ON EVIDENCE-BASED FINDINGS OF THE NUTRITION AND RETROSPECTIVE MORTALITY SURVEY CONDUCTED IN AUGUST 2021, IN MAIDUGURI, BORNO STATE, NIGERIA

Anthony Ekpo
Federal University of Agriculture, Makurdi, Nigeria
E-mail: ekpo.anthony@uam.edu.ng
Phone Number: +234 803 463 4602

ABSTRACT

We present evidence-based findings of the Nutrition and Retrospective Mortality Survey, conducted in August, 2021 in Maiduguri, Borno State, Nigeria. The study was conducted during the insurgency period, when Boko Haram (A popular armed group) consistently attacked the Northern part of Nigeria especially the North-eastern States of Borno, Adamawa and Yobe (the BAY States). The survey's overall objective was to determine the magnitude and severity of malnutrition and retrospective mortality rates among the under-five children and by extension the entire population in Bolori-II, Nigeria with the hope for a more oriented and well-designed intervention which would also contribute in up-scaling the Nutrition program in Bolori II and Borno State in general. The survey was also able give an idea on the nutritional status of children in the area prior to the COVID-19 pandemic, when apparently there was suspension of activities for greater parts of 2020. Overall, the outcome of the survey was able to give policy direction that ultimately boosted the nutritional and health status of the vulnerable children and others living in the community. Community members from 40 randomly selected clusters in Bolori II were assessed to determine the prevalence rates of acute malnutrition among children 6 to 59 months of age using WHZ, WFA, HFA, MUAC and bilateral oedema approach.

Key Words: *Nutrition survey, Retrospective, Mortality survey, Prevalence rates and Selected Clusters*

1.0 METHODOLOGY

In this study, a cross sectional survey procedure was employed, using a two-stage cluster sampling technique based on Probability Proportional to Size (PPS), which is useful in a Nutrition and Mortality survey, this is to allow for a more proportional representation from villages/wards according to their population sizes. The numbers of inclusion in the survey were kept to an absolute minimum with a view to maximizing interview time. The sample sizes were at necessary minimum to ensure minimal acceptable precision as per the Standardized Monitoring and Assessment of Relief and Transitions (SMART) guidelines. The survey followed the usual methods for measuring Mid-Upper Arm Circumference (MUAC), weight, height and age of children (0-59 months) using well trained measurers according to the SMART guideline. All the 24 enumerators and 4 supervisors were recruited were <60 years of age to avoid the risk of COVID-19 complications. The full SMART assessment, targeted all the nine (9) sub-wards in Bolori II community, with a seemingly heterogeneous characteristics as shown by their hypothetically estimated population size extracted and sourced from the Premiere Urgence Internationale (PUI) Food Security Surveillance (FSS) unit based on current population knowledge of the area. This was however used strictly to enable and ease the process of cluster selections based on existing frame at the planning stage of the survey. Here, we considered a household to comprise a group of people man, one wife or even if he has more than two wives, her children and any of the husband's relatives living under the same roof, and sharing food from the same pot (WFP).

1.0.1 Sample Size Calculation

The sample size for the Anthropometric and Mortality surveys were calculated using the ENA for SMART software version 2020 (updated 11th Jan, 2020).

The sample size (n) for the nutrition component of the survey was calculated based on a prior estimated prevalence of 11.1% of Global Acute Malnutrition (GAM), a desired precision of ±3.5% and a design effect of 2.3, all the parameters are from a previous survey of 2019. The resulting sample size was 573 households and 775 children 6-59 months. These sample sizes were based on 26.8% of children under-five years of age, with an expected average of 6.3 (approximately 6) members per household and assuming a 11% non-response rate. Theoretically, n is given by:

$$n = \left[\frac{t^2(p)(1-p)(DEFF)(1.05)}{d^2(pc)(hz)} \right] \ldots.. \quad (1)$$

where;

n = required sample size, expressed as number of households

t = is a factor to achieve 95% confidence interval

p = is the estimated value of the indicator/expected prevalence 1.05=factor necessary to raise the sample size by 5 % for non-response

$DEFF$ = Design effect

D = relative desired precision

pc = proportion of children under five years,

hz = average household size (that is, average number of persons per household).

1.0.2 First Stage Sampling Procedure: Selection of Clusters

The study population comprises all individuals identified in the 9 settlements (Sub-wards) in Bolori II, with their housing pattern traditionally arranged in clusters (Bulamas). 40 clusters were randomly selected based on PPS using the table of assigning clusters on ENA for SMART 2020 (Jan 11, version) platform. The 9 sub-wards were considered as the Primary Sampling Unit (PSU) while the households; the Basic Sampling Units (BSU). The selected 40 clusters were based on the list of wards/sub-wards gathered over the years by PUI in conjunction with the Bolori II community leaders/key informants in the course of the FFS intervention project from 2017-2021. All selected wards were fully accessible during the survey. At least 15-20 eligible children from the 20 selected households that were aged 0-59 months for weight-for-height (WFH) and 6-59 months for MUAC assessments were included in the survey. The clusters generated as Reserved Clusters (RCs) were kept only if 10% or more clusters were not possible to be surveyed. In each cluster selected, team members from the PUI Nutrition and FSL units, together with the Bulama in-charge of the ward were on ground to provide further information and guidance about the ward/cluster.

1.0.3 Second Stage Sampling Procedure: Household Selection

Since the arrangement of houses/settlements in most parts of Bolori II are systematic in nature, the second stage of sampling which consisted of selecting households within each cluster was based on the systematic random selection procedure. Household listing maintained the existing door-to-door marking by PUI Food Security and Livelihood (FSL) unit and those used for Expanded Program on Immunization (EPI) activities in the area, with support from the community leaders (Lawans and Bulamas), four (4) PUI field staff members and the survey supervisors. This arrangement served as the sampling frame for the subsequent selection of approximately 20 random households per cluster for the nutrition survey, i.e., 775/40. The sampling interval (SI) was based on the division of the total number of sampling units in the cluster by the number of sampling units to be to surveyed. Therefore:

$$\text{SI}=\frac{Total.number.of.sampling.units.in.the.cluster}{Number.of.sampling.units.to.be.surveyed(20)}..(2)$$

A random number generator was used to randomly select a start number, between 1 and the sampling interval, to identify the first household (A random app downloaded into the mobile phone of the team leaders was used as the random number generator and this was demonstrated during the training). The sampling interval was then used to identify all subsequent households to be included in the survey. An illustration was given that: Suppose 44 is the sampling interval and the first household to be visited is household number 10, then the second would be 10+44=54, i.e., household number 54, so the enumerators sequentially skip 43 houses after house number 10 and begin enumeration in house number 54. If there were more than two households in any house systematically selected, only two randomly selected households with eligible children were measured before proceeding to the next house. The household listing form in was used as a control during the field selection.

Every household was asked for voluntary consent to take part in the survey before they were interviewed. All children 0-59 months living in the selected house were included for anthropometric measurements, including twins and orphans or unrelated children living with the sampled household. Households without this category of children were only assessed for mortality and Pregnant and Lactating Women (PLW) nutritional status. When a selected household was found to comprise one husband and several wives with their respective children, the entire household was enumerated.

Mortality interview was administered first to the household including any of the head of household's relatives living with them at the time of the survey. Anthropometric measurement for the eligible children in that household was then taken and thereafter the Infant Young Child Feeding (IYCF) and Women (15-49 years old) nutritional status questionnaires were administered respectively; using the same cluster as that of mortality, but with a specific sample size targeted for the IYCF. If there were no eligible children in a household, the enumerator uses the cluster control form to do a summary of the enumeration outcome in that household, and then move to the next house. Absent households or households with absent children were revisited once, at the end of the day with cluster control form appropriately filled.

1.0.4 Retrospective Mortality

Demography and mortality status were assessed for all selected household members, regardless of the presence of children. All members of the household were enumerated according to the household definition. The mortality component of the survey was based on a 1.52/10000pp/day estimated death rate, a precision of $\pm$ 0.5/10000/day, 2.3 design effect and recall period of 130 days (28th March, 2021 - 6th August, 2021 (Easter festival - After the last Id el Kabir festival). The resulting sample size as obtained from ENA for SMART version 2020 (updated in Jan., 11th 2020) were 4499 persons or 802 households based on average household size of 6 persons (6.3) with a non-response rate of 11%. The listing began from the head of the household, the wife/wives, all the children to the last child and thereafter the relative(s) of the head of the household or those of his wife that were present at the time of the survey. The Crude Death Rate was calculated by ENA Software for SMART using the following formula:

$$CDR = \frac{Number.of.deaths \times 10{,}000.persons}{Population.at.mid-int\,erval \times time.int\,ervals.in.days} \ldots (3)$$

The Under-5 Death Rate was calculated by ENA Software for SMART using the following formula:

$$U5DR \frac{Number.of.deaths.of.U5s \times 10{,}000.U5s}{population.of.U5s.at.mid-int\,erval \times Time.int\,erval.in.days} (4)$$

2.0 DATA COLLECTION

The variables of interest such as age, sex, weight, height, oedemas, MUAC, measles and polio vaccinations, Vitamin A coverage, presence of ARI and diarrhea were collected during anthropometric measurement. Standardized questionnaires for nutrition and mortality as recommended for SMART methodology nutrition and mortality survey, which were coded in ODK (Open Data Kit) and formatted on Android smartphone tablets, with one for each team, was used for the data collection and electronic entry. Questionnaires for the IYCF, caregiver's MUAC, immunization and child morbidity were also coded alongside the two standard questionnaires. Daily data collected by each team were subjected to plausibility checks. All survey team members were provided with face masks and gloves; and all household members who were directly in contact with the survey team were encouraged to also wear a face mask before the start of the interview. During the interview, the interviewer and respondent maintained a good distance of at least one (1) meter apart, even with the face mask on. Constant hand-washing and hand-sanitizing were also strictly enforced with the provision of hand sanitizers to all the teams.

Age: A child's age in months was determined from the birth date by interviewing the mother or an adult member of the household using mainly a local event, which was made available or by using the vaccination card reporting the child birth date if possible. **Height/Length:** The height of a child (0-59 months) was measured bare-headed and bare-footed with a wooden measuring board and reported with a precision of 0.1cm. Any child who was two years or more was measured in the upright position, while those less than two years had their length measured in the lying down position. **Weight:** The weight was measured with an electronic scale and reported with a precision of 0.1kg. The scale had a 2-in-1 (mother/child) function. Children who could easily stand up were weighed on their own. All scales were checked for accuracy each morning before departure, their calibration were ensured before each measurement. Infants were measured with their mothers or caregiver and thereafter the difference was captured by subtraction. However, children were not measured bare body due to cold, but it was ensured that they were not measured with heavy clothing on.

MUAC: Mid-Upper Arm Circumference was measured on the mid-way point of a child's (6-59 months) and women's (15-49 years) left arm using a standard measuring tape with a precision of 0.1cm and converted to the nearest mm.

Oedema: Bilateral oedemas was diagnosed if an imprint was observed after 5-seconds pressure with the thumb on the dorsum of both feet of an eligible child and was recorded as "yes" or "no". All children with a MUAC smaller than 115mm or presence of bilateral oedemas or WHZ less than -3 Z-score according to WHO_{2006} growth standards were referred to the closest Out-patient Therapeutics Programme (OTP) by the team leader. Any suspected case that required confirmation by multiple team members were judiciously confirmed together with the supervisor. 17 Severe Acute Malnutrition (SAM) cases were discovered on-the-spot and referrals consequently issued. For the mortality questionnaire, questions such as the current household members present as at the time of the data collection, age of respondents, sex, persons that joined the household within the 130 days recall period, persons that left the household within the recall period, children that were born within the 130 days recall period, and persons that died within the recall period we collected were using a standardize questionnaire.

3.0 DATA PROCESSING AND ANALYSIS

Data processing and analysis of the nutrition and mortality questionnaires were done using ENA for SMART software version 2020 (updated Jan, 11th 2020) and the results were given based on WHO_{2006} growth standards. 7 outlier values were excluded with SMART flags for deviating from the normalized curve of growth for both weight-for-height and height-for-age with -3 to 3 for WHZ, -3 to 3 for HAZ, -3 to 3 for WAZ for the survey population. Age of respondents were entered in months for children in anthropometric measurement, while age of respondents was entered in years for mortality survey and adult women MUAC. Zero was entered for ages of respondents below one (1) year old. However, all necessary precautions were taken to protect the privacy of respondents. Collected data sets were cleaned up and analyzed on ENA for SMART software version 2020 (updated on the 11th, Jan., 2020), Excel and SPSS platforms daily; and cleaning logs were maintained to track all changes from original raw data.

4.0 RESULTS ANTHROPOMETRY

All the prevalence rates considered in this survey were based on the exclusion of z-scores from observed mean SMART flags: WHZ -3 to 3; HAZ -3 to 3; and WAZ -3 to 3. Table 1 shows that the sex distribution is even, where the two sex curves mimics the normal curve, hence devoid of negative nor positive skewness with an overall sex ratio: p-value = 0.507 (boys and girls equally represented). Prevalence of acute malnutrition based on weight-for-height z-scores (and/or oedema) in table 2 gave GAM rate to be 15.8% and SAM rate to be 3.9% which indicates a critical threshold. The same is the case in terms of GAM and SAM rates for boys and that of girls. However, prevalence of oedema is presently 0.9%, with n=7 as against the 0.3% in the previous survey, an indication that cases of oedema exist now more than it was before the COVID-19 pandemic, hence more detailed attention needs to be paid on the nutritional needs of the under-fives.

Table 1: Distribution of Age and Sex of Sample

	Boys		Girls		Total		Ratio
AGE (mo)	**no.**	**%**	**no.**	**%**	**no.**	**%**	**Boy:Girl**
6-17	97	48.7	102	51.3	199	24.2	1.0
18-29	94	50.8	91	49.2	185	22.5	1.0
30-41	101	46.8	115	53.2	216	26.3	0.9
42-53	89	47.8	97	52.2	186	22.7	0.9
54-59	20	57.1	15	42.9	35	4.3	1.3
Total	**401**	**48.8**	**420**	**51.2**	**821**	**100.0**	**1.0**

The surveyed sample of children 6-59 months was 821 with 22 out of range. The distribution as dis-aggregated by age and sex are presented in Table 1 above. The overall sex ratio (male/female) 1.0, indicating a sample with equal representation of boys and girls with a slight excess of girls. The exact birth date was not possible to determine (through proper documents) for over 88% of the children; only less than 12% of the surveyed children had documentation of evidence of their exact date of birth. This may have compromised the quality of the age determination to some extent, and therefore may have impacted the estimation of the stunting and underweight prevalence as well.

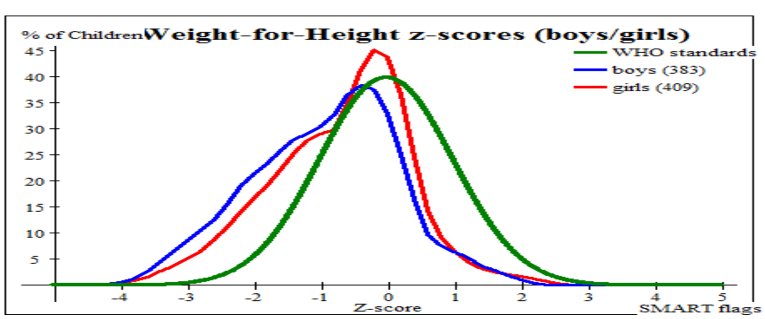


Figure 1: Gaussian distribution Curve for Sex of children (WFH).

As collaborated from table 1, figure 1 shows the normal distribution curve of the WFH z-score (in red and blue) which mimics the WHO standards normal curve (in green), with a mean of -0.82 and a standard deviation of curve 1.06

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

Usually, Weight for Height (WHZ) or mid-upper arm circumference (MUAC), in addition to bilateral pitting oedema presence effectively measures acute malnutrition by WHO/UNICEF Statement 2009. The WHZ based index is largely used as a nutritional or anthropometric index, the MUAC based index has a closer relation to infant and child mortality. However, children with oedema are most often classified as suffering from severe acute malnutrition (SAM), regardless of their MUAC and WHZ values. Therefore, acute malnutrition in children 6 to 59 months can be either moderate or severe. SAM is a very important indicator because it is the most dangerous form of malnutrition and it is closely linked to mortality risk. According to WHO and UNICEF Joint Statement, a child with severe acute malnutrition (WHZ <-3; and/or MUAC<115mm and/or bilateral oedema) has 9-fold increased risk of death compared to a child who do not suffer from acute malnutrition.

Table 2: Prevalence of acute malnutrition based on weight-for-height z-scores (and/or oedema) and by sex.

	All n = 799	**Boys** n = 389	**Girls** n = 410
Prevalence of global malnutrition (<-2 z-score and/or oedema)	(126) 15.8 % (13.0 - 19.1 95% C.I.)	(73) 18.8 % (15.1 - 23.0 95% C.I.)	(53) 12.9 % (9.3 - 17.7 95% C.I.)
Prevalence of moderate malnutrition (<-2 z-score and >=-3 z-score, no oedema)	(95) 11.9 % (9.4 - 15.0 95% C.I.)	(53) 13.6 % (10.4 - 17.7 95% C.I.)	(42) 10.2 % (6.9 - 14.9 95% C.I.)
Prevalence of severe malnutrition (<-3 z-score and/or oedema)	(31) 3.9 % (2.7 - 5.5 95% C.I.)	(20) 5.1 % (3.3 - 7.9 95% C.I.)	(11) 2.7 % (1.6 - 4.6 95% C.I.)

The prevalence of GAM as per WHZ among children 6-59 months in Bolori II was 15.8% (13.0 - 19.1 95% C.I.) as presented in Table 2 above and was categorized as critical. This prevalence seems slightly higher in girls than boys but difference is not statistically significant (P-value = 0.0613). The prevalence of SAM as per WHZ among children 6-59 months was 3.9% (2.7 – 5.5 95% C.I.) which is quite critical. However, the difference between the previous Global Acute Malnutrition (GAM) and SAM of 2019 and the rates now also not statistically significant with p-values of 0.3648 and 0.4341 respectively.

Table 3: Distribution of acute malnutrition and oedema based on weight-for-height z-scores

State of Oedema	**<-3 z-score**	**>=-3 z-score**
Oedema present	Marasmic kwashiorkor. 0 (0.0 %)	Kwashiorkor. 7 (0.9 %)
Oedema absent	Marasmic No. 37 (4.5 %)	Not severely malnourished. 777 (94.6 %)

The table 3 above shows that there are 7 (0.9%) cases of bilateral oedema identified during this survey indexed by WFH. Unlike WFH z-score, oedema does not exclude any outliers from the denominator, hence; all 821 children were included in the table.

4.0.2 Prevalence of acute malnutrition based on MUAC cut off's (and/or oedema) by sex.

Ideally, classifying children's nutritional status using MUAC criteria in combination with bilateral oedema is useful in diagnosis of SAM and referral into Community Management of Accute Malnutrition (CMAM) program. MUAC is preferred in screening of malnourished cases to Weight-for-Height (WHZ) because of its simplicity. The MUAC tapes (either in cm or mm) are easier to carry than the scales and easier to use for measuring children at community level.

Table 4:Prevalence of acute malnutrition based on MUAC cut off's (and/or oedema) by sex.

	All n = 825	**Boys** n = 402	**Girls** n = 423
Prevalence of global malnutrition (< 125 mm and/or oedema)	(76) 9.2 % (6.9 - 12.2 95% C.I.)	(31) 7.7 % (5.6 - 10.5 95% C.I.)	(45) 10.6 % (7.4 - 15.0 95% C.I.)
Prevalence of moderate malnutrition (< 125 mm and >= 115 mm, no oedema)	(45) 5.5 % (3.9 - 7.6 95% C.I.)	(18) 4.5 % (2.7 - 7.3 95% C.I.)	(27) 6.4 % (4.1 - 9.7 95% C.I.)
Prevalence of severe malnutrition (< 115 mm and/or oedema)	(31) 3.8 % (2.6 - 5.4 95% C.I.)	(13) 3.2 % (1.9 - 5.4 95% C.I.)	(18) 4.3 % (2.7 - 6.8 95% C.I.)

As presented in Table 4 above and figure 4 below, the prevalence of GAM as per MUAC among children 6-59 months in Bolori II is 9.2% (6.9-12.2 95% CI) and that of SAM was 3.8% (2.6-5.4 95% CI) and the difference in current GAM and SAM rates for boys and girls are not statistically significant with p-values of 0.4978 and 0.6879respectively.

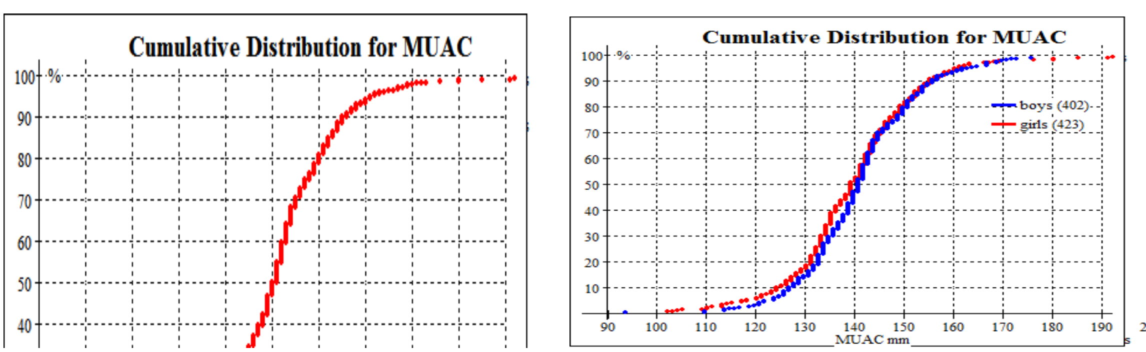


Figure 2: Cumulative distribution for MUAC (0-59) for all and aggregated by sex

The study revealed that the prevalence rate for GAM among the girls is higher than that for boys, this is also applicable in the SAM cases based on MUAC. Incidentally, this same scenario played out in the December 2019 survey, however, many surveys have shown how MUAC is more sensitive towards detecting cases among females than male children belonging to the younger age category (6-29) months, they are mostly identified by MUAC as compared to the older age category (30-59) months.

Table 5: Prevalence of acute malnutrition based on MUAC cut off's (and/or oedema) by severity and Age

		Severe wasting (< 115 mm)		Moderate wasting (>= 115 mm and < 125 mm)		Normal (> = 125 mm)		Oedema	
Age (mo)	**Total no.**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**
6-17	199	12	6.0	28	14.1	159	79.9	1	0.5
18-29	185	4	2.2	11	5.9	170	91.9	2	1.1
30-41	216	4	1.9	5	2.3	207	95.8	2	0.9
42-53	186	0	0.0	1	0.5	185	99.5	2	1.1
54-59	35	0	0.0	0	0.0	35	100.0	0	0.0
Total	821	20	2.4	45	5.5	756	92.1	7	0.9

When dis-aggregated by age group, 6-17 months had the highest MAM and SAM, as shown in Table 5. The older age groups 42-53 and 54-59 months had no SAM cases.

The younger age groups (6-29) were statistically more vulnerable to acute malnutrition compared to older groups (30-59) as per the MUAC criteria (p-value < 0.05).

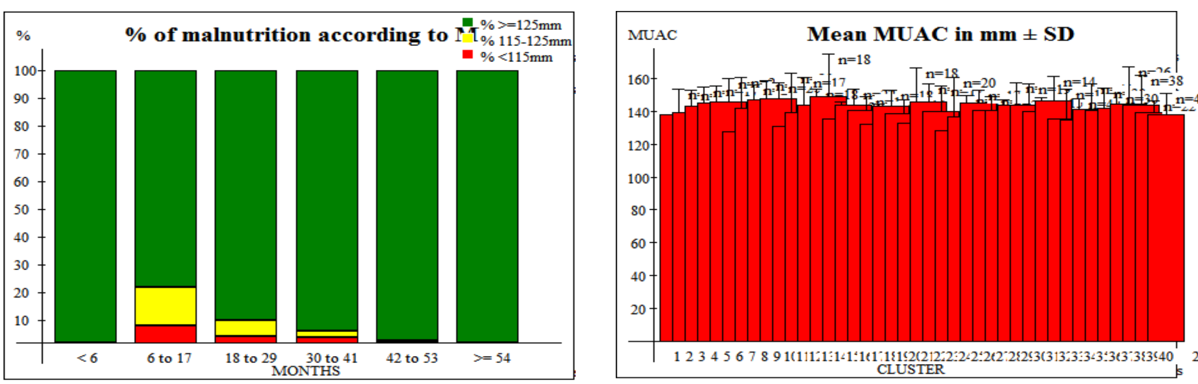


Figure 3: Percentage of Malnutrition based on MUAC (0-59) by age and cluster

Figure 3 shows that MUAC is more sensitive towards detecting cases among children belonging to the younger age category (6-41) months and the trend of mean MUAC within clusters, with children in cluster 13 and 6 having the highest and lowest mean MUACs respectively.

4.0.3 Combined GAM and SAM based on WHZ and MUAC cut off's (and/or oedema)

Obtaining the prevalence of GAM and SAM based on the combined WHZ and MUAC cut off's (and/or oedema) is the best way to estimate the actual caseload as many cases cannot be identified by one criterion only.

Table 6: Detailed numbers for combined GAM and SAM

Criteria	GAM Prevalence		SAM Prevalence	
	no.	**%**	**no.**	**%**
MUAC Criterion alone	43	5.2	21	2.5
WHZ Criterion alone	93	11.3	21	2.5
Both MUAC and WHZ Criteria	26	3.2	3	0.4
Oedema	7	0.8	7	0.8
Total	**169**	**20.5**	**52**	**6.3**

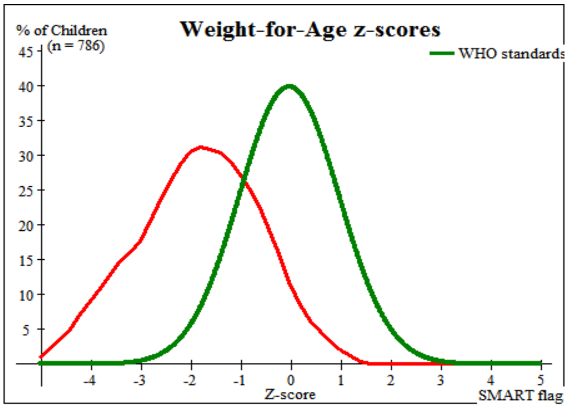
As shown in Table 6 above, by using all the criteria, i.e.; WHZ, MUAC, combined MUAC and WHZ and/or Oedema, the GAM rate was found to be 169 (20.5%) with the SAM rate of 52 (6.3%). Meanwhile, about 15.4% of the GAM rate (26/169) and 5.8% of the SAM (3/52) cases were detected with both WHZ and MUAC criteria. This gives an indication that there is a great need for the use of combined methods for case detection and admission criterion.

4.0.4 Prevalence of underweight based on weight-for-age z-scores by sex (0-59)

As presented in Table 7 below, the prevalence of underweight as per WAZ among children 6-59 months in Bolori II was 43.1% (38.1-48.3) %, 95% CI, therefore, according to WHO severity thresholds (<10 low, 10-<20 medium, 20-<30 high and 30≥ Very high) this prevalence is categorized "very high" while the prevalence of severe underweight as per WAZ among children 6-59 months was 18.4% (14.9 - 22.6) %, 95% CI, this is categorized as medium.

Table 7: Prevalence of underweight based on weight-for-age z-scores by sex (6-59)

	All n = 786	**Boys** n = 378	**Girls** n = 408
Prevalence of underweight (<-2 z-score)	(339) 43.1 % (38.1 - 48.3 95% C.I.)	(169) 44.7 % (39.4 - 50.1 95% C.I.)	(170) 41.7 % (35.2 - 48.5 95% C.I.)
Prevalence of moderate underweight (<-2 z-score and >=-3 z-score)	(194) 24.7 % (21.1 - 28.7 95% C.I.)	(96) 25.4 % (20.8 - 30.6 95% C.I.)	(98) 24.0 % (19.2 - 29.6 95% C.I.)
Prevalence of severe underweight (<-3 z-score)	(145) 18.4 % (14.9 - 22.6 95% C.I.)	(73) 19.3 % (15.3 - 24.1 95% C.I.)	(72) 17.6 % (12.6 - 24.1 95% C.I.)



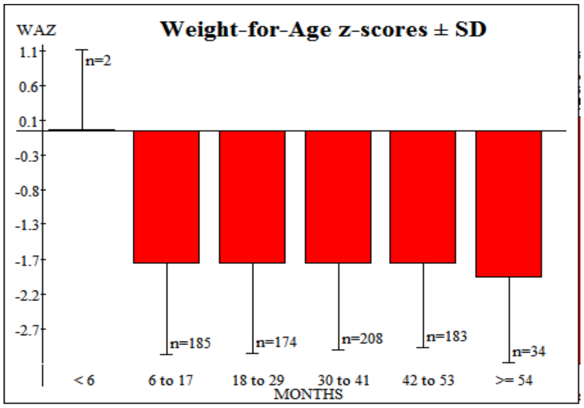


Figure 4: Distribution of WAZ compared to the WHO Reference curve and WAZ sample by Age

The WAZ distribution curve (in red) as compared to the WHO 2006 reference WAZ distribution curve (in green) as presented in figure 4 above demonstrates a downward shift to the left, suggesting a medium under-weighted population in comparison to the normal population. Further analysis suggests that linear underweight is at its highest in the group of children aged 54-59 months as shown in the chart on the right-hand side of figure 4.

4.0.5 Prevalence of stunting based on height-for-age z-scores and by sex (6-59)

The prevalence of stunting as per HAZ among children 6-59 months in Bolori II ward was 55.6% (50.1-60.9), 95% CI, and severe stunting was 28.0% (23.9 - 32.5), 95% CI as presented in Table 8 below. According to UNICEF-WHO prevalence thresholds, this prevalence was categorized as "Very High". This prevalence seems slightly higher in boys than girls but it is not statistically significant for instance, the difference in prevalence of stunting for boys and girls is statistically insignificant with p-value of 0.7400 while that of severe stunting is also statistically insignificant with p-value 0.8622.

Table 8: Prevalence of stunting based on height-for-age z-scores and by sex (6-59)

	All n = 707	**Boys** n = 338	**Girls** n = 369
Prevalence of stunting (<-2 z-score)	(393) 55.6 % (50.1 - 60.9 95% C.I.)	(194) 57.4 % (50.3 - 64.2 95% C.I.)	(199) 53.9 % (47.9 - 59.8 95% C.I.)
Prevalence of moderate stunting (<-2 z-score and >=-3 z-score)	(195) 27.6 % (23.6 - 31.9 95% C.I.)	(97) 28.7 % (24.1 - 33.7 95% C.I.)	(98) 26.6 % (21.9 - 31.9 95% C.I.)
Prevalence of severe stunting (<-3 z-score)	(198) 28.0 % (23.9 - 32.5 95% C.I.)	(97) 28.7 % (23.4 - 34.7 95% C.I.)	(101) 27.4 % (22.2 - 33.2 95% C.I.)

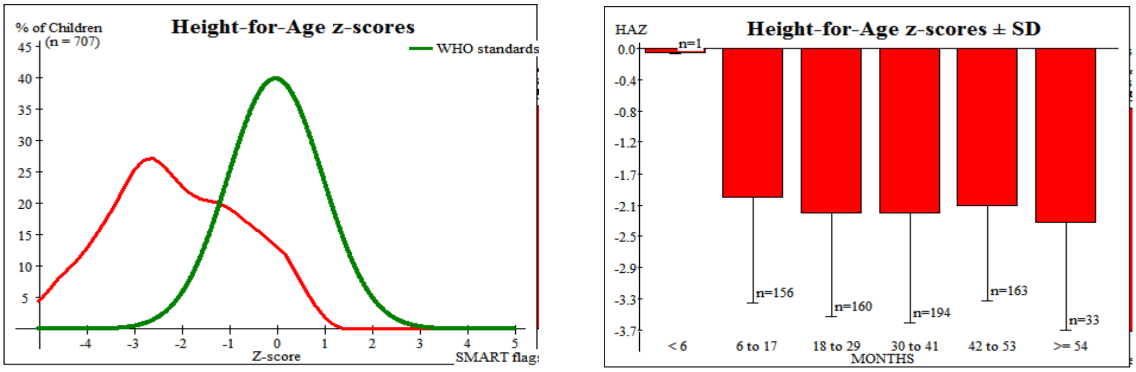


Figure 5: Distribution of HAZ compared to the WHO Reference curve and WAZ sample by Age

The HAZ distribution curve (in red) as compared to the WHO 2006 reference HAZ distribution curve (in green) as presented in Figure 5 above demonstrates a shift to the left, suggesting a very stunted population in comparison to the normal population. Further analysis suggests that linear severe growth retardation is at its highest in the group of children aged 54-59 months as shown

Table 9: 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	792	-0.82±1.06	1.44	11	22
Weight-for-Age	786	-1.83±1.21	2.07	7	32
Height-for-Age	707	-2.13±1.40	2.07	2	116

* contains for WHZ and WAZ the children with edema.

From table 9 above, one can clearly see that the standard deviation when indexed by WFH is smaller than the other two, i.e., WFA and HFA, hence more efficient among the three indicators compared here.

5.0 MORTALITY RESULTS

Mortality data collection was carried out first before the anthropometric measurements and every member in a selected household were enumerated. The Tables below give a summary of the mortality rates and statistics of the sampled population. The crude mortality and the under-5 mortality rates were calculated based on a recall period of 130 days. Apparently, even with the obvious movement in the Bolori II population, the CMR dropped slightly from the previous 1.52 (95% CI 1.03-2.22) deaths per 10,000 of the population per day to 1.50 (95% CI 1.15-1.96) deaths per 10,000. Meanwhile, the U5MR increased from the previous 1.51 (95% CI 0.72-3.12) deaths per 10,000 of the population per day to 2.44 (95% CI 1.53-3.88) deaths per 10,000 of the population per day. However, this increase is statistically not significant with a p-value of 0.6398. This increase may be attributed to the non-availability of enough food during the lean season and cumulative adverse effects the U5's may have suffered during the COVID-19 pandemic. Tables below further give a summary of the mortality results. This change even though not statistically significant is such that the and the U5MR and CMR of above 1 per 10,000 persons per day is an indication of emergency thresholds; as per the SPHERE and WHO standards. This can be addressed by improving on the overall healthcare system in the area at both Governmental and humanitarian levels.

Table 10: Crude Mortality and Under-5 Mortality Rates

Death Rates		
Category	**Rate (95% CI)**	**Design Effect**
CMR	1.50 (1.15-1.96)	1.19
U5MR	2.44 (1.53 - 3.88)	1.30

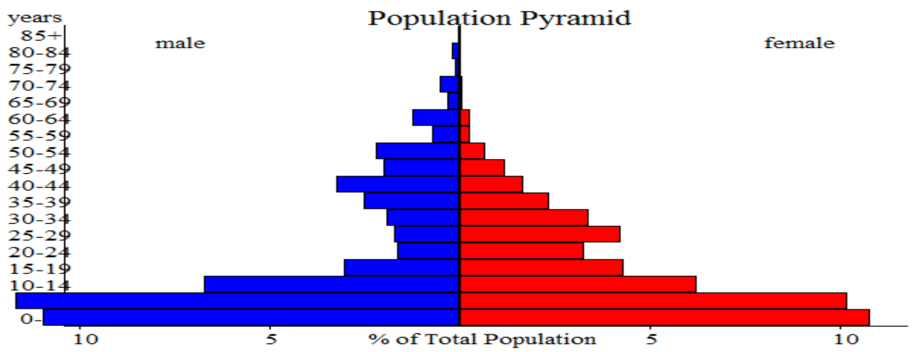


Figure 6: Population Pyramid

Table 11: Summary Statistics of respondents

Individual Results of Death Rates:	
Number of persons recorded within recall period	4860
Percentage of children under five	21.7
Mean household size	6.5
Total number of deaths during the recall period	67
Total number of deaths during the recall period <5 years old	24
Total number of HHs	797
% of non-response households	11

Table 11 above gives summary statistics of respondents enumerated for the mortality component of the survey.

6.0 CONCLUSION

1.) The prevalence of SAM of 3.9% (2.7 - 5.5, 95% CI) and GAM of 15.8% (13.0 - 19.1,95% CI) were found to be very critical and require more urgent intervention. It indicates that deterioration in food supply and availability is obvious in the location. These rates are higher than the 2019 SAM and GAM rates of 2.0 (0.9 - 4.2 95% CI) and 11.1% (7.7-15.6 95% CI) respectively. These critical rates were as predicted by the IPC Acute Malnutrition Analysis of September 2020-August 2021 for particularly MMC and Jere. Therefore, more efforts were to be put into strengthening available community nutrition programs to be able to maintain lower rates of SAM cases for treatment at facilities and scaling-up on overall nutrition surveillance strategies.

2.) Even though, there was a strong nutritional program in place for proper management of cases of malnutrition with well-trained health professionals and a strong supply chain of nutrition supplies, the revealed SAM and GAM rates signified an urgent need to increase food support to households with food challenges in the area, as well as cash in-flow, or more aggressive food voucher programs to cushion the effects of households suffering from food inadequacy. It was also recommended, that the extent of coverage in the area should be checked via a SQUEAC, as well as ascertaining if any barrier to access exist via a Barrier Analysis.

3.) Stunting prevalence was found to still be as high as 28.8% (23.9 - 32.5 95% CI) as against the previous 30.4% (25.0 - 36.5 95% CI), even though it dropped slightly, there was great need to further intensify the activities of the IYCF such as maternal education on appropriate child care practice with unlimited window of opportunity by specifically using the platforms of mother-to- mother groups, and mothers attending health facilities for ANC or bringing children for treatment. Overall, the need to embrace the multi-sector intervention approach to reach out to more maternal needs especially by involving more of these women in cash in-flow activities was emphasized, since the population keeps increasing by the day. The integration of other nutrition needs activities to ensure a comprehensive package for prevention such as drastic WASH interventions and aggressive health education at the community level was also desirable.

4.) There was a drastic increase in the rate of U5 Mortality which was previously 4.36% in 2017. 1.51% in 2019 and then 2.44% (1.53 - 3.88 95% CI), the sudden increase was attributed to the complications occasioned by the suffering and long hunger period as a result of the series of lockdown, thus suggesting that there was urgent need to intensify the level of improvements in the humanitarian assistance expected in the area. Even with that scenario, it was important to encourage continuous nutritional knowledge and good health practices among mothers and caregivers towards their children including the adult population.

5.) Generally, because of the population movements in and out of Bolori II as at the time of the study, the study saw that there was the need for further care to reach the people, this could be achieved by up-scaling the interventions both in nutrition services, health provisions and other improved livelihood gestures within the Bololi II ward and by extension sub-wards. In fact, other nutritional needs like WASH interventions which could further strengthen hygiene awareness could also go a long way in improving the overall well-being of the Bolori II inhabitants especially in the area of child morbidity.

7.0 REFERENCE

[1.] ACF (April, 2021); Integrated Nutrition and Mortality SMART Survey Report, Mamyan Province, Afghanistan.

[2.] ACF (August, 2017); Nutrition and Mortality SMART Survey Report, Mamyan Province, Afghanistan.

[3.] Cadre Harmonize (March, 2020); Results

[4.] Cadre Harmonize (Oct-Dec, 2019); Analysis National Validation Workshop, http://www.food-security.net/en/datas/nigeria.

[5.] ENA software for SMART 2020 updated 11th January, 2020.

[6.] FHI360 (2019); Preliminary SMART Survey findings in Bama, Damboa, Dikwa and Ngala LGAs, Borno State.

[7.] IPC Acute malnutrition Analysis, September 2020-August 2021, North-East Nigeria

[8.] The Lancet Series, September 2008, vol. 372 No. 9642

[9.] Indicators for assessing infant and young child feeding practices: definitions and measurement methods. Geneva: World Health Organization and the United Nations Children's Fund (UNICEF), 2021.

[10.] SCI (February, 2021); SMART Survey Report in Jere, Konduga, Mafa and MMC, Borno State.

[11.] NNHS (June, 2018); Nigeria Nutrition and Health Survey.

[12.] NiESWG (February, 2021); BAY States, NE Nigeria Report.

[13.] Nutrition and Food Security Surveillance, Round 8 Report, October 2019.

[14.] OCHA (August, 2016); Nigeria - Borno State: Humanitarian Briefing Note.

[15.] OCHA(July, 2020) Nigeria Situational Report.