Nutrition Survey using SMART Methodology and Mortality in Gwoza MSF OCBA project, Borno State / Nigeria.

Survey Report

December 2018 – January 2019

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CONTENTS

LIST OF TABLE 5

LIST OF FIGURE 5

LIST OF ABBREVIATIONS 6

SUMMARY 7

1. INTRODUCTION 8

1.1. Context 8
1.2. MSF presence in the country 8
1.3. Background - Justification for the study 9

2. OBJECTIVES 11

2.1. Primary objectives 11
2.2. Secondary objectives 11

3. STUDY DESIGN 11

4. STUDY POPULATION 11

5. DEFINITIONS 12

5.1. Household definitions 12
5.2. Specific situations 13

6. SAMPLE SIZE AND SAMPLING 14

6.1. Sample size 14
6.2. Sampling 15

7. DATA COLLECTION 16

7.1. Data collection tools 16
7.2. Variables collected 17

8. TRAINING OF THE SURVEY TEAM 17

8.1. Standardization test 18
8.2. Pilot test (pre-investigation) 18

9. DATA MANAGEMENT, ENTRY AND ANALYSIS 18

9.1 Data analysis 19

10. RESULTS 21

10.1. Overall data quality of the survey 21
10.2. Socio-demographic characteristic of the surveyed population 21
10.3. Anthropometric and immunization results 24
10.4. Retrospective mortality results 27

11. DISCUSSION 29

12. CONCLUSION AND RECOMMENDATION 31

13. ANNEXES 32

Annex 1: Plausibility check for: nig_201812_msf_gwoza.as 32
Annex 2: standardisation test results for muac 37

Annex 3: sampled clusters for gwoza 38
Annex 4: questionnaire 39
Annex 5: survey team 40
Annex 6: map of the borno state showing the 27 lgas. 41

LIST OF TABLE

Table 1: Sample size for anthropometry..... 14
Table 2: Sample size for mortality 14
Table 3: Sample size for Immunization..... 15
Table 4: Summary of the number of final households to be surveyed by site..... 16
Table 5: Number of Clusters and households to investigate..... 16
Table 6: WHO classification of acute malnutrition by mid-upper arm circumference..... 19
Table 7: Alert and Emergency Thresholds for Death Rates 20
Table 8: Overall Survey Data Quality 21
Table 9: Demographic characteristic of Household surveyed 22
Table 10: Reason of arrival and period of arrival for all households members surveyed..... 23
Table 11: Displaced people and their period of arrival in the Gwoza town 24
Table 12: Distribution of age and sex of sample..... 24
Table 13: Prevalence of acute malnutrition based on MUAC cut off's (and/or oedema) and by sex..... 25
Table 14: Prevalence of acute malnutrition by age, based on MUAC cut off's and/or oedema 25
Table 15: Measles vaccine coverage in children aged 9 to 59 months. 26
Table 16: Immunization status by sex, children aged 9 to 59 months. 27
Table 17: Mortality rates in the general population, by age group, and by sex..... 27
Table 18: Main causes of deaths and locations 28

LIST OF FIGURE

Graph 1: Distribution of the population by age and sex..... 22
Graph 2: Cumulative Distribution of MUAC by Gender..... 26

LIST OF ABBREVIATIONS

AAH: Action Against Hunger
CDR: Crude Death Rate
ENA: Emergency Nutrition Assessment
FAO: Food and Agriculture Organization
GAM: Global Acute Malnutrition
HH: Household
IDP: Internal Displaced Person
IPC: Integrated Phase Classification
LGA: Local Government Area
MMC: Maiduguri Central
MoH: Ministry of Health
MSF: Médecins Sans Frontières
MUAC: Mid Upper Arm Circumference
NSAG: Non State Armed Group
OCBA: Operational Centre Barcelona Athena
PPS: Probability Proportional to Size
SAM: Severe Acute Malnutrition
SMART: Standardized Monitoring and Assessment of Relief and Transitions
U5DR: Under-5 Death Rate
WHO: World Health Organization

SUMMARY

Concerned by the complex emergencies prevailing in Nigerian Army controlled areas of Borno state in November 2016, MSF OCBA opened Gwoza and Pulka project with the objective to reduce mortality and morbidity of the most affected people trough restoration of provision of lifesaving essential decentralized health care. The intervention focused on provision of health care while delivering an integrated package relieve activities such as food distribution, protection, medical and mental health, psychosocial support to IDP (especially new arrivals) and addressing humanitarian gaps. In order to obtain the current health and nutrition situation, a SMART survey in Gwoza town (Nigerian Army controlled area) had to be conducted, to better understand the context (including outbreak and nutrition crisis preparedness), guide our medical humanitarian strategy and decide the best action to take in favour of those population. This survey obtained descriptive data on mortality, nutritional status and vaccination coverage and also had the objective to assess for children aged 6 to 59 months the nutritional status, the death rate, the measles and vaccination coverage among children aged 9 to 59 months in Gwoza town.

It was a cross-sectional survey with two-stage cluster sampling, using Standardized Monitoring and Assessment of Relief and Transitions (SMART) methodology, a standardized, simplified nutritional survey method with tablet data entry on a daily basis to improve their quality.

The main results obtained show a prevalence of GAM according to MUAC of 2.0% (1.0 - 3.8%, 95% CI) and 0.2% (0.0 - 1.5%, 95% CI) of prevalence in SAM, death rates for 10,000 people per day of 0.28 (0.16 - 0.51, 95% CI) deaths for the CDR and 0.36 (0.09-1.48, 95% CI) deaths for the U5DR. The vaccination coverage is around 13.15% (10.37 - 16.53, 95% CI) on presentation of a vaccination record and 52.16% (47.61 - 56.66, 95% CI) according to the mother/caretaker.

The prevalence of GAM obtained is below 7% (alert threshold, Nutrition Guidelines, MSF 2014). Similarly, the prevalence of SAM of 0.2% is below the alert threshold range of 1.5 - 3% (alert threshold, Nutrition Guidelines, MSF 2014). The results from this survey are a snapshot of the nutritional situation at the time the data was collected in the field as it is a cross-sectional survey. It therefore produces a punctual image of the situation and will allow putting in place appropriate strategies according to the context and needs of the populations.

1. INTRODUCTION

1.1. CONTEXT

Borno State is one of the thirty six states in the Federal Republic of Nigeria, and has an estimated population of 4.5 million people which is ranked as the 12th populous state in Nigeria[1]. The state is located in Northern Eastern Nigeria which has experienced years of conflict between the military and Non State Armed Group (NSAG). The state occupies the greater part of the Chad Basin and shares boundaries with Adamawa State to the South, Gombe State to the West, Yobe State to the North-West, Republic of Niger to the North, Republic of Chad to the North-East and Republic of Cameroon to the East[2].

The on-going conflict in the North East continues to increase population displacements, restrict income generating opportunities, limit trade flows and escalate food prices. As a result of the reduced food availability and access, local and Internally Displaced Persons (IDPs) populations in worst-affected areas of Borno, Yobe and Adamawa states continue to experience food gaps, in line with crisis (IPC Phase 4) acute food insecurity, with an estimated 2.45 million people in Phase 3-5[3]. According to Food and Agriculture Organization (FAO), 6.4% of the population of Borno are IDPs and another 3.4% are refugee. In addition, at least 35% of the resident households in Borno State have an IDP or returnee in household[4] and they are food aid dependant receiving general food distribution.

1.2. MSF PRESENCE IN THE COUNTRY

Concerned by the complex emergencies prevailing in Nigerian Army controlled areas of Borno state in November 2016, OCBA team conducted rapid assessments aiming to develop interventions that will address needs, alleviate suffering of community and people living in the Nigerian Army controlled areas of Borno state. Following this exploratory mission, MSF OCBA opened Gwoza and Pulka project with the objective to reduce mortality and morbidity of the most affected people trough restoration of provision of lifesaving essential integrated health care. The intervention focused on provision of health care while delivering an integrated package relieve activities such as food distribution, protection, medical and mental health, psychosocial support to IDP (especially new arrivals) and addressing humanitarian gaps.

According to UNICEF (2018), in the northeast Nigeria, in the three states of Adamawa, Yobe and Borno that have been affected by the on-going conflict, one in every five children is severely malnourished. An estimated 940,000 children aged 6 to 59 months across these

[1] Borno State Nutritional and mortality survey, Save The Children, August 2018
[2] http://www.ngex.com/nigeria/places/states/borno.htm
[3] Cadre Harmonisé for Identification of Risk Areas and Vulnerable Populations in Sixteen (16) States and the Federal Capital Territory (FCT) of Nigeria
[4] Food Security, Livelihood and Vulnerability Assessment Report (2016) by FAO and NBS

states are acutely malnourished, 440,000 with Severe Acute Malnutrition and 500,000 with Moderate Acute Malnutrition.

Lately, the town of Pulka mostly and to some extent Gwoza, all within Gwoza LGA located in south-east of Borno State, has recorded an increasing influx of new internally displaced person (IDP) arrivals, this growing influx of IDP new arrivals severely stressed the limited existing resources especially access to safe water, shelter, other social services contributing to the already intense humanitarian needs in these locations.

1.3. BACKGROUND - JUSTIFICATION FOR THE STUDY

The nutrition situation in Borno State has been classified as serious according to the Nutrition in Emergency Sector Working Group which noted that the prevalence of Global Acute Malnutrition (GAM) increased from 6% in 2010 to 11.5% in 2015, with the peak being in 2012 when the prevalence of GAM was estimated as 13.8%[5]. Additionally, a small scale SMART survey conducted by Action Against Hunger in April 2016 showed critical nutrition situation in MMC and Jere Local Government Areas (LGAs) which are in Borno State, with the prevalence of acute malnutrition being estimated as 19.2% and the prevalence of severe acute malnutrition being estimated as 3.1%[6]. Another SMART Survey conducted in November 2016 in Northern Eastern Nigeria, showed varying GAM rates with MMC/Jere recording the highest GAM Rate of 13.0%[7] which is classified as serious according to WHO Classification of Malnutrition.

Recently the study conducted in August 2018 by Save the Children International (SCI) has established that the prevalence of acute malnutrition in Borno is classified as critical (GAM=9.0% [6.2-12.8]) [1]. The same study show also that crude and under-five mortality rates are considered stable and within the acceptable thresholds (0.79 [0.52-1.20] and 1.60 [0.83-3.07] respectively).

With regard to immunization, the discrepancy between the different sources of data and the lack of internal and external coherence of the data represent important problems. According to the report of the SMART 2018 survey (SCI), immunization coverage for measles was 48.5% in surveyed area.

According to MSF protection data collected, Gwoza received 314 new arrivals in June, 201 new arrivals in July, 162 new arrivals in August, a higher prevalence of severe malnutrition under five children based on the screening done at arrival point using only MUAC and oedema criteria. This number has been noticed since week 26 with an average of SAM rate of 15.7% and GAM rate of 21%, indicating that remaining people in their villages of origin may face an increased food insecurity and livelihood crisis. This may be explained by challenges faced by the population in NSAG controlled area to access their farmland (due to insecurity and conflict targeting productive fields) as well as by poor sanitation conditions

[5] Nigeria Nutrition in Emergency Sector Response Plan 2017
[6] Final results of small-scale nutrition survey in MMC & Jere LGAs, Borno State
[7] Summary Findings of Nutrition and Food Security Survey, North East Nigeria, November 2016

and lack of access to healthcare services. In addition, access to food from outside the NSAG areas may also has been reduced due to control on the roads from the Nigerian Army. MSF OCBA needs also to consider that this peak has been noticed during the lean season, when usually malnutrition rates would increase all over North East Nigeria due to the fact that the members of the communities use part of their already insufficient food for seed. It is also important to consider our limited sample size (as we do not have access to this population in totality, but only to the ones entering the Nigerian Army controlled enclave), the data needs to be analysed with care as it may not be the true representation of malnutrition and food insecurity in NSAG controlled area.

In order to obtain the current health and nutrition situation, a SMART survey in Gwoza town (Nigerian Army controlled area) had to be conducted, to better understand the context (including outbreak and nutrition crisis preparedness), guide our medical humanitarian strategy and decide the best action to take in favour of those population.

2. OBJECTIVES

2.1. PRIMARY OBJECTIVES

Assess the nutritional status among children aged 6 to 59 months and retrospective death rate in the intervention area of MSF OCBA (Gwoza town) from November 2018 to January 2019, for evaluation, follow-up and orientation of MSF OCBA activities in Nigeria.

2.2. SECONDARY OBJECTIVES

For each intervention area, it will be:

- To estimate the prevalence of acute malnutrition (global, moderate and severe) by Mid-Upper Arm Circumference (MUAC) and the search for bilateral edema in children aged 6 to 59 months;
- To estimate the retrospective Crude Death Rate (CDR) and the Under-5 Death Rate (U5DR);
- To estimate measles immunization coverage among children aged 9 to 59 months;

3. STUDY DESIGN

Due to the dispersion of the population and the lack of household lists, a cluster survey was conducted.

It was a cross-sectional survey with two-stage cluster sampling, using Standardized Monitoring and Assessment of Relief and Transitions (SMART) methodology, a standardized, simplified nutritional survey method with tablet data entry on a daily basis to improve their quality.

During this survey, MUAC measurements and the search for edema was performed as this is the indicator that best measures mortality risk.

The retrospective mortality was also assessed, as well as measles immunization coverage among 9 -59 months.

4. STUDY POPULATION

The study population was consisting of all people living in the Gwoza town, inside the security perimeter (controlled by the Nigerian Army).

For the anthropometric nutrition survey, the study population was that of children aged 6 to 59 months as they represent the most vulnerable layer of the population. In this age group, the risk of increasing the mortality rate is particularly high in times of crisis.

For the mortality survey, the study population was consisting of all the households selected for the survey (with or without children under 5).

For measles immunization coverage, the study population was that of children aged 9 to 59 months in all households selected for the survey.

5. DEFINITIONS

5.1. Household definitions

Definition of household

Was considered as a household, “all persons who slept in the house the day before, shared the same meal and who recognize the authority of a head of household”.
The whole household was included, no matter the age of the household member or the relation with the other members.

Definition of head of household

The head of household was defined as follows:

- Adult household member >18 years, *and*
- Can give accurate information on all demographic and mortality issues in his/her household (can describe with reasonable accuracy the events that occurred during the recall period), *and*
- Has lived in the household the entire recall period, *and*
- Is present at the time of the survey

A household was excluded from the study if none of the household members fulfil all these criteria.

Definition of permanent member of the household

A permanent member of the household was defined as a person who is part of the household according to the household definition and is present at the moment of the study or slept in the house the previous evening.

5.2. Specific situations

Missing child	Each child missing and meeting the inclusion criteria of the survey appeared on the nutrition questionnaire. The team returned to visit the household at the end of the day to take the measurements (MUAC and edema) of this child. If the child was not present, he was not replaced. The mortality questionnaire has been completed as well as information regarding vaccination.
Missing household	If the occupants of a selected household were absent, the interviewers would return to visit the household before the end of the day. If at the end of the day the household was still absent, the household was recorded as absent and children aged 6 to 59 months were noted as absent.
Hospitalized child	If a child was hospitalized during the survey, it was not measured by the interviewers but was noted absent/hospitalized on the questionnaire. If there were many cases, it had to be notified in the report.
Physically differently abled children	They were included in the survey by collecting the following data: age, sex, MUAC, search for bilateral edema. If physical deformity prevented measurement of MUAC, this data was considered missing. Other information (mortality, vaccination) was collected.
Common courses (concessions)	The number of households living in the concession was requested and households were numbered clockwise from the household previously surveyed.
Polygamous families	We were referring to the definition of the household. If each woman ate separately, each woman and her children were a household. Households were numbered clockwise. If all the women of the head of household and their children ate in the same dish then the entire concession constituted a single household.
Refusal / Unable visit within the selected household	The team went to the next household but the household was not replaced by another.
Household without children	The team was only doing the mortality questionnaire.
Empty House / Concession (Abandoned)	The team made sure with the neighbours that it was well abandoned. The house was ignored for the household numbering procedure and the team moved on to the next household.

6. SAMPLE SIZE AND SAMPLING

6.1. Sample size

The required sample size was calculated with the Emergency Nutritional Assessment Software (ENA for SMART, version of July 9, 2015). The sample size of each survey component was determined by the ENA software using the following available data.

Table 1: Sample size for anthropometry

Parameters	Gwoza	Source
Percentage of MAG expected according to MUAC	12.8	Borno State Nutritional and mortality survey, Save the Children, August 2018
Desired precision	3.5	Recommended precision for prevalence 10-15%
Design effect	1.5	SMART methodology recommendation
Number of children to be included	**572**	**As calculated from ENA**
Average household size	5.7	MSF OCBA monthly census, October 2018
% of children under 5 years	23.5	MSF OCBA monthly census, October 2018, Borno strategic health developments plan.
Non response rate	3	There isn't possible migration of population at that time.
Number of HH to investigate	**489**	**As calculated from ENA**

Table 2: Sample size for mortality

Parameters	Gwoza	Source
Estimated mortality rate / 10000 person / day	0.79	Borno State Nutritional and mortality survey, Save the Children, August 2018
Desired precision / 10000 pers/day	0.4	
Design effect for CDR	1.5	SMART methodology recommendation
Recall period (days)	96	
Number of persons to be included	**3226**	**As calculated from ENA**
Average household size	5.7	MSF OCBA monthly census, October 2018
Non response rate	3	There isn't possible migration of population at that time.
Number of HH to investigate	**584**	**As calculated from ENA**

The sample size calculation for the measles immunization takes into account the recommendations of the WHO Reference Manual for Cluster Immunization Coverage Surveys (WHO, 2015). The assumptions and parameters used to calculate the sample are as follows:

- Number of strata in which the survey is to be conducted: **1 (A)**;
- The effective sample size (ESS) for 85% expected post-vaccination programmatic coverage with a desired 5% accuracy: **265 (B**);
- A design effect (DE) estimated by the formula DE = 1+(m-1)*ICC, where m (estimated at 15) represents the average number of eligible children per cluster and ICC (estimated at 0.042) the intra-cluster correlation coefficient: **1.58 (C)**;
- The average number of households to visit to find a specific eligible child at such parameters as birth and infant mortality rates, average household size and target population: **1 (D)**;
- The inflation factor to account for non-responders estimated at around 5% of the target: **1.05 (E)**;

Table 3: Sample size for Immunization

Variables	Formula	Value obtained
Number of full interviews required	$N_{FI} = A \times B \times C$	**419**
Total number of households to visit to get N_{EC}	$N_{HH\ to\ visit} = N_{FI} \times D \times E$	**440**
Number of households to visit by stratum	$N_{HH\ to\ visit\ per\ stratum} = B \times C \times D \times E$	**440**
Number of clusters needed per stratum	$N_{cluster\ per\ stratum} = B \times C / m$	**28**
Total number of households to visit per cluster	$N_{HH\ to\ visit\ per\ cluster} = D \times E \times m$	**16**
Total number of clusters in the survey	$N_{total\ cluster} = A \times N_{cluster\ per\ stratum}$	**28**

The sample size of the survey was determined by the higher sample size.

6.2. Sampling

A two-stage cluster sampling methodology was chosen as an adaptation of the standardized method recommended by the WHO[8].

This standard two-stage cluster sampling method was used to randomly select clusters first (primary sampling units) and secondly households (secondary sampling units).

[8] Henderson RH, Sundaresan T. Cluster sampling to assess immunisation coverage: A review of experience with simplified sampling methodology. Bulletin of the World Health Organization 1982(60):253-60

- **First-stage sampling technique: selection of clusters**

The first-stage sampling technique consisted of determining the list of clusters (villages or neighbourhoods) to be investigated for the survey areas. The draw was done using the ENA software in proportion to the size of the population.
The sampling frame used consisted of the list of villages or neighbourhoods collected from the site.
The software also gave us reserve clusters, which should be used only in cases where 10% or more of the original clusters could not be surveyed or if the final sample size obtained was less than 80% of that required when planning with ENA.

- **Second-degree sampling technique: household selection**

The selection of second-degree households was done with the systematic random method by applying a sampling interval (P).

The sampling interval is the number of households separating 2 sampled households. The sampling interval for each cluster was calculated by dividing the total number of households (N) by the number of households to be surveyed in the cluster (18 households). The number obtained (P) by this operation is the sampling interval for selecting the 18 households of the sample.

Table 4: Summary of the number of final households to be surveyed by site

Site	Number of HH/nutrition	Number of HH/mortality	Number of HH/immunization	Number of HH to investigate FINAL
Gwoza town	489	584	440	**584**

Table 5: Number of Clusters and households to investigate.

Investigation area	Number of total clusters to survey	Number of households to survey / day / cluster (X)
Gwoza town	33	18

7. DATA COLLECTION

7.1. Data collection tools

Data was collected using standardized questionnaires:

- a household-level anthropometric and mortality questionnaire, to assess the nutritional status of children aged 6 to 59 months and mortality of the population;
- a calendar of local events to estimate the age of the child in case no official document exists;

7.2. Variables collected

Sex: it was coded as "M" for males and "F" for females.

Mortality data: The recall period for the retrospective mortality assessment was approximately 96 days in relation to the date of the survey.

Age: The age of children aged 6 to 59 months were determined using official documents confirming their date of birth (birth certificate, and any other official source available). If documents were not available, a calendar of local events was used to estimate the age of the children (prepared in collaboration with the enumerators) based on important local events.
When the age was not possible to find out by the mentioned methods, the team used a wooden straight stick to quickly assess height. The wooden straight stick had two marks: 67 cm corresponds to the lowest height (6 months) and 110 cm corresponds to the maximum height (59 months).

Mid-upper Arm Circumference (MUAC): The MUAC was measured for all eligible children aged between 6 and 59 months. When assessing the MUAC, the midpoint of the left arm bent at 90 degrees was first identified by locating the tip of the shoulder blades and tip of the elbow. The midpoint was then lightly marked with a washable ink pen and the arm put in a relaxed position. The MUAC tape was then carefully positioned around the arm ensuring that it is not too tight or too loose.

Edema: The presence of bilateral edema was sought also for all eligible children aged 6 to 59 months. The child's feet were held with both hands at the same time and a modest amount of pressure was applied with the thumbs to the top of the ankle of the child's feet (hard pressure is not required to test for edema). The formation of a pit in the region where pressure was applied (for at least a few seconds) signifies the presence of edema.

Vaccination against measles: The information was sought first with the vaccination card, and if not according to the words of the mother of the child, in all children from 9 to 59 months.

8. TRAINING OF THE SURVEY TEAM

Data collection was carried out by 5 teams of 2 people.
Surveyors were trained/retrained before the start of the investigation. Five days training were provided to all interviewers to familiarise them with the background of the study, the questionnaires, the information sheet and the informed consent form. The training was dispensed in English by the principal investigator. It consists of an intensive review of the questionnaires and the information sheet including role-plays. As the interviews were held in the national language, the principal investigator had ensured that all interviewers have used

the same and correct wording for providing information to the households and for the interviews.
The topics covered during this training were: surveys and objectives, sampling (cluster sampling, systematic random selection, segmentation...), anthropometry and mortality (use of the calendar of events), the standardization test, data entry and analysis with ENA software, field procedures (including nutrition and mortality questionnaire completion), plausibility testing.
The immunization schedule of the routine immunization Nigeria as well as the collection of immunization data was also discussed. The theory was completed by practical exercises.
The 5-days training was finished with a pilot study in a place, which is outside of the study area. The pilot study allowed for the testing and possible final adaptation of the questionnaires and informed consent to field conditions.

8.1. Standardization test

A MUAC standardization test was organized according to the recommendations of the SMART methodology. Each group of investigators had taken, in pairs, twice, the brachial perimeter of 10 children and search for bilateral edema. The MUAC measurements was analysed in the ENA software. The precision and accuracy of each investigator was evaluated on the basis of the results obtained.

8.2. Pilot test (pre-investigation)

A pilot test was conducted in a locality that is not part of the selected clusters in the survey areas. Each team had visited 5 HHs, all eligible children in these HHs were measured for anthropometric measurements and mortality questionnaire was administered to the head of the HH. Data was entered into the ENA. The survey manager had supervised all stages of the pilot test.

9. DATA MANAGEMENT, ENTRY AND ANALYSIS

Data collection: Survey teams and supervision.

Each team consisted of a team leader and a measurer, and was supervised by the survey manager.
The main roles and responsibilities of each team member and their main duties were:

The measurer was responsible for reading the MUAC and verifying the edema of children from 6-59 months.

The supervisor was responsible for the close supervision of the teams (geographical delimitation of the cluster, random selection of households, completion of questionnaires and implementation of measure....).

The team leader was responsible for presenting the team and the purpose of the investigation to local officials, to complete the questionnaires mortality, anthropometric and of coverage and validating measures; report to the survey manager, verify the material and prepare the requirements for the next day.

Before leaving each household and going to the next, the team checked the questionnaires to make sure they are properly completed. At the end of the day and before leaving the cluster, the team ensured the completeness of all the questionnaires.

The data entry was done with KoboCollect tool (version 1.14.0a) and transferred in the ENA software for SMART on a daily basis at the return of the field.
All data was anonymised (names are not collected) and electronic files stored password-protected by MSF. Only study investigators had access to these data files. Data cleaning was done to check for inconsistencies in data entry and responses. The quality of the data was reviewed daily by the survey manager. The survey manager ensured the quality of the data daily and had organized debriefing sessions to answer the problems encountered.

9.1 Data analysis

The anthropometric data (MUAC, edema) of children aged 6-59 months were analysed using the latest version of ENA (July 9, 2015). Outliers or missing values were reported and excluded from the analysis. The ENA software calculated the prevalence of acute malnutrition according to MUAC.

Conduct in the presence of malnourished children
During the survey, children suffering from acute malnutrition (MUAC <125 mm and/or presence of edema) were referred to the appropriate health facilities. Investigators filled a duplicate reference sheet (one for the child's mother and one for the surveyors) to keep the child's contact information and verify admission within days.

Table 6: WHO classification of acute malnutrition by mid-upper arm circumference

Classification	MUAC (mm)
Global	<125 and / or edema
Moderate	≥115 and <125 mm
Severe	<115 mm and / or edema

The mortality data were calculated using the same ENA software. The death rate indicates the number of people in the sample who died during the recall period. Death rates are expressed as the number of deaths/10,000 persons/day.
The crude death rate (CDR) is defined as the number of people in the total population who died between the start of the recall period and the time of the survey.
The under-five death rate (U5DR) is defined as the number of children under-5 in the total population who died between the start of the recall period and the time of the survey

Table 7: Alert and Emergency Thresholds for Death Rates

Classification	Number of deaths
CDR	
Alert level	1 / 10.000 people / day
Emergency level	2/10 000 people / day
U5DR	
Alert level	2 / 10.000 children / day
Emergency level	4/10 000 children / day

Vaccination data were entered using KoboCollect tool along with the anthropometric data and analysed in Epi Info software (version 7.2.2.6). The outcome of the vaccination data analysis was the overall vaccination coverage stratified by age groups and sex.

All indicators (i.e. sex and age of the survey population) were calculated as proportions with 95% confidence intervals (95%CI). Estimates of actual design (cluster) effect were also being calculated for each variable and those with effects greater than 1 were reported. Where appropriate, differences in proportions were measured using Pearson $\chi 2$ test and p-value (p) was presented.

10. RESULTS

10.1. Overall data quality of the survey

The data collection process performed in all the 33 clusters permitted to visit 593 HHs (18 HHs per cluster). Among them, 3 HHs were excluded (participant are under 18 years in 2 HHs and all the HH member left during the month of the survey in the other) and 6 HHs were absent after a second revisit. The planning with ENA software targeted 584 households in total. We have had 584 households responded to the survey which translates to a response rate of 100%, considered as excellent.

A total of 546 children aged 6 to 59 months were included from the sampled households. Among them, 34 left during the recall period, 2 died also during the recall period and 10 were absent. At the end, 500 children were measured among the 510 available with a response rate of 98%.

We covered 89.2% of our target planned by ENA software (510 versus 572 children), considered as satisfactory (above the 80% threshold). This could be attributed to the fact that the parameters used for the sample size calculation were average for the entire State (Borno State), but there could be slight variations across the LGAs.

The total population from the sampled households was 3311 (3226 planned by ENA) with a response rate of 102.6%.

The data quality is assessed according to the anthropometric data standards as defined by the SMART Methodology. The overall score of this survey is 4% which is classified as excellent based on SMART Flags. The excellent data quality would be attributed to a number of factors including through training, close supervision and monitoring of the teams while in the field. The table below illustrates the overall data quality based on survey findings.

Table 8: Overall Survey Data Quality

Criteria	**Score**	**Conclusion**
Overall Sex ratio (Significant chi square)	**0 (p=0.494)**	Excellent
Age ratio(6-29 vs 30-59) (Significant chi square)	**4 (p=0.031)**	Acceptable
Digit preference score - MUAC	**0 (4)**	Excellent
Overall Data Quality Score	**4 %**	***Excellent***

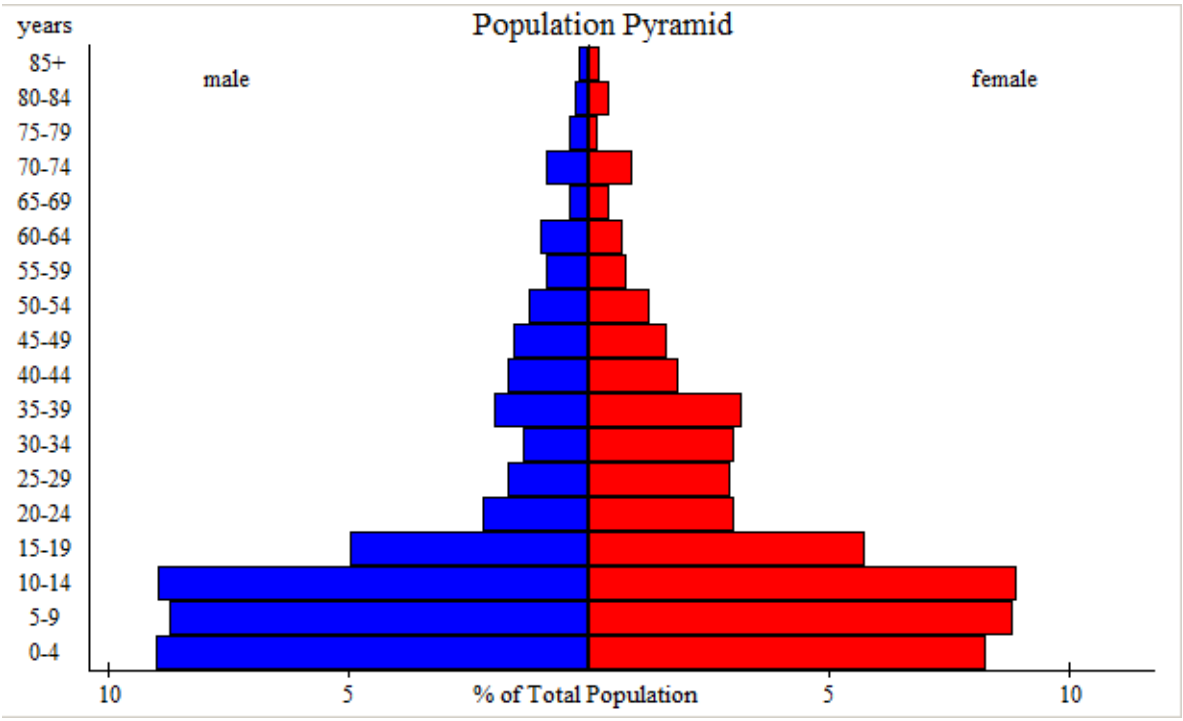
10.2. Socio-demographic characteristic of the surveyed population

As already highlighted above, a total of 3311 people (1567 males and 1744 females) were included in this survey with a sex ratio of 0.90. The table below present the demographic characteristic of HHs surveyed.

Table 9: Demographic characteristic of Household surveyed

Characteristic	Results
Total number of HHs	**584**
Total number of HHs with children under five	**361**
Average household size	**5.7**
Mid Interval Population Size	**3311.5**
Number of Clusters	**33**
Percentage of children under five	**18.8**
Birth Rate	**1.26**
In-migration Rate (Joined)	**3.65**
Out-migration Rate (Left)	**8.49**

The age pyramid below shows the distribution of the total population of the surveyed households in Gwoza town. On this graph, we note a deficit in absolute value in men on the age group 18 - 49 (398 men versus 572 women).



Graph 1: Distribution of the population by age and sex

The context of Gwoza presents a heterogeneous population, constituted of internal displaced persons and the host community. It should be noted that displaced persons live at the same time in camps intended to welcome them but also in the host community. Thus, the tables below present the households members surveyed according to their reasons of arrival on the one hand and their period of arrival on the other hand.

Table 10: Reason of arrival and period of arrival for all households members surveyed

REASON FOR ARRIVAL	Frequency	Percentage	Cum. Percentage
returning close to home	2454	69.58%	69.58%
displacement	814	23.08%	92.66%
Other	259	7.34%	100.00%
Total	**3527**	**100.00%**	**100.00%**
ARRIVAL FROM			
Maiduguri	681	19.30%	19.30%
villages in Borno	1531	43.40%	62.70%
other state	1125	31.89%	94.59%
Cameroun	15	0.43%	95.01%
other	176	4.99%	100.00%
Total	**3528**	**100.00%**	**100.00%**
PERIOD OF ARRIVAL			
≤ 1 month	93	2.64%	2.64%
> 1 months - ≤ 3 months	71	2.01%	4.65%
> 3 months	3364	95.35%	100.00%
Total	**3528**	**100.00%**	**100.00%**

Up to 23% of people surveyed are displaced persons. According to their formal location, 43.40% come from villages in Borno; less than 1% of them are coming from Cameroun.

The table below show that among people arrived in Gwoza less than 1 month before the survey, 23.66% are displaced person.

Note that the answer Other both in reason for arrival and formal location is constituted of people that joined Gwoza for visitation (wedding, condolences etc…) or people that have never travel out of the town (New born, native etc…).

Table 11: Displaced people and their period of arrival in the Gwoza town

	REASON FOR ARRIVAL							
PERIOD OF ARRIVAL	**Returning close to home**		**Displacement**		**Other**		**Total**	
	n	**%**	**n**	**%**	**n**	**%**	**N**	**%**
≤ 1 month	16	17.20	22	23.66	55	59.14	93	100
> 1 months - ≤ 3 months	28	39.44	2	2.82	41	57.75	71	100
> 3 months	2410	71.66	790	23.49	163	4.85	3363	100
TOTAL	**2454**	**69.58**	**814**	**23.08**	**259**	**7.34**	**3527**	**100**

10.3. Anthropometric and immunization results

- **Anthropometric results**

As mentioned already, 546 children aged 6 to 59 months were included from the sampled households. Of these children, 281 were boys while 265 were girls as shown in the table below.

Table 12: Distribution of age and sex of sample

	Boys		**Girls**		**Total**		**Ratio**
AGE (month)	**no.**	**%**	**no.**	**%**	**no.**	**%**	**Boy:girl**
6-17	81	54.7	67	45.3	148	27.1	1.2
18-29	67	52.3	61	47.7	128	23.4	1.1
30-41	55	47.8	60	52.2	115	21.1	0.9
42-53	68	51.9	63	48.1	131	24.0	1.1
54-59	10	41.7	14	58.3	24	4.4	0.7
Total	**281**	**51.5**	**265**	**48.5**	**546**	**100.0**	**1.1**

Boys and girls are equally represented in our sample as shown by the sex ratio of 1.1 (between 0.8 and 1.2) and thus the survey was unbiased for gender.

Global Acute Malnutrition (GAM) according to MUAC is defined as proportion of children with a MUAC <125 mm with or without edema. Also, Severe Acute Malnutrition (SAM) is defined as the proportion of children with a MUAC <115 mm with or without oedema. Anthropometric data were collected in 500 children and tables below show the distribution of acute malnutrition cases according to MUAC by age group and sex.

Table 13: Prevalence of acute malnutrition based on MUAC cut off's (and/or oedema) and by sex

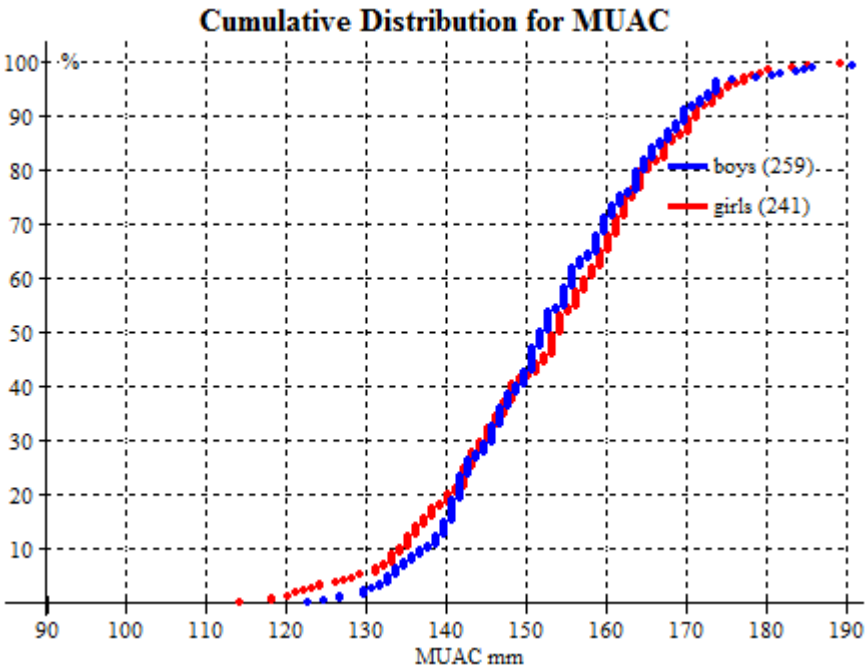
	All n = 500	**Boys** n = 259	**Girls** n = 241
Prevalence of Global Acute Malnutrition **(GAM)** **MUAC < 125 mm or edema**	(10) **2.0 %** (1.0 - 3.8 95% C.I.)	(1) **0.4 %** (0.1 - 2.8 95% C.I.)	(9) **3.7 %** (1.8 - 7.7 95% C.I.)
Prevalence of Moderate Acute Malnutrition **(MAM)** **MUAC < 125 and MUAC >= 115 mm, no edema**	(9) **1.8 %** (0.9 - 3.6 95% C.I.)	(1) **0.4 %** (0.1 - 2.8 95% C.I.)	(8) **3.3 %** (1.5 - 7.3 95% C.I.)
Prevalence of Severe Acute Malnutrition **(SAM)** **MUAC < 115 mm and/or edema**	(1) **0.2 %** (0.0 - 1.5 95% C.I.)	(0) **0.0 %** (0.0 - 0.0 95% C.I.)	(1) **0.4 %** (0.1 - 3.2 95% C.I.)
% of oedema (n=0)	**0.0%**		
mean±SD of MUAC (n=517)	**152.9 ± 13.6**		
Design effect MUAC <125mm	**1.03**		

Difference between boy and girl is significant: Chi2 = 7.14; P-value = 0.007< 0.05. No oedema case was recorded in this assessment.

Table 7 presents the prevalence of acute malnutrition in the survey area desegregated by age. The most affected age group is children aged 6-17 months (5.2% of MAM and 0.7% of SAM).

Table 14: Prevalence of acute malnutrition by age, based on MUAC cut off's and/or oedema

		SAM (< 115 mm)		**MAM (>= 115 and < 125mm)**		**Normal (> = 125 mm)**		**Oedema**	
Age (month)	**Total no**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**
6-17	134	1	0.7	7	5.2	126	94.0	0	0.0
18-29	123	0	0.0	2	1.6	121	98.4	0	0.0
30-41	100	0	0.0	0	0.0	100	100.0	0	0.0
42-53	122	0	0.0	0	0.0	122	100.0	0	0.0
54-59	21	0	0.0	0	0.0	21	100.0	0	0.0
Total	**500**	**1**	**0.2**	**9**	**1.8**	**490**	**98.0**	**0**	**0.0**



Graph 2: Cumulative Distribution of MUAC by Gender

- **Measles immunization results**

Immunization coverage in measles for children aged 9 to 59 months was evaluated in two ways: on presentation of a vaccination card justifying the effective vaccination and then according to the responses of the mother/caretaker of the child. A total of 464 children of this age group were assessed on measles vaccination.

Thus, vaccination coverage in measles only on presentation of a vaccination card is 13.15%. In addition, the coverage according to the mother/caretaker and on presentation of a vaccination card is 65.30%. The table below gives us a detailed description of the different measles vaccine coverage obtained during this survey.

Table 15: Measles vaccine coverage in children aged 9 to 59 months.

Measles	Frequency	Percentage (%)	95% Conf Limits	Cum. Percentage(%)
Yes with card	61	**13.15**	10.37 - 16.53	13.15
Yes oral	242	**52.16**	47.61 - 56.66	**65.30**
No	160	34.48	30.30 - 38.92	99.78
Don't know	1	0.22	0.04 - 1.21	100.00
Total	**464**	**100.00**	-	100.00

An analysis of the results by sex of vaccinated versus unvaccinated children is presented in the table below. Here the status of vaccinated includes children vaccinated with vaccination card and those whose mother/caretaker has claimed to be vaccinated (without vaccination card).

Table 16: Immunization status by sex, children aged 9 to 59 months.

	STATUS		
SEX	**Not vaccinated**	**Vaccinated**	**Total**
F	79 (49.07%)	150 (49.50%)	229 (49.35%)
M	82 (50.93%)	153 (50.50%)	235 (50.65%)
Total	161 (100%)	303 (100%)	464 (100%)

There is no significant difference between girl and boy according to the status of vaccinated or not (Chi2 = 0.008, P-value = 0.928> 0.05).

10.4. Retrospective mortality results

The death rate indicates the number of people in the sample who died during the recall period, being 96 days for our study. It is expressed in number of deaths/10,000 people/day. Standards set by the WHO in 2006 classify the different rates obtained within a population during surveys to decide on the conduct to be held. The table 7 gives us the different thresholds set.

For this study, the Crude Death Rate (CDR) and that of children under 5 years (U5DR) were calculated and recorded in the following table:

Table 17: Mortality rates in the general population, by age group, and by sex

Variables	Crude Death Rate/10,000 people/day (95% CI)	Design Effect
Overall (CDR)	**0.28 (0.16-0.51)**	1
Sex		
Male	**0.27** (0.10-0.69)	1
Female	**0.30** (0.13-0.70)	1
Ages		
0-4 (U5DR)	**0.36 (0.09-1.48)**	1
5-11	0.00 (0.00-0.00)	1
12-17	0.00 (0.00-0.00)	1
18-49	**0.21** (0.05-0.87)	1
50-64	**0.53** (0.07-3.76)	1
65-120	**2.83** (1.03-7.57)	1

The main causes and places of death recorded during this study are presented in the following table:

Table 18: Main causes of deaths and locations

Causes of deaths	%	Location of death	%
1] Unknown	0	1] In current location	66.7
2] Injury/Traumatic	11.1	2] During migration	0.0
3] Illness	88.9	3] In place of last residence	11.1
		4] Other	22.2

11. DISCUSSION

The assessment of nutritional status and retrospective mortality in Gwoza town yielded the following key findings:

- A prevalence of GAM according to the MUAC of 2.0 % (1.0 - 3.8%, 95% C.I.);
- A prevalence of MAM and SAM of 1.8 % (0.9 - 3.6%, 95% C.I.) and 0.2 % (0.0 - 1.5%, 95% C.I.) respectively;
- A measles vaccine coverage of 13.15% and 65.30% on presentation of a vaccination card and according to the mother/caretaker respectively;
- A CDR of 0.28 (0.16-0.51) and a U5DR of 0.36 (0.09-1.48);

The prevalence of GAM obtained is below 7% (alert threshold, Nutrition Guidelines, MSF 2014). Similarly, the prevalence of SAM of 0.2% is below the alert threshold range of 1.5 - 3% (alert threshold, Nutrition Guidelines, MSF 2014).

These parameters (GAM and SAM) associated with mortality locate us generally according to the MSF classification in food secure context.

It should be noted that the most affected age group is 6 to 17 months, which alone accounts for 5.9% of GAM and 0.7% of SAM. These results can be explained by the fact that it is at this age that the child enters the phase of weaning and for lack of food adapted to its needs, he is confronted with a problem of under nutrition. Here we think that in a context of limited resources and facing crises, but also the lack of knowledge about infant feeding, parents are not able to provide adequate food to cover the needs of their children. Moreover, there is a significant difference between the prevalence of GAM obtained in boys and that recorded in girls (Chi2 = 7.14; P-value = 0.007$<$ 0.05). The MSF ITFC total admission shows also the same result. In 2018, 130 boys and 173 girls were admitted with a sex ratio of 1.3 (P-value = 0.01350 $<$ 0.05). This rather surprising difference could be related to sociological and cultural factors whose in-depth evaluation must be done in order to explain these results and propose solutions.

Although no previous survey have been conducted in the same survey area (Gwoza town) in the past which could be used for comparison. Nutritional and mortality surveys have been conducted previously by other agencies in Borno State which although the data cannot be directly comparable (due to difference in survey areas definition). However, a rough comparison between the results of this survey and that conducted by Action Against Hunger (AAH) in the Borno State shows a significant difference in the prevalence of GAM (2.0% versus 9.0%) and SAM (0.2% versus 3.1%). Note that, AAH survey was conducted in August 2018, which falls within the lean season. This season is characterized according to the World

Food Program by reduced household level stocks and decline in market supply of food commodities and it's the peak of the hunger seasons. Further, the SAM admission data shows that this season is characterized by increased admissions in the OTP Programs with the peak being in August, and also high morbidity especially increased malaria.

The retrospective mortality evaluated between October 1st, 2018 and the date of data collection presents a CDR and a U5DR below the WHO standard alert threshold (1 and 2 deaths/10,000 people/day for CDR and U5DR respectively). These results show that the death rate in the study area is under control. For the same reasons mentioned above, it is difficult to make comparisons with previous results to our study. Nevertheless, our findings are in the same line with Save the Children International assessment done in August 2018 where the CDR and U5DR was 0.79 [0.52-1.20] and 1.60 [0.83-3.07] respectively.

However, the results obtained suggest that men and women are affected equally (0.27 versus 0.30). Older people (over 50 years) have the highest mortality rates exceeding the emergency threshold. In addition, more than 66.7% of deaths occurred in the current location (Gwoza) and the main cause was the illness (88.9%).

Immunization coverage compared to Borno State remains low and below recommended standards. This low coverage does not protect people from a possible measles outbreak. An analysis of the results by sex showed us that there is no significant difference between boys and girls according to the status vaccinated or not.

12. CONCLUSION AND RECOMMENDATION

The present survey provided a picture of the current nutritional situation in Gwoza town (area controlled by Nigerian Army) and supplement nutritional monitoring data in Borno State.

Analysis of the results on the prevalence of global acute malnutrition reveals that the nutritional situation in the town of Gwoza does not suggest a state of alert; they reflect a situation generally of food secure. So, the food aid intervention and the nutrition intervention in the area are fulfilling their target of ensuring low malnutrition and food secured environment.

In view of the mortality results, we are below the alert threshold for both the crude death rate and the under 5 death rate (<1 for CDR and <2 for U5DR). As already highlighted above, these results show that the death rate in the study area is under control.

In addition, data on measles vaccination indicate an immunization coverage that does not favour group immunity that can stop possible epidemics.

Given the above results, the following recommendations were made:

- Continue nutritional surveillance (screening of malnutrition) and referencing cases through MSF Community Health Workers (CHW) already present in the communities;
- Strengthen the community referral system for malnourished children, and also consider training mothers for MUAC screening and referral;
- Strengthen health promotion activities and especially the Infant and Young Child Feeding (IYCF);
- Advocacy with other NGOs present in Gwoza for the strengthening and consolidation of the management of cases of malnutrition, particularly cases of MAM;
- Sensitize communities, especially mothers, about the benefits of immunization;
- Plan for mass immunization campaigns targeting children less than 5 years, and the campaigns can be integrated with other activities such as deworming and vitamin A supplementation;
- Assess the determinants of malnutrition in the area to understand in depth the reasons why girls are more affected by malnutrition than boys;
- Advocate for World Food Program (WFP) to continue Food Assistance to the entire population;

13. ANNEXES

Annex 1: Plausibility check for: nig_201812_msf_gwoza.as

Overall data quality

Criteria	Flags*	Unit	Excel.	Good	Accept	Problematic	**Score**
Flagged data (% of out of range subjects)	Incl	%	0-2.5 0	>2.5-5.0 5	>5.0-7.5 10	>7.5 20	**0** (%)
Overall Sex ratio (Significant chi square)	Incl	p	>0.1 0	>0.05 2	>0.001 4	<=0.001 10	**0** (p=0.494)
Age ratio(6-29 vs 30-59) (Significant chi square)	Incl	p	>0.1 0	>0.05 2	>0.001 4	<=0.001 10	**4** (p=0.031)
Dig pref score - weight	Incl	#	0-7 0	8-12 2	13-20 4	> 20 10	**0** (0)
Dig pref score - height	Incl	#	0-7 0	8-12 2	13-20 4	> 20 10	**0** (0)
Dig pref score - MUAC	Incl	#	0-7 0	8-12 2	13-20 4	> 20 10	**0** (4)
Standard Dev WHZ .	Excl	SD	<1.1 and	<1.15 and	<1.20 and	>=1.20 or	
.	Excl	SD	>0.9 0	>0.85 5	>0.80 10	<=0.80 20	**0** ()
Skewness WHZ	Excl	#	<±0.2 0	<±0.4 1	<±0.6 3	>=±0.6 5	**0** ()
Kurtosis WHZ	Excl	#	<±0.2 0	<±0.4 1	<±0.6 3	>=±0.6 5	**0** ()
Poisson dist WHZ-2	Excl	p	>0.05 0	>0.01 1	>0.001 3	<=0.001 5	**0** (p=)
OVERALL SCORE WHZ =			0-9	10-14	15-24	>25	**4** %

The overall score of this survey is 4 %, this is excellent.

There were no duplicate entries detected.

Missing or wrong data:
Percentage of children with no exact birthday: 100 %

Age distribution:
Month 6 : #####
Month 7 : ####################
Month 8 : ##############
Month 9 : #########
Month 10 : ##################
Month 11 : #########
Month 12 : ###############
Month 13 : ################
Month 14 : ################
Month 15 : ##################
Month 16 : ########
Month 17 : ######
Month 18 : ###########

Month 19 : #########
Month 20 : ##########
Month 21 : ######
Month 22 : ######
Month 23 : #########
Month 24 : ####################
Month 25 : ####################
Month 26 : ############
Month 27 : ##########
Month 28 : ########
Month 29 : #######
Month 30 : ############
Month 31 : #####
Month 32 : #######
Month 33 : #########
Month 34 : #######
Month 35 : ################
Month 36 : ##################
Month 37 : ########
Month 38 : ############
Month 39 : #########
Month 40 : #######
Month 41 : #####
Month 42 : ##########
Month 43 : ##########
Month 44 : ##
Month 45 : ######################
Month 46 : #######
Month 47 : ##########
Month 48 : ########################
Month 49 : #########
Month 50 : ##########
Month 51 : #####
Month 52 : ####################
Month 53 : ####
Month 54 : ######
Month 55 : ##########
Month 56 : #####
Month 57 : ##
Month 58 :
Month 59 : #

Age ratio of 6-29 months to 30-59 months: 1.02 (The value should be around 0.85), p-value = 0.031 (significant difference)

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

Age cat.	mo.	boys	girls	total	ratio boys/girls
6 to 17	12	81/65.2 (1.2)	67/61.5 (1.1)	148/126.7 (1.2)	1.21
18 to 29	12	67/63.6 (1.1)	61/59.9 (1.0)	128/123.5 (1.0)	1.10
30 to 41	12	55/61.6 (0.9)	60/58.1 (1.0)	115/119.7 (1.0)	0.92
42 to 53	12	68/60.6 (1.1)	63/57.2 (1.1)	131/117.8 (1.1)	1.08
54 to 59	6	10/30.0 (0.3)	14/28.3 (0.5)	24/58.3 (0.4)	0.71

```
6  to 59     54    281/273.0 (1.0)    265/273.0 (1.0)                      1.06
```

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

Overall sex ratio: p-value = 0.494 (boys and girls equally represented)
Overall age distribution: p-value = 0.000 (significant difference)
Overall age distribution for boys: p-value = 0.001 (significant difference)
Overall age distribution for girls: p-value = 0.079 (as expected)
Overall sex/age distribution: p-value = 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: **4** (0-7 excellent, 8-12 good, 13-20 acceptable and > 20 problematic), p-value for chi2: 0.616

Analysis by Team

Team	**1**	**2**	**3**	**4**	**5**
n =	87	108	115	124	112

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

	0.89	1.35	0.89	1.00	1.04

Sex ratio (male/female):

	1.12	1.16	1.02	0.77	1.38

Digit preference MUAC (%):

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

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

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

Team 1:

Age cat.	mo.	boys	girls	total	ratio boys/girls
6 to 17	12	11/10.7 (1.0)	12/9.5 (1.3)	23/20.2 (1.1)	0.92
18 to 29	12	10/10.4 (1.0)	8/9.3 (0.9)	18/19.7 (0.9)	1.25
30 to 41	12	7/10.1 (0.7)	6/9.0 (0.7)	13/19.1 (0.7)	1.17
42 to 53	12	15/9.9 (1.5)	10/8.8 (1.1)	25/18.8 (1.3)	1.50
54 to 59	6	3/4.9 (0.6)	5/4.4 (1.1)	8/9.3 (0.9)	0.60
6 to 59	54	46/43.5 (1.1)	41/43.5 (0.9)		1.12

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

Overall sex ratio: p-value = 0.592 (boys and girls equally represented)
Overall age distribution: p-value = 0.318 (as expected)
Overall age distribution for boys: p-value = 0.366 (as expected)
Overall age distribution for girls: p-value = 0.725 (as expected)
Overall sex/age distribution: p-value = 0.148 (as expected)

Team 2:

Age cat.	mo.	boys	girls	total	ratio boys/girls
6 to 17	12	21/13.5 (1.6)	17/11.6 (1.5)	38/25.1 (1.5)	1.24
18 to 29	12	11/13.1 (0.8)	13/11.3 (1.1)	24/24.4 (1.0)	0.85
30 to 41	12	11/12.7 (0.9)	9/11.0 (0.8)	20/23.7 (0.8)	1.22
42 to 53	12	14/12.5 (1.1)	10/10.8 (0.9)	24/23.3 (1.0)	1.40
54 to 59	6	1/6.2 (0.2)	1/5.3 (0.2)	2/11.5 (0.2)	1.00
6 to 59	54	58/54.0 (1.1)	50/54.0 (0.9)		1.16

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

Overall sex ratio: p-value = 0.441 (boys and girls equally represented)
Overall age distribution: p-value = 0.004 (significant difference)
Overall age distribution for boys: p-value = 0.053 (as expected)
Overall age distribution for girls: p-value = 0.153 (as expected)
Overall sex/age distribution: p-value = 0.002 (significant difference)

Team 3:

Age cat.	mo.	boys	girls	total	ratio boys/girls
6 to 17	12	16/13.5 (1.2)	14/13.2 (1.1)	30/26.7 (1.1)	1.14
18 to 29	12	12/13.1 (0.9)	12/12.9 (0.9)	24/26.0 (0.9)	1.00
30 to 41	12	12/12.7 (0.9)	15/12.5 (1.2)	27/25.2 (1.1)	0.80
42 to 53	12	15/12.5 (1.2)	15/12.3 (1.2)	30/24.8 (1.2)	1.00
54 to 59	6	3/6.2 (0.5)	1/6.1 (0.2)	4/12.3 (0.3)	3.00
6 to 59	54	58/57.5 (1.0)	57/57.5 (1.0)		1.02

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

Overall sex ratio: p-value = 0.926 (boys and girls equally represented)
Overall age distribution: p-value = 0.118 (as expected)
Overall age distribution for boys: p-value = 0.600 (as expected)
Overall age distribution for girls: p-value = 0.244 (as expected)
Overall sex/age distribution: p-value = 0.085 (as expected)

Team 4:

Age cat.	mo.	boys	girls	total	ratio boys/girls
6 to 17	12	19/12.5 (1.5)	13/16.2 (0.8)	32/28.8 (1.1)	1.46
18 to 29	12	15/12.2 (1.2)	15/15.8 (0.9)	30/28.1 (1.1)	1.00
30 to 41	12	10/11.8 (0.8)	22/15.3 (1.4)	32/27.2 (1.2)	0.45
42 to 53	12	10/11.7 (0.9)	15/15.1 (1.0)	25/26.8 (0.9)	0.67
54 to 59	6	0/5.8 (0.0)	5/7.5 (0.7)	5/13.2 (0.4)	0.00
6 to 59	54	54/62.0 (0.9)	70/62.0 (1.1)		0.77

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

Overall sex ratio: p-value = 0.151 (boys and girls equally represented)
Overall age distribution: p-value = 0.159 (as expected)
Overall age distribution for boys: p-value = 0.036 (significant difference)
Overall age distribution for girls: p-value = 0.356 (as expected)
Overall sex/age distribution: p-value = 0.003 (significant difference)

Team 5:

Age cat.	mo.	boys	girls	total	ratio boys/girls
6 to 17	12	14/15.1 (0.9)	11/10.9 (1.0)	25/26.0 (1.0)	1.27
18 to 29	12	19/14.7 (1.3)	13/10.6 (1.2)	32/25.3 (1.3)	1.46
30 to 41	12	15/14.3 (1.1)	8/10.3 (0.8)	23/24.6 (0.9)	1.88
42 to 53	12	14/14.0 (1.0)	13/10.1 (1.3)	27/24.2 (1.1)	1.08
54 to 59	6	3/6.9 (0.4)	2/5.0 (0.4)	5/12.0 (0.4)	1.50
6 to 59	54	65/56.0 (1.2)	47/56.0 (0.8)		1.38

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

Overall sex ratio: p-value = 0.089 (boys and girls equally represented)
Overall age distribution: p-value = 0.180 (as expected)
Overall age distribution for boys: p-value = 0.462 (as expected)
Overall age distribution for girls: p-value = 0.454 (as expected)
Overall sex/age distribution: p-value = 0.038 (significant difference)

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

Annex 2: standardisation test results for muac

	subjects	mean	SD	max	Technical error	TEM/mean	Coef of reliability	Bias from superv	Bias from median	result
	#	mm	mm	mm	TEM (mm)	TEM (%)	R (%)	Bias (mm)	Bias (mm)	
Supervisor	10	147.4	15.6	3	1.22	0.8	99.4	-	3.4	TEM good
Enumerator 1	10	147.4	15.5	4	1.69	1.1	98.8	-0.05	3.35	TEM good
Enumerator 2	10	148.4	14.2	4	1.47	1	98.9	0.95	4.35	TEM good
Enumerator 3	10	147.6	15.1	4	1.57	1.1	98.9	0.25	3.65	TEM good
Enumerator 4	10	148.7	14.6	3	1.45	1	99	1.3	4.7	TEM good
Enumerator 5	10	147.9	15.2	5	2.31	1.6	97.7	0.55	3.95	TEM acceptable
Enumerator 6	10	149.5	15.4	7	2.12	1.4	98.1	2.1	5.5	TEM acceptable
Enumerator 7	10	146.8	14.5	4	1.45	1	99	-0.6	2.8	TEM good
Enumerator 8	10	149.8	15.9	4	1.47	1	99.1	2.35	5.75	TEM good
Enumerator 9	10	148.2	15	4	1.64	1.1	98.8	0.8	4.2	TEM good
Enumerator 10	10	147.1	15.1	4	1.72	1.2	98.7	-0.35	3.05	TEM good
enum inter 1st	10x10	148.1	14.8	-	2.25	1.5	97.7	-	-	TEM acceptable
enum inter 2nd	10x10	148.2	14.8	-	1.96	1.3	98.2	-	-	TEM good
inter enum + sup	11x10	148.1	14.8	-	2.04	1.4	98.1	-	-	TEM acceptable
TOTAL intra+inter	10x10	-	-	-	2.72	1.8	96.6	0.73	4.06	TEM poor
TOTAL+ sup	11x10	-	-	-	2.64	1.8	96.8	-	-	TEM acceptable

Annex 3: sampled clusters for Gwoza

Geographical unit	Population size	Cluster
Ajari - HC/5	1153	1
Ajari - HC/31	1400	2
Bulabulin - HC/37	1252	3
Bulabulin - HC/39	1266	4
Bulabulin - HC/40	2295	5,6
Bulabulin - HC/41	1810	7
Gadamayo - 20 housing IDP Camp/13	1518	8
Gadamayo - 20 housing IDP Camp/14	1996	9
Gadamayo - 20 housing IDP Camp/15	1100	10
Gadamayo - HC/2	1428	11
Gadamayo - HC/3	1233	12
Gadamayo - HC/6	1515	13
Gadamayo - HC/7	1669	RC
Gadamayo - HC/9	896	14
Gadamayo - HC/11	1120	15
Gadamayo - HC/16	1107	16
Guduf - HC/34	944	17
G. Wakane - GSS IDP Camp/4	3193	RC,18
G. Wakane - GSS IDP Camp/33	2483	RC
G. Wakane - HC/17	1828	19
G. Wakane - HC/18	1627	20
G. Wakane - HC/19	2180	21,22
G. Wakane - HC/20	3036	23
G. Wakane - HC/21	1999	24,25
G. Wakane - HC/22	1975	26
G. Wakane - HC/24	1366	27
G. Wakane - HC/35	1199	28
G. Wakane - IDP Camp/26	1109	29
G. Wakane REB - HC/23	2062	30
G. Wakane REB - HC/36 A	1238	RC
Hausari - HC/28	977	31
Hausari - HC/29	1787	32
Hausari - HC/30	2433	33

Annex 4: questionnaire

NutMort Borno Survey_Questionnair

Annex 5: survey team

	Name	Telephone
Team 1	HASSAN HAMADINA	
	MOHAMMED BULAMA	
Team 2	ALI TADA DAGWAZA	
	DAHIRU BUKAR	
Team 3	HAMIDU HAMAN	
	RABIYATU BUBA	
Team 4	MUHAMMED BELLO BASHIR	
	SHEHU UWA	
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Annex 6: map of the Borno state showing the 27 LGAs.