Overall age distribution: p-value = 0.718 (as expected)
Overall age distribution for boys: p-value = 0.600 (as expected)
Overall age distribution for girls: p-value = 0.048 (significant difference)
Overall sex/age distribution: p-value = 0.015 (significant difference)

Team 4:

Age cat.	mo.	boys	girls	total	ratio boys/girls
6 to 11	6	5/4.0 (1.3)	5/4.1 (1.2)	10/8.1 (1.2)	1.00
12 to 23	12	5/7.8 (0.6)	5/8.0 (0.6)	10/15.8 (0.6)	1.00
24 to 35	12	9/7.5 (1.2)	9/7.7 (1.2)	18/15.3 (1.2)	1.00
36 to 47	12	8/7.4 (1.1)	7/7.6 (0.9)	15/15.0 (1.0)	1.14
48 to 59	12	7/7.3 (1.0)	9/7.5 (1.2)	16/14.9 (1.1)	0.78
6 to 59	54	34/34.5 (1.0)	35/34.5 (1.0)		0.97

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

Overall sex ratio: p-value = 0.904 (boys and girls equally represented)
Overall age distribution: p-value = 0.536 (as expected)
Overall age distribution for boys: p-value = 0.810 (as expected)
Overall age distribution for girls: p-value = 0.762 (as expected)
Overall sex/age distribution: p-value = 0.483 (as expected)

Team 5:

Age cat.	mo.	boys	girls	total	ratio boys/girls
6 to 11	6	5/3.5 (1.4)	6/5.2 (1.2)	11/8.7 (1.3)	0.83
12 to 23	12	7/6.9 (1.0)	14/10.0 (1.4)	21/16.9 (1.2)	0.50
24 to 35	12	6/6.6 (0.9)	9/9.7 (0.9)	15/16.4 (0.9)	0.67
36 to 47	12	9/6.5 (1.4)	8/9.6 (0.8)	17/16.1 (1.1)	1.13
48 to 59	12	3/6.5 (0.5)	7/9.5 (0.7)	10/15.9 (0.6)	0.43
6 to 59	54	30/37.0 (0.8)	44/37.0 (1.2)		0.68

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

Overall sex ratio: p-value = 0.104 (boys and girls equally represented)
Overall age distribution: p-value = 0.405 (as expected)
Overall age distribution for boys: p-value = 0.481 (as expected)
Overall age distribution for girls: p-value = 0.616 (as expected)
Overall sex/age distribution: p-value = 0.071 (as expected)

Team 6:

Age cat.	mo.	boys	girls	total	ratio boys/girls
6 to 11	6	3/5.5 (0.5)	4/4.1 (1.0)	7/9.6 (0.7)	0.75
12 to 23	12	10/10.7 (0.9)	10/8.0 (1.3)	20/18.7 (1.1)	1.00
24 to 35	12	11/10.4 (1.1)	9/7.7 (1.2)	20/18.1 (1.1)	1.22
36 to 47	12	8/10.2 (0.8)	6/7.6 (0.8)	14/17.9 (0.8)	1.33
48 to 59	12	15/10.1 (1.5)	6/7.5 (0.8)	21/17.7 (1.2)	2.50
6 to 59	54	47/41.0 (1.1)	35/41.0 (0.9)		1.34

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

Overall sex ratio: p-value = 0.185 (boys and girls equally represented)
Overall age distribution: p-value = 0.655 (as expected)
Overall age distribution for boys: p-value = 0.398 (as expected)
Overall age distribution for girls: p-value = 0.849 (as expected)
Overall sex/age distribution: p-value = 0.108 (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 point — SD for WHZ

```
                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: 1.03 (n=10, f=0)  ##########
02: 0.54 (n=10, f=0)
03: 1.25 (n=10, f=0)  ####################
04: 0.75 (n=08, f=0)
05: 0.73 (n=09, f=0)
06: 0.76 (n=04, f=0)
07: 0.81 (n=06, f=0)  #
08: 0.35 (n=04, f=0)
09: 0.94 (n=05, f=0)  ######
10: 0.47 (n=03, f=0)
11: 1.10 (n=02, f=0)  ~~~~~~~~~~~~
12: 0.08 (n=02, f=0)
```

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

Team: 2

Time SD for WHZ
point 0.8 0.9 1.0 1.1 1.2 1.3 1.4 1.5 1.6 1.7 1.8 1.9 2.0 2.1 2.2 2.3
01: 1.07 (n=10, f=0) ##########
02: 0.78 (n=07, f=0)
03: 0.71 (n=08, f=0)
04: 0.86 (n=08, f=0) ###
05: 0.95 (n=08, f=0) ######
06: 0.69 (n=07, f=0)
07: 0.82 (n=07, f=0) #
08: 1.33 (n=07, f=0) ######################
09: 1.10 (n=06, f=0) ############
10: 1.30 (n=07, f=0) ####################
11: 1.21 (n=05, f=0) ##################
12: 1.02 (n=05, f=0) #########
13: 1.42 (n=04, f=0) OOOOOOOOOOOOOOOOOOOOOOOOO
14: 0.94 (n=03, f=0) OOOOOO
15: 0.81 (n=03, f=0)
16: 0.86 (n=02, f=0) ~~~

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

Team: 3

Time SD for WHZ
point 0.8 0.9 1.0 1.1 1.2 1.3 1.4 1.5 1.6 1.7 1.8 1.9 2.0 2.1 2.2 2.3
01: 0.88 (n=08, f=0) ###
02: 1.08 (n=07, f=0) ############
03: 1.27 (n=08, f=0) ####################
04: 0.65 (n=08, f=0)
05: 0.30 (n=04, f=0)
06: 0.85 (n=08, f=0) ##
07: 0.71 (n=08, f=0)
08: 1.04 (n=08, f=0) ##########
09: 1.05 (n=06, f=0) ###########
10: 1.15 (n=07, f=0) ###############
11: 1.32 (n=07, f=0) ######################
12: 0.59 (n=06, f=0)
13: 0.58 (n=05, f=0)
14: 0.47 (n=02, f=0)
16: 0.41 (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: 0.89 (n=09, f=0) ####
02: 0.98 (n=08, f=0) ########
03: 0.73 (n=08, f=0)

04: 1.04 (n=08, f=0) ##########
05: 0.79 (n=09, f=0)
06: 0.67 (n=08, f=0)
07: 0.80 (n=04, f=0)
08: 0.78 (n=05, f=0)
09: 1.44 (n=04, f=0) OOOOOOOOOOOOOOOOOOOOOOOOO
11: 0.65 (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: 0.92 (n=10, f=0) #####
02: 0.96 (n=10, f=0) #######
03: 0.59 (n=09, f=0)
04: 1.16 (n=07, f=0) ################
05: 0.76 (n=06, f=0)
06: 0.58 (n=06, f=0)
07: 0.59 (n=05, f=0)
08: 1.32 (n=04, f=0) ######################
09: 1.80 (n=04, f=0) ##
10: 0.18 (n=02, f=0)
11: 0.39 (n=03, f=0)
12: 0.29 (n=02, f=0)
13: 0.51 (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: 6

Time SD for WHZ
point 0.8 0.9 1.0 1.1 1.2 1.3 1.4 1.5 1.6 1.7 1.8 1.9 2.0 2.1 2.2 2.3
01: 0.47 (n=08, f=0)
02: 0.80 (n=08, f=0)
03: 0.86 (n=09, f=0) ###
04: 0.68 (n=07, f=0)
05: 1.14 (n=04, f=0) ###############
06: 0.81 (n=04, f=0)
07: 1.08 (n=05, f=0) #############
08: 1.12 (n=04, f=0) ##############
09: 0.44 (n=02, f=0)
10: 0.40 (n=03, f=0)
11: 0.53 (n=04, f=0)
12: 0.86 (n=03, f=0) OOO
13: 0.31 (n=03, f=0)
14: 0.86 (n=02, f=0) OO
15: 0.91 (n=03, f=0) OOOOO

(when n is much less than the average number of subjects per cluster different symbols are used:

0 for n < 80% and ~ for n < 40%; The numbers marked "f" are the numbers of SMART flags found in the different time points)

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

Appendix 2: Assignment of Clusters

SMART Survey - Saptari District - June 2013 - Cluster selection (58)		
Ward	**Population size**	**Cluster**
AURAHI-7	800	1
BAIRAWA-8	928	2
BAMANGAMAKATTI-2	1179	3
BANAINIYA-8	723	4
BANAULI-2	708	5
BARSAIN (KO)-1	947	6
BASBITI-5	450	7
BELHI-7	488	8
BHAGAWATPUR-6	360	9
BHARDAHA-1	2461	10
BIRPURBARAHI-1	753	11
BISHAHARIYA-6	712	Reserve cluster
BORIYA-3	377	12
CHHINNAMASTA-2	2030	13
DADHA-3	653	14
DEURI-1	546	15
DHANAGADI-5	560	16
DHODHANPUR-3	742	17
DIMAN-4	506	Reserve cluster
FARSETH-6	454	18
FATEPUR-7	630	19
GAMHARIYAPARWAHA-3	889	20
HANUMAN NAGAR-1	698	21
HARDIYA-6	589	22
HARIPUR-6	627	23
INARWA FULPARIYA-8	355	Reserve cluster
JAGATPUR-6	527	24
JANDAUL-1	551	25
JOGINIYA-1-4	538	26
KABILASH-7	727	27
KALYANPUR-3	2262	28
KANCHANPUR-1	1364	29
KATAIYA-6	621	30
KHOJPUR-7	571	31
KO. MADHEPURA-7	595	32
KOILADI-6	604	Reserve cluster
LALAPATI-2	539	33
LOHAJARA-3	803	34

MADHUPATI-2	531	35
MAINAKADERI-2	246	36
MALEKPUR-5	1053	37
MALETH-9	744	38
MALHANIYA-7	1335	39
MAUWAHA-5	648	Reserve cluster
NARDHO-3	786	40
ODRAHA-1	610	41
PAKARI-9	1162	42
PATO-1	1406	43
PIPRA (EAST)-1	443	44
PORTAHA-2	815	45
RAJBIRAJ MUNICIPALITY-1	1674	46
RAJBIRAJ MUNICIPALITY-4	3072	47
RAJBIRAJ MUNICIPALITY-6	3927	48
RAJBIRAJ MUNICIPALITY-8	3206	49
RAMNAGAR-9	286	50
RAMPUR JAMUWA-7	732	51
RAYAPUR-6	942	52
RUPNAGAR-9	566	53
SANKARPURA-7	757	54
SIMRAHASIGIYOUN-6	536	55
SITAPUR-3	301	56
TERAHOTA-5	1461	57
TIKULIYA-4	475	Reserve cluster
TRIKOLA-8	984	58

Appendix 3: Evaluation of Enumerators

Please note: Maximum enumerators that can be entered in ENA Delta software (November 2012) is 20. Enumerators 21-25 were therefore entered in separate analysis with against results of the Supervisor.

Weight:

	Precision: Sum of Square [W2-W1]	Accuracy: Sum of Square [Superv.(W1+W2)-Enum.(W1+W2]	No. +/- Precision	No. +/- Accuracy
Supervisor	0.16		5/2	
Enumerator 1	0.18 OK	0.18 OK	5/4	2/6
Enumerator 2	0.14 OK	0.22 OK	5/3	3/5
Enumerator 3	0.16 OK	0.08 OK	5/2	5/3
Enumerator 4	0.15 OK	0.11 OK	5/4	3/5
Enumerator 5	0.17 OK	0.15 OK	4/4	2/5
Enumerator 6	0.16 OK	0.48 OK	2/5	3/7
Enumerator 7	0.13 OK	0.33 OK	4/3	2/6
Enumerator 8	0.17 OK	0.35 OK	4/4	2/6
Enumerator 9	0.26 OK	0.34 OK	3/6	2/5
Enumerator 10	0.16 OK	0.10 OK	3/4	2/5
Enumerator 11	0.13 OK	0.19 OK	3/4	3/7
Enumerator 12	0.13 OK	0.19 OK	3/4	3/7
Enumerator 13	0.14 OK	0.30 OK	5/3	3/7
Enumerator 14	0.17 OK	0.21 OK	6/2	3/7
Enumerator 15	0.20 OK	0.20 OK	5/3	3/6
Enumerator 16	0.18 OK	0.24 OK	6/3	3/7
Enumerator 17	0.17 OK	0.19 OK	4/4	2/6
Enumerator 18	0.62 POOR	0.82 POOR	3/5	1/7
Enumerator 19	10.96 POOR	10.18 POOR	3/2	5/5
Enumerator 20	0.24 OK	0.58 POOR	3/3	4/6
Enumerator 21	*0.17 OK*	*0.19 OK*	*4/4*	*2/6*
Enumerator 22	*0.20 OK*	*0.20 OK*	*5/3*	*3/6*
Enumerator 23	*0.18 OK*	*0.24 OK*	*6/3*	*3/7*
Enumerator 24	*0.62 POOR*	*0.82 POOR*	*3/5*	*1/7*
Enumerator 25	*0.18 OK*	*0.24 OK*	*6/3*	*3/7*

Height:

	Precision: Sum of Square [H2-H1]	Accuracy: Sum of Square [Superv.(H1+H2)-Enum.(H1+H2]	No. +/- Precision	No. +/- Accuracy
Supervisor	10.33		6/3	
Enumerator 1	54.86 POOR	50.39 POOR	9/1	8/2
Enumerator 2	7.78 OK	14.17 OK	8/1	7/3
Enumerator 3	11.05 OK	33.88 POOR	5/3	4/6

Enumerator 4	11.50 OK	35.53 POOR	7/3	5/5
Enumerator 5	6.76 OK	20.67 OK	6/3	4/6
Enumerator 6	6.13 OK	19.48 OK	6/3	4/6
Enumerator 7	9.95 OK	25.92 OK	5/5	3/7
Enumerator 8	11.06 OK	23.25 OK	4/5	3/7
Enumerator 9	14.09 OK	56.94 POOR	4/6	5/5
Enumerator 10	14.14 OK	127.29 POOR	3/7	4/6
Enumerator 11	7.85 OK	13.18 OK	3/3	5/5
Enumerator 12	8.28 OK	21.93 OK	4/5	5/5
Enumerator 13	2.38 OK	35.67 POOR	3/5	4/6
Enumerator 14	73.64 POOR	52.89 POOR	4/6	4/6
Enumerator 15	22.13 POOR	12.92 OK	4/5	7/2
Enumerator 16	20.05 OK	19.86 OK	5/3	5/4
Enumerator 17	4.34 OK	16.37 OK	5/5	7/3
Enumerator 18	6.09 OK	27.14 OK	5/4	5/5
Enumerator 19	143.02 POOR	157.13 POOR	7/3	8/2
Enumerator 20	4.93 OK	17.64 OK	6/3	5/5
Enumerator 21	*4.34 OK*	*16.37 OK*	*5/5*	*7/3*
Enumerator 22	*22.13 POOR*	*12.92 OK*	*4/5*	*7/2*
Enumerator 23	*20.05 OK*	*19.86 OK*	*5/3*	*5/4*
Enumerator 24	*6.09 OK*	*27.14 OK*	*5/4*	*5/5*
Enumerator 25	*20.05 OK*	*19.86 OK*	*5/3*	*5/4*

MUAC:

	Precision: Sum of Square [MUAC2-MUAC1]	Accuracy: Sum of Square [Superv.(MUAC1+MUAC2)-Enum.(MUAC1+MUAC2]	No. +/- Precision	No. +/- Accuracy
Supervisor	86.00		2/4	
Enumerator 1	75.00 OK	209.00 OK	5/4	4/6
Enumerator 2	101.00 OK	195.00 OK	6/4	7/3
Enumerator 3	218.00 POOR	230.00 OK	7/3	5/4
Enumerator 4	34.00 OK	152.00 OK	3/5	5/4
Enumerator 5	37.00 OK	97.00 OK	3/5	1/7
Enumerator 6	22.00 OK	188.00 OK	2/2	3/5
Enumerator 7	116.00 OK	270.00 POOR	6/3	3/6
Enumerator 8	54.00 OK	190.00 OK	8/1	6/3
Enumerator 9	175.00 POOR	369.00 POOR	1/9	6/4
Enumerator 10	177.00 POOR	413.00 POOR	7/3	3/6
Enumerator 11	41.00 OK	189.00 OK	5/5	4/5
Enumerator 12	80.00 OK	350.00 POOR	5/4	5/4
Enumerator 13	184.00 POOR	512.00 POOR	3/7	6/4
Enumerator 14	128.00 OK	332.00 POOR	5/5	4/5
Enumerator 15	139.00 OK	349.00 POOR	4/5	4/5
Enumerator 16	224.00 POOR	198.00 OK	9/1	6/4
Enumerator 17	96.00 OK	258.00 OK	6/3	6/3
Enumerator 18	157.00 OK	135.00 OK	6/3	4/5
Enumerator 19	428.00 POOR	490.00 POOR	1/6	3/7
Enumerator 20	69.00 OK	223.00 OK	4/5	6/3
Enumerator 21	*96.00 OK*	*258.00 OK*	*6/3*	*6/3*
Enumerator 22	*139.00 OK*	*349.00 POOR*	*4/5*	*4/5*

Enumerator 23	*224.00 POOR*	*198.00 OK*	*9/1*	*6/4*
Enumerator 24	*157.00 OK*	*135.00 OK*	*6/3*	*4/5*
Enumerator 25	*224.00 POOR*	*198.00 OK*	*9/1*	*6/4*

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.

Appendix 4: Result Tables for NCHS growth reference 1977

Table 47: Prevalence of acute malnutrition based on weight-for-height z-scores (and/or oedema) and by sex

	All n = 480	**Boys** n = 231	**Girls** n = 249
Prevalence of global malnutrition (<-2 z-score and/or oedema)	(101) 21.0 % (17.4 - 25.2 95% C.I.)	(50) 21.6 % (17.0 - 27.1 95% C.I.)	(51) 20.5 % (16.0 - 25.8 95% C.I.)
Prevalence of moderate malnutrition (<-2 z-score and >=-3 z-score, no oedema)	(96) 20.0 % (16.6 - 23.9 95% C.I.)	(49) 21.2 % (16.5 - 26.9 95% C.I.)	(47) 18.9 % (14.6 - 24.0 95% C.I.)
Prevalence of severe malnutrition (<-3 z-score and/or oedema)	(5) 1.0 % (0.4 - 2.4 95% C.I.)	(1) 0.4 % (0.1 - 3.1 95% C.I.)	(4) 1.6 % (0.6 - 4.1 95% C.I.)

The prevalence of oedema is 0.0 %

Table 48: 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 (mo)	**Total no.**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**
6-11	62	0	0.0	3	4.8	59	95.2	0	0.0
12-23	110	1	0.9	40	36.4	69	62.7	0	0.0
24-35	113	1	0.9	25	22.1	87	77.0	0	0.0
36-47	102	2	2.0	13	12.7	87	85.3	0	0.0
48-59	93	1	1.1	15	16.1	77	82.8	0	0.0
Total	480	5	1.0	96	20.0	379	79.0	0	0.0

Table 49: Distribution of acute malnutrition and oedema based on weight-for-height z-scores

	<-3 z-score	**>=-3 z-score**
Oedema present	Marasmic kwashiorkor No. 0 (0.0 %)	Kwashiorkor No. 0 (0.0 %)
Oedema absent	Marasmic No. 5 (1.0 %)	Not severely malnourished No. 476 (99.0 %)

Table 50: Prevalence of acute malnutrition based on MUAC cut off's (and/or oedema) and by sex

	All n = 483	Boys n = 232	Girls n = 251
Prevalence of global malnutrition (< 125 mm and/or oedema)	(37) 7.7 % (5.5 - 10.5 95% C.I.)	(12) 5.2 % (3.3 - 8.1 95% C.I.)	(25) 10.0 % (6.8 - 14.4 95% C.I.)
Prevalence of moderate malnutrition (< 125 mm and >= 115 mm, no oedema)	(33) 6.8 % (5.0 - 9.3 95% C.I.)	(11) 4.7 % (2.9 - 7.6 95% C.I.)	(22) 8.8 % (5.9 - 12.7 95% C.I.)
Prevalence of severe malnutrition (< 115 mm and/or oedema)	(4) 0.8 % (0.3 - 2.2 95% C.I.)	(1) 0.4 % (0.1 - 3.1 95% C.I.)	(3) 1.2 % (0.4 - 3.7 95% C.I.)

Table 51: 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.**	**%**
6-11	64	3	4.7	7	10.9	54	84.4	0	0.0
12-23	110	1	0.9	16	14.5	93	84.5	0	0.0
24-35	114	0	0.0	7	6.1	107	93.9	0	0.0
36-47	102	0	0.0	3	2.9	99	97.1	0	0.0
48-59	93	0	0.0	0	0.0	93	100.0	0	0.0
Total	483	4	0.8	33	6.8	446	92.3	0	0.0

Table 52: Prevalence of acute malnutrition based on the percentage of the median and/or oedema

	n = 480
Prevalence of global acute malnutrition (<80% and/or oedema)	(60) 12.5 % (9.7 - 15.9 95% C.I.)
Prevalence of moderate acute malnutrition (<80% and >= 70%, no oedema)	(60) 12.5 % (9.7 - 15.9 95% C.I.)
Prevalence of severe acute malnutrition (<70% and/or oedema)	(0) 0.0 % (0.0 - 0.0 95% C.I.)

Table 53: Prevalence of malnutrition by age, based on weight-for-height percentage of the median and oedema

	Severe	Moderate	Normal	Oedema

Age (mo)	Total no.	wasting (<70% median) No.	%	wasting (>=70% and <80% median) No.	%	(> =80% median) No.	%	No.	%
6-11	62	0	0.0	3	4.8	59	95.2	0	0.0
12-23	110	0	0.0	23	20.9	87	79.1	0	0.0
24-35	113	0	0.0	18	15.9	95	84.1	0	0.0
36-47	102	0	0.0	7	6.9	95	93.1	0	0.0
48-59	93	0	0.0	9	9.7	84	90.3	0	0.0
Total	480	0	0.0	60	12.5	420	87.5	0	0.0

Table 54: Prevalence of underweight based on weight-for-age z-scores by sex

	All n = 481	**Boys** n = 231	**Girls** n = 250
Prevalence of underweight (<-2 z-score)	(233) 48.4 % (43.7 - 53.2 95% C.I.)	(99) 42.9 % (35.1 - 51.0 95% C.I.)	(134) 53.6 % (47.3 - 59.8 95% C.I.)
Prevalence of moderate underweight (<-2 z-score and >=-3 z-score)	(186) 38.7 % (34.1 - 43.5 95% C.I.)	(74) 32.0 % (25.6 - 39.3 95% C.I.)	(112) 44.8 % (38.5 - 51.3 95% C.I.)
Prevalence of severe underweight (<-3 z-score)	(47) 9.8 % (7.4 - 12.8 95% C.I.)	(25) 10.8 % (7.5 - 15.4 95% C.I.)	(22) 8.8 % (5.5 - 13.8 95% C.I.)

Table 55: Prevalence of underweight by age, based on weight-for-age z-scores

Age (mo)	Total no.	Severe underweight (<-3 z-score) No.	%	Moderate underweight (>= -3 and <-2 z-score) No.	%	Normal (> = -2 z score) No.	%	Oedema No.	%
6-11	63	4	6.3	11	17.5	48	76.2	0	0.0
12-23	109	15	13.8	49	45.0	45	41.3	0	0.0
24-35	114	16	14.0	43	37.7	55	48.2	0	0.0
36-47	102	8	7.8	32	31.4	62	60.8	0	0.0
48-59	93	4	4.3	51	54.8	38	40.9	0	0.0
Total	481	47	9.8	186	38.7	248	51.6	0	0.0

Table 56: Prevalence of stunting based on height-for-age z-scores and by sex

	All n = 474	**Boys** n = 225	**Girls** n = 249
Prevalence of stunting (<-2 z-score)	(143) 30.2 % (25.3 - 35.6 95% C.I.)	(71) 31.6 % (24.5 - 39.6 95% C.I.)	(72) 28.9 % (22.6 - 36.1 95% C.I.)

Prevalence of moderate stunting (<-2 z-score and >=-3 z-score)	(111) 23.4 % (19.1 - 28.3 95% C.I.)	(53) 23.6 % (18.3 - 29.7 95% C.I.)	(58) 23.3 % (17.7 - 30.0 95% C.I.)
Prevalence of severe stunting (<-3 z-score)	(32) 6.8 % (4.8 - 9.4 95% C.I.)	(18) 8.0 % (4.9 - 12.7 95% C.I.)	(14) 5.6 % (3.2 - 9.6 95% C.I.)

Table 57: Prevalence of stunting by age based on height-for-age z-scores

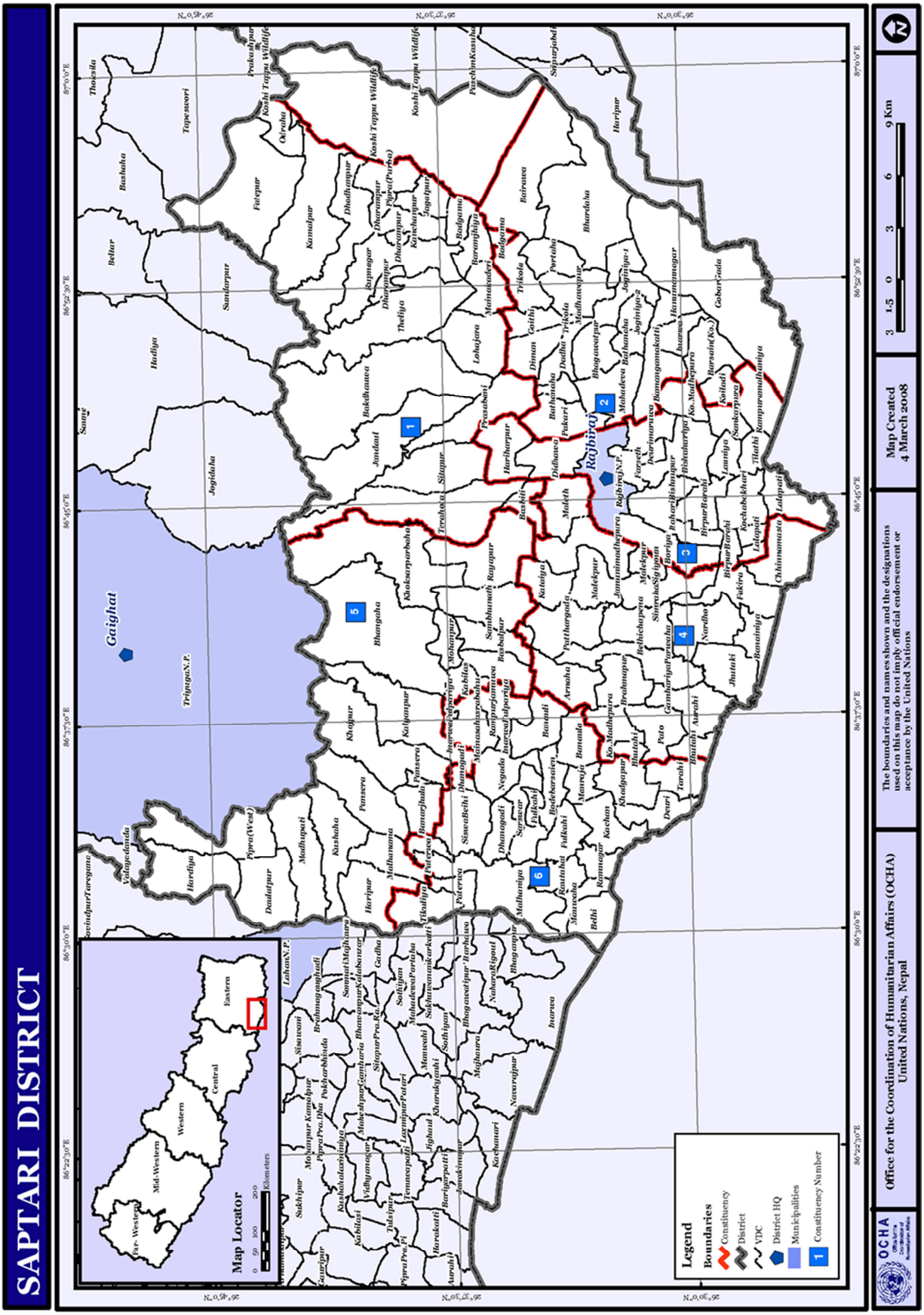
		Severe stunting (<-3 z-score)		Moderate stunting (>= -3 and <-2 z-score)		Normal (> = -2 z score)	
Age (mo)	**Total no.**	**No.**	**%**	**No.**	**%**	**No.**	**%**
6-11	61	3	4.9	9	14.8	49	80.3
12-23	110	8	7.3	26	23.6	76	69.1
24-35	112	8	7.1	23	20.5	81	72.3
36-47	99	4	4.0	26	26.3	69	69.7
48-59	92	9	9.8	27	29.3	56	60.9
Total	474	32	6.8	111	23.4	331	69.8

Table 58: 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	480	-1.35±0.79	1.09	36	1
Weight-for-Age	481	-1.95±0.86	1.11	34	2
Height-for-Age	474	-1.45±1.05	1.50	36	7

* contains for WHZ and WAZ the children with oedema.

Appendix 5: Map of the surveyed District



Appendix 6: Seasonal calendar – Saptari district

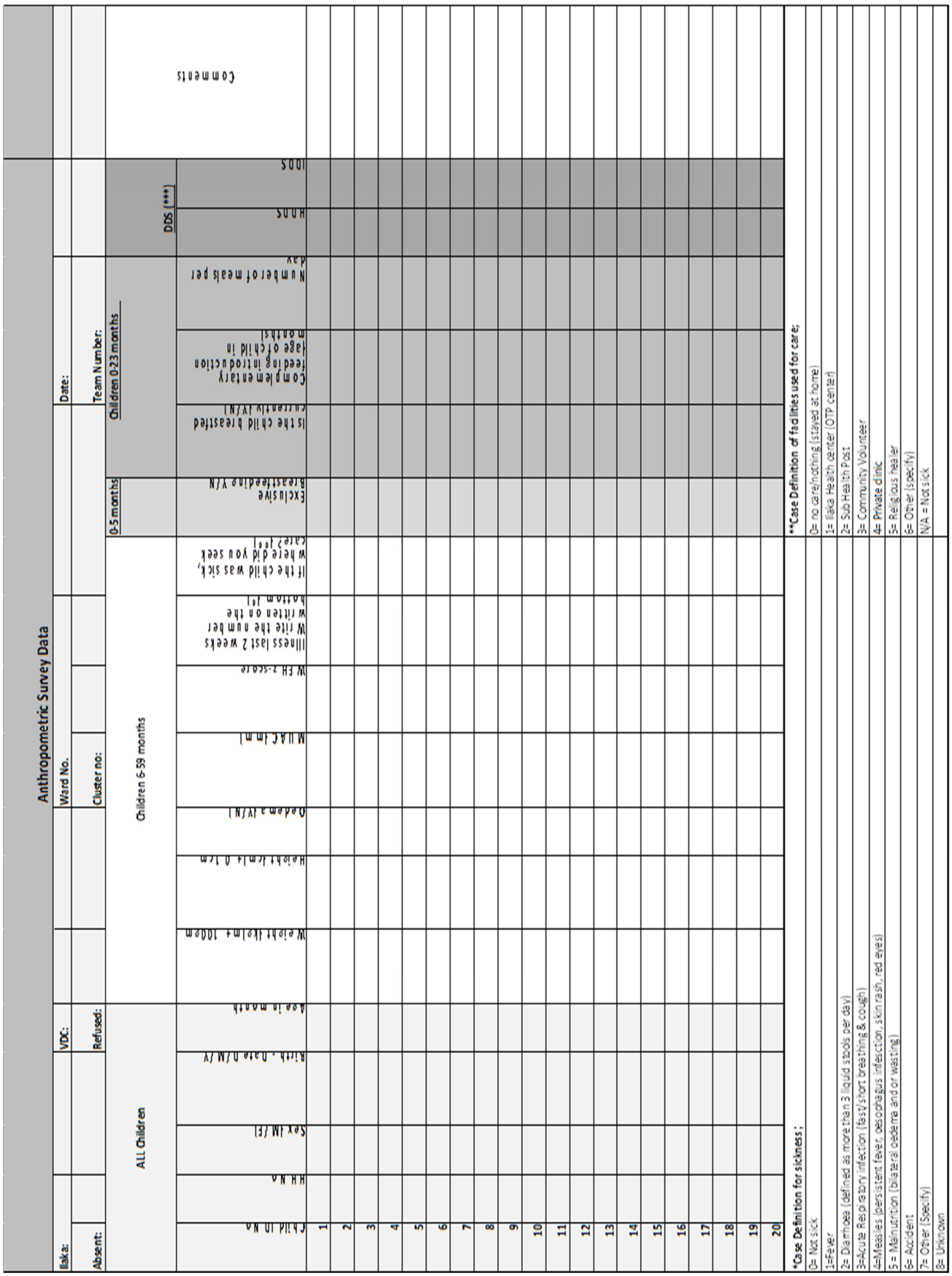
Month / Work		January	February	March	April	May	June	July	August	Sepatember	October	November	December
Plantation	Paddy												
	Wheat												
	Maize												
	Mustard												
	Vegetable (Seasonal)												
	Vegetable (Off Seasonal)												
Harvesting	Paddy												
	Wheat												
	Maize												
	Mustard												
Food insecurity													
Dease/infection		ARI, common cold, skin infection		Diarrhoea, dysentry, typhoid fever, skin infection								ARI, Common cold and cough, Skin infection	
Festival													
Hot Season													
Cold Season													
Festival													
Work load													
Migration for work (in and out side country)													

Appendix 7: Local Events Calendar Saptari District

Seasons	Religious Holidays	Local events	Other events	Month		Year	Age (M)
Rainy season				June	Jeshda Ashad	2013	0
Dry season				May	Baishak-Jeshda	2013	1
Dry season	ShivRatri	Chaite dasain (Ramnawami)		April	Chaitra-Baishak	2013	2
Dry season		Holi		March	Falgun-Chaitra	2013	3
Cold season				February	Magh-Falun	2013	4
Cold season		Maghi		January	Paush-Magh	2013	5
Cold season				December	Kartik	2012	6
Cold season	Diwali			November	Ashbin	2012	7
Dry season		Dasain/Chhat		October	Bhadra	2012	8
Dry season		Dasain		September	Shrwan	2012	9
Rainy season	Krishna Janmastami/Rachyabandhan			August	Shrwan-Bhadra	2012	10
Rainy season				July	Ashad-Shrwan	2012	11
Rainy season				June	Jeshda Ashad	2012	12
Dry season				May	Baishak-Jeshda	2012	13
Dry season	ShivRatri	Chaite dasain (Ramnawami)		April	Chaitra-Baishak	2012	14
Dry season		Holi		March	Falgun-Chaitra	2012	15
Cold season				February	Magh-Falun	2012	16
Cold season		Maghi		January	Paush-Magh	2012	17
Cold season				December	Kartik	2012	18
Cold season	Diwali/chhat			November	Ashbin	2011	19
Dry season	Dasain			October	Bhadra	2011	20
Dry season				September	Shrwan	2011	21
Rainy season	Krishna Janmastami/Rachyabandhan			August	Shrwan-Bhadra	2011	22
Rainy season				July	Ashad-Shrwan	2011	23
Rainy season				June	Jeshda Ashad	2011	24
Dry season				May	Baishak-Jeshda	2011	25
Dry season	ShivRatri	Chaite dasain (Ramnawami)		April	Chaitra-Baishak	2011	26
Dry season		Holi		March	Falgun-Chaitra	2011	27
Cold season				February	Magh-Falun	2011	28
Cold season		Maghi		January	Paush-Magh	2011	29
Cold season				December	Kartik	2011	30
Cold season				November	Ashbin	2010	31

Dry season	Diwali/Chhat			October	Bhadra	2010	32
Dry season		Dasain		September	Shrwan	2010	33
Rainy season	Krishna Janmastami/Rachyabandhan			August	Shrwan-Bhadra	2010	34
Rainy season				July	Ashad-Shrwan	2010	35
Rainy season				June	Jeshda Ashad	2010	36
Dry season				May	Baishak-Jeshda	2010	37
Dry season	ShivRatri	Chaite dasain (Ramnawami)		April	Chaitra-Baishak	2010	38
Dry season		Holi		March	Falgun-Chaitra	2010	39
Cold season				February	Magh-Falun	2010	40
Cold season		Maghi		January	Paush-Magh	2010	41
Cold season				December	Kartik	2010	42
Cold season				November	Ashbin	2009	43
Dry season	Diwali/Chhat			October	Bhadra	2009	44
Dry season	Dasain			September	Shrwan	2009	45
Rainy season	Krishna Janmastami/Rachyabandhan			August	Shrwan-Bhadra	2009	46
Rainy season				July	Ashad-Shrwan	2009	47
Rainy season				June	Jeshda Ashad	2009	48
Dry season				May	Baishak-Jeshda	2009	49
Dry season	ShivRatri	Chaite dasain (Ramnawami)		April	Chaitra-Baishak	2009	50
Dry season		Holi		March	Falgun-Chaitra	2009	51
Cold season				February	Magh-Falun	2009	52
Cold season		Maghi		January	Paush-Magh	2009	53
Cold season				December	Kartik	2009	54
Cold season	Diwali/chhat			November	Ashbin	2008	55
Dry season	Dasain			October	Bhadra	2008	56
Dry season				September	Shrwan	2008	57
Rainy season	Krishna Janmastami/Rachyabandhan			August	Shrwan-Bhadra	2008	58
Rainy season				July	Ashad-Shrwan	2008	59
Rainy season				June	Jeshda-Ashad	2008	60

Appendix 8: Anthropometry and nutrition questionnaire



Anthropometric Survey Data

Ilaka: | VDC: | Ward No. | Date:

Absent: | Refused: | Cluster no: | Team Number:

	ALL Children										Children 6-59 months										0-5 months	Children 0-23 months			DDS (***)		
	Child ID No.	HH No.	Sex (M/F)	Birth - Date O/M/Y	Age in month	Weight (kg)- 100gm	Height (cm)- 0.1cm	Oedema (Y/N)	MUAC (cm)	W FH Z-score	Illness last 2 weeks Write the number on the hantam [6]	If the child was sick, where did you seek care? [6]	Exclusive Breastfeeding Y/N	Is the child breastfed currently (Y/N)	Complementary feeding introduction (age of child in months)	Number of meals per day	HHDS	IDDS	Comments
1																			
2																			
3																			
4																			
5																			
6																			
7																			
8																			
9																			
10																			
11																			
12																			
13																			
14																			
15																			
16																			
17																			
18																			
19																			
20																			

*Case Definition for sickness:
0= Not sick
1=Fever
2= Diarrhoea (defined as more than 3 liquid stools per day)
3=Acute Respiratory infection (fast/short breathing & cough)
4=Measles (persistent fever, oesophagus infection, skin rash, red eyes)
5= Malnutrition (bilateral oedema and/or wasting)
6= Accident
7= Other (Specify)
8= Unknown

**Case Definition of facilities used for care;
0= no care/nothing (stayed at home)
1= Ilaka Health center (OTP center)
2= Sub Health Post
3= Community Volunteer
4= Private clinic
5= Religious healer
6= Other (specify)
N/A = Not sick

Appendix 9: Diet Diversity Score questionnaire

DIETARY DIVERSITY SCORE (DDS)					
VDC :		DATE :		TEAM NO:	
CLUSTER:		CHILD ID NO:		HH NO:	

IN THE LAST 24 HOURS, did you or any adult HH member eat ANY of the following items? Note that foods may be contained as a combination sauce.		What did your child (6 to 59 months) eat in the last 24 hours (from when he/she got up untill he/she went to sleep)?	
Type of food	**Adult HH members 1=Yes 0=No**	**Type of Food**	**Children 6-59 months 1=Yes, 0=No**
Cereals/staples (Rice,wheat)		Cereals/staples (Rice,wheat)	
Pulses/legumes/nuts (lentils,dall,chick peas, peanuts)		Foods rich in Vitamin A (carrot, pumpkin, mango, sweet potato others)	
Dairy and dairy products (milk,yogurt)		Other Fruits and vegetables (banana,other)	
Fish/Sea food (fish,prawn....)		Meat (chicken,mutton,fish,goat etc)	
Eggs		Eggs	
Meat (chicken,mutton etc)		Pulses/legumes/nuts (lentils,dall,chick peas, peanuts)	
Sugar/Gur/ Sweets/Honey		Milk/yogurt	
Fats/Oils/Ghee (foods cooked in oils)		Foods cooked in oils/fat t	
Roots (sweet potato,potato , others)			
Any Fruits (i.e. mango, papaya, banana, guava...)			
Any vegetables (i.e. cabbage, carrot, tomato, beans etc)			
Beverages (Tea, Fanta, Coke...)			
Total HDDS (0-12)	...../12	**Total IDDS (0-8)**	...../8

Appendix 10: Mortality questionnaire

Household enumeration data collection form mortality calculation survey SMART

(one sheet/household)

VDC:				Ward No. :			Date:	
Cluster No:				Team number:			HH number:	

No	Name	Sex *(M/F)*	Age in years	Joined during recall period *(Y/N)*	Left during recall period *(Y/N)*	Born during recall period *(Y/N)*	Died during recall period *(Y/N)*	Cause of death *(use code below)*
1								
2								
3								
4								
5								
6								
7								
8								
9								
10								
11								
12								
13								
14								
15								
16								
17								
18								
19								
20								

Codes for cause of death	
1=Diarrhoea (more than 3 loose stools/day)	5=Malnutrition (wasting and/or bilateral oedema)
2=Fever	6=Accident /injury related
3=Measles	7=other (fill)
4=Difficulty Breathing/chest infection	

Appendix 11: Comparison of breastfeeding practices and IDDS