Standardized Monitoring and Assessment of Relief and Transitions (SMART) Survey Report in Mayendit County, Unity State, South Sudan

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Table 1: List of Abbreviations

AMN	Acute Malnutrition
BHA	Bureau of Humanitarian Assistance
BSFP	Blanket supplementary feeding programme
CHD	County Health Department
CMR	Crude Mortality Rate
CI	Confidence interval (at 95% throughout report)
CMR	Crude Mortality Rate
DDG	Digital Data Gathering
EBF	Exclusive Breastfeeding
ENA	Emergency Nutrition Assessments
FCS	Food Consumption Score
FSL	Food Security and Livelihoods
FSNMS	Food Security and Nutrition Monitoring System
GAM	Global Acute Malnutrition
HFA	Height for Age
HAZ	Height for Age Z scores
HH	Household
HHS	Household Hunger Scale
IDP	Internally Displaced Persons
IMC	International Medical Corps
IPC	Integrated Phase Classification
IRC	International Rescue Committee
IYCF	Infant and Young Child Feeding
LCS	Livelihood Coping Strategies
MAM	Moderate Acute Malnutrition
MDD	Minimum Dietary Diversity
MM	Millimetre
MUAC	Mid Upper Arm Circumference
NGO	Non-Governmental Organization
NIWG	Nutrition Information Working Group
ODK	Open Data Kit
OTP	Out-Patient Therapeutic Programme
PLW	Pregnant and Lactating Women
PPS	Probability Proportional to Size

RC	Reserve Cluster
RRC	Relief and Rehabilitation Commission
SAM	Severe Acute Malnutrition
SD	Standard Deviation (measure of spread around the mean)
SMART	Standardized Monitoring and Assessment of Relief and Transitions
SP	Samaritan's Purse
TSFP	Targeted Supplementary Feeding Programme
U5MR	Under Five Mortality Rate
UNIDOR	Universal Intervention and Development Organization
WASH	Water Sanitation and Hygiene
WFH	Weight for Height
WHO	World Health Organization
WHZ	Weigh for Height Z Scores

Executive Summary

This SMART survey was conducted in all Payams of Mayendit county, Unity State, South Sudan from March 15th - March 25th, 2023. A two-stage sampling was used in this survey, in which, cluster sampling used for identifying the villages using proportion to population size (PPS) method and then simple random sampling used to identify households. A total of 730 children aged 6-59 months from across 556 households in 47 clustered villages in Mayendit County were surveyed for anthropometric data to assess their nutritional status. The final sample is more than the planned sample size of 479 children and there was no need to activate reserve clusters.

Table 2: Executive Summary Table

Category	Indicator	**n**	**N**	**(%) (95% CI)**
Wasting	Prevalence of global malnutrition by WHZ (<-2 z-score and/or oedema)	147	718	20.5 % (16.8-24.7 95% CI)
	Prevalence of severe malnutrition (<-3 z-score and/or oedema)	31	718	4.3 % (2.9-6.4 95% CI)
	Prevalence of global malnutrition by MUAC (< 125 mm and/or oedema)	41	730	5.6 % (3.9-8.0 95% CI)
	Prevalence of severe malnutrition (< 115 mm and/or oedema)	2	730	0.3 % (0.1-1.1 95% CI)
Stunting	Prevalence of stunting (<-2 z-score)	106	666	7.5 % (adjusted for SD=1)
Underweight	Prevalence of underweight (<-2 z-score)	145	723	20.1 % (16.9-23.6 95% CI)
	Prevalence of severe underweight (<-3 z-score)	44	723	6.1 % (4.2-8.7 95% CI)
Mortality	Crude Death Rate (Deaths/10,000 people/day)	16	556	0.51 % (0.33-0.79 95% CI)
	Under-5 Death Rate (Deaths/10,000 children U5/day)	2	556	0.23 % (0.06-0.93 95% CI)
Nutrition and Health Service Coverage	Measles (N= 689) card + mother confirmation	563	708	79.5 % (76.4-82.2 95% CI)
	De-worming (N= 658) (children12-59 months)	521	635	82 % (78.9-84.9 95% CI)
	Vitamin A Supplementation	597	736	81.1 % (78.4-83.8 95% CI)

Introduction

South Sudan, the world's youngest country having gained independence from Sudan in 2011, has faced internal conflict since 2013, causing widespread displacements, disrupted livelihoods, and chronically high levels of acute food insecurity and malnutrition in many parts of the country. A Peace deal was signed in September 2018, which resulted in improved security and increased access to affected populations for humanitarian assistance, and an increase in refugee and Internal Displaced Person (IDP) returnees to their communities. However, as of July 2021, there remains an estimated 2.26 million refugees from South Sudan residing in neighbouring countries (Uganda, Sudan, Ethiopia, Kenya, DRC)[1]. The consolidated findings from the IPC Technical Working Group and External Reviews shows an estimated 6.31 million people in South Sudan are likely experiencing high levels of acute food insecurity (IPC Phase 3 or above) between Dec 2022 and March 2023 and an estimated 1.4 million children under the age of five in South Sudan will likely suffer from acute malnutrition over the course of 2023. These include about 61,000 classifieds in IPC Phase 5 Catastrophe, during July and October 67% of the counties are classified under IPC Phase 4 (Critical) in Greater Upper Nile Region where Mayendit county in Unity State is one of the counties classified under IPC Phase 4[2] .

Mayendit County is located in Unity State and borders Koch County to the north, Leer County to the east, and Panyijiar County to the south-east. It also borders Lakes State (Rumbek North County) to the south-west, Warrap State (Tonj East and Tonj North Counties) to the west, and Jonglei State (Ayod County) via a narrow strip of land to the east. Mayendit County has 13 Payams namely; Madol 1, Madol 2, Bhor, Pabuong and Malkuer, Thaker, Mirinyal, Dablual, Tharjiathbor, Leah, Kuok, Tutnyang, Rubkuay & Jaguar. The 2022 population projection was 70,802 compared to 66,015 in 2020 and 53,783 in the 2008 census. The main ethnic group living in Mayendit are the Haak Nuer (Beek, Jalok, Kuey). Based on the recent IPC Analysis conducted in October 2022, Mayendit County was classified as Critical for projection one (IPC AMN Phase 4). During the lean season from April to July 2022, the food security situation is likely to deteriorate driven by the loss of productive assets linked to conflict, poor macroeconomic conditions, and large-scale crop and livestock losses associated with recurrent shocks during this period (ibid)

Mayendit county population is estimated to be 82,572 households (578,004 individuals) and the primary economic activity in Mayendit County is agriculture. However, with the people in Mayendit County being nomadic agro-pastoralists, they engage in both agriculture and rearing of livestock, especially cattle. With Mayendit being located alongside the river Nile, fishing also serves as a livelihood for some communities. International Rescue Committee (IRC) has been present in Mayendit since January 2021 and is implementing a resilience program with a focus on food security, gender-based violence, nutrition (community level), hygiene promotion, and social cohesion. IRC implements in six Payams of Mayendit County including Rubkuay, Thaker, Dablual, Bor, Tutnyang and Tharjiathbor. There are 11 OTP/TSFP sites and one SC which are all

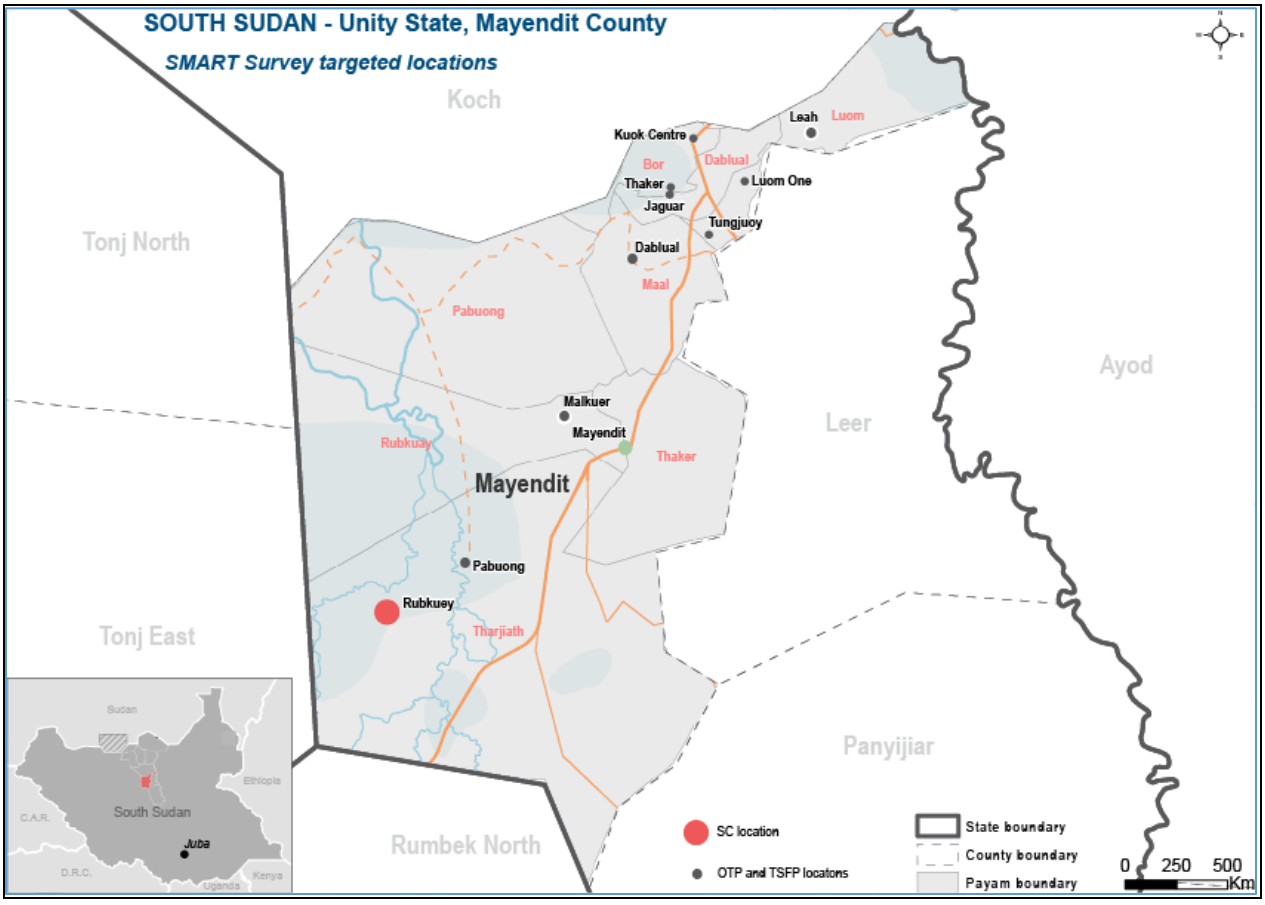
[1] South Sudan Overview: Development news, research, data | World Bank
[2] IPC_South_Sudan_Acute_Food_Insecurity_Malnutrition_22July_23July_report.pdf (ipcinfo.org)

run by Universal Intervention and Development Organization (UNIDOR), the sites located at; Rubkuay, Tutnyang, Kuok, Leah, Luom, Jaguar, Thaker, Dablual, Pabuong, Malkuer and Mayendit HQ. The nutrition partners within Mayendit County are IRC, Universal Intervention and Development Organization (UNIDOR) and Samaritan Purse with the lead nutrition partner being UNIDOR. Other partners operating in Mayendit county include Medair and Nile Hope.

REACH Initiative has worked in South Sudan since 2012 conducting needs assessments and providing evidence-based information to inform the humanitarian response in the country. Since 2019, REACH has engaged with the Nutrition Information Working Group (NIWG), participated in IPC Acute Malnutrition analysis workshops, and provided technical support to nutrition partners for SMART survey implementation in the country.

The nutrition situation in Mayendit County remains an information gap for implementing partners as well as for the IPC AMN. The previous SMART survey which was conducted in October 2019 by IMC, showed a GAM rate of 13.6 % (10.4 - 17.5 95% CI). In order to fill this information gap, IRC, and REACH Initiative planned to implement a SMART survey from approximately March 3 to March 25, collecting anthropometric and mortality data, as well as key multi-sectoral indicators (FSL, WASH, Health) to better understand the status on AMN in Mayendit County as well as its key drivers.

Figure 1: Mayendit County



Survey Objectives

Goal: To assess the nutrition situation and retrospective mortality rates amongst the population and to analyse the possible factors contributing to acute malnutrition of the community in Mayendit County, Unity State, South Sudan from March 15 to 25th, 2023.

Specific Objectives:

- To estimate the prevalence of acute malnutrition, stunting and underweight among children (boys and girls) aged 6 – 59 months and the pregnant and lactating Women (PLW) in Mayendit County.
- To estimate retrospective Crude Mortality Rate (CMR) and Under 5 Mortality Rate (U5MR) in Mayendit County.
- To estimate the coverage of measles vaccination for children 9-59 months in Mayendit County.
- To estimate the coverage of Vitamin A supplementation for children 6-59 months in Mayendit County.
- To estimate the coverage of deworming treatment for children 12-59 months in Mayendit County.
- To assess childhood morbidity and health seeking behaviors among children aged 6-59 months in Mayendit County.
- To assess the WASH situation in Mayendit County. (Main water source, distance/time to water source, water treatment status, access to soap, access to latrine)
- To assess food security and livelihoods situation in Mayendit County. [Food Consumption Scores (FCS), Household Hunger Scale (HHS), main livelihoods, and Livelihood Coping Strategies (LCS)]
- To formulate practical interventions and recommendations.

Methodology

Methodology Overview

For this survey, as per the SMART guideline, we have used two stage sampling i.e. cluster sampling and household sampling. As different villages have different population sizes it is recommended to use proportion to population size (PPS) method to select each cluster where all the clusters have fair chance of being selected based on their estimated population size. After the clusters are selected, households will be selected using simple random sampling. Following both methods ensures the equal and fair selection of both clusters and households to make the survey representative.

Sampling Procedure: Selection of Clusters

A cluster is the smallest geographical unit for the study and in this case villages were considered clusters. To select clusters the list of the total number of villages (203) with populations varying from 122 to 1,523 per cluster as per the data obtained from county health department (CHD). Then, as per the calculation (detailed calculation is presented below) to achieve the total number of households of 570 households a total of 48 clusters were required. We have inserted the list of these villages along with their respective population and ENA[3] generated those 48 clusters with 5 reserve clusters (RC) using PPS method. We have visited 47 out of 48 clusters and no need to activate the reserve clusters as we have achieved the minimum required sample for both clusters and number of children as per the SMART guideline.

Sampling Procedure: Selection of Households

Definition of household for the survey: A household for this survey was defined as a group of people living together, cook and eat from the same cooking pot. Polygamous families were defined based on the same, when each wife has her own pot, even if living in the same compound, this was treated as different households. On arrival in the selected clusters, the team leader met with the village elders. During the data collection, the team introduced themselves, explaining the survey objectives as well as expectations from the elder.

Household selection techniques: The standard definition of a HH was shared to aide in developing the HH listing within the cluster. One of two methods was used for household listing in the filed; (1) a verbal listing from one or more community leaders, and whenever not possible then (2) a manual house to house listing. Twelve households in each cluster were randomly selected from the complete list of HHs using the random number generator application in smart phones. These are the HHs that were visited by the survey teams. The village guide and community leaders were supporting the teams in updating the list of households.

[3] ENA is software for use in Emergency Nutrition Assessments as in SMART surveys to make nutrition assessments and mortality rate calculations in emergency situations as easy and reliable as possible..

For clusters with more than 150HHs, segmentation was used to select one portion of the cluster that would represent the cluster. Selection of segments was done using either PPS[4] or simple random sampling dependent on the population sizes of the specific segments[5]. In the selected segment the process of HH selection had followed the same process done in each cluster for selection of the 12 HH.

In selected households, all eligible children (aged 6-59 months) were measured and the household questionnaire applied. Empty households and households with absent children were re-visited and information of the outcome recorded on the cluster control form. This form was also used to record information on empty and non-responding households.

Table 3: Sample Size (Anthropometric)

Parameter	Mayendit County	Justification
Estimated Prevalence (%)	17.5%	Mayendit SMART survey was conducted in OCTOBER 1st to 17th, 2019 by IMC, 13.6 % (10.4 - 17.5 95% CI). As the situation in Mayendit is deteriorating as per the IPC recent findings and the past tension in Mayendit County. In addition the previous survey was conducted in harvest season while this survey will be conducted in lean season.
Desired Precision	4	Based on the Last SMART survey Guide
Design Effect	1.27	From the 2019 SMART Survey Conducted by IMC
Children to be Included	**479**	
Average Household Size	7	From the 2019 SMART Survey Conducted by IMC
% children Under-Five	19.9%	From the 2019 SMART Survey Conducted by IMC
% Non-Respondents	5%	From the 2019 SMART Survey Conducted by IMC
Households to be Included	**402**	

Table 4: Sample Size (Mortality)

Parameter	Mayendit County	Justification
Estimated death rate per 10,000/day	1.66	Mayendit County SMART survey, OCTOBER 1st to 17th, 2019 by IMC, 1.24 (0.92↔1.66). Higher CI prevalence used as we are expecting a higher prevalence compared to 2019 due to the recent conflict.
Desired Precision	0.5	This is taken as per the SMART guidance

[4] Probability proportional to size is a sampling process where each element of the population (of size N) has a chance to be selected to the sample when performing one draw. For instance when each cluster can be selected with a probability that is proportional to the number of units inside it.

[5] As per the SMART Guidelines, if the Segments will have almost equal population sizes, then, SRS will be used; but if the population sizes will be different, then PPS method will be use

Design Effect	1.27	Mayendit County SMART survey, OCTOBER 1st to 17th, 2019 by IMC
Recall Period	93	Will be Updated When The SMART survey start
Population to be Included	**3792**	
Average Household Size	7	Mayendit County SMART survey, OCTOBER 1st to 17th, 2019 by IMC
% Non-Respondents	5%	Will be update once in the field
Households to be Included	**570**	

The maximum sample size is returned by the mortality sample size calculation and this was considered the final sample size, with **570** households for the survey in Mayendit county was used.

Table 5: Number of Households Team Interviews per Day

Activity	**Estimated Time**
Departure from Office	**8:00 AM**
a. Daily morning Briefings	*15min*
b. Travel to clusters	*60 min*
c. Introduction and HH list development	*30 min*
d. Lunch break	*30 min*
e. Total Time from one HH to another	*5 min*
f. Travel back to base	*60 min*
Total time for HH listing, travelling and breaks (a + b + c + d + f)	195 min
Arrival back to Base	**5:30 PM**
Total Available time in a day	9:30hrs (570 minutes)
Available time for work	570 - 195 minutes= 375 minutes
Time taken to complete one questionnaire	*25 minutes*
Total time per household + e	*30 minutes*

Given the above, the number of households that a team can comfortably visit in a day is calculated as follows:

375 (min) / 30 (min) =12.5 **HH/per day ~ 12 HH**

Accordingly, the number of clusters per survey area is presented in the table below:

Table 6: Number of Clusters

	Mayendit
Total number of HH based on sample size calculation	570
Total number of HH to be assessed per day per team	12
Clusters Needed	47.5
Rounded UP	**48**

Survey Teams, Training, Data Collection and Data Management

Survey Teams: Six teams with four members (1 Team Leader, 1 measurer, 1 assistant, 1 tablet) in each team were involved in the execution of the survey. At each cluster, a local guide was employed to facilitate data collection at the household level. The survey teams were recruited by RRC with the involvement of the local partners such as IRC, SP and UNIDOR at Mayendit County level. As much as possible, the team members were a mix of both males and females and were recruited from the local communities. Supervisors consisted of a mix of IRC, SP, UNIDOR and REACH staff.

Training: The survey teams were trained for six days (1 additional day for the second standardization test) in the time frame of March 8 to 14 March 2023. The training has covered various components including taking anthropometric measurements, sampling of households, data collection tools, digital data collection, data quality checks, standardization exercise among other themes. The training of the enumerators was facilitated by SMART certified staff and staff with experience conducting SMART surveys.

Supervision: The overall management of the survey was done by REACH Initiative with support from IRC, SP and UNIDOR. Maximum supervision of the survey teams was ensured to facilitate quality data.

Data Entry and Management: Data has been collected through REACH tablets using Kobo/ODK. The data collection tools were programmed and uploaded in the tablets which were used by the survey teams. The teams uploaded the collected data to a central server on daily basis to allow the Survey Manager to review the data collected each day, clean the data and give the feedback every morning to the teams.

Data Quality

In order to ensure optimal and high data quality, a number of measures were put in place which includes:

a) The survey was done in accordance with the submitted protocol, and that the following were ensured:

i. Ensure that training of survey teams is done using standardised material as recommended by SMART Methodology[6]
ii. Undertaken standardisation test as part of the training; taking appropriate steps thereafter based on performance of the survey teams (standardization test was retaken)
iii. Appropriate calibration of survey equipment, during the training and on every morning before proceeding to the field for data collection was followed.
iv. Plausibility checks were conducted on daily basis and informed the daily debriefing sessions which were conducted every day.

b) Data was collected through digital platform, and control checks and skip patterns were programmed to improve the data quality.

c) Anthropometry data was auto analysed using ENA software anthropometry section. The same software was also used to analyse the mortality data.

Questionnaire

The survey adopted the data collection tools which have been developed by the Global SMART Team for both anthropometric and mortality surveys. Other indicators were collected using the modules in line with current FSNMS questionnaires as much as possible.

Data Collected

1. **Anthropometry**
   - **Age:** was be determined using birth/health cards/records when available and local calendar of events which were jointly developed by local leaders and survey enumerators.
   - **Sex:** Male or female
   - **Weight:** Children's weights was taken without clothes using mother and child digital weighing scales (SECA scales with precision of 100gm).
   - **Height/length:** Children height was measured using the wooden UNICEF measuring boards (precision of 0.1cm). Children less than 2 years of age were measured lying down, while those greater than or equal to 2 years of age were measured standing up.
   - **Mid-upper arm circumference (MUAC):** Measurements were taken at the mid-point of the left upper arm using both the child and adult MUAC tapes (precision of 0.1cm) for children 6-59 months and for adult women 15-49 years of age.
   - **Bilateral pitting oedema:** was assessed by the application of normal thumb pressure on both feet for 3 seconds.
   - **Referral:** All children with acute malnutrition and not already enrolled in treatment were referred using referral forms to existing TSFP and OTP programs in the county.

[6] SMART Methodology Manual 2.0 - SMART Methodology

2. **Demographics and Mortality:** The following information was collected for all current household members: age in years, sex, whether they were born into the household or if they joined since 5 December 2022. Information on any members that had left or died since 5 December 2022 was similarly collected.

3. **Health Interventions Data:** Vitamin A supplementation, Deworming and Measles immunization data were collected through health cards or recall.

4. **Morbidity**: Two-week retrospective morbidity data was collected from mothers/caregivers of all children (6-59 months) included in the anthropometric survey.

5. **Food Security Indicators**:
    a. **Food Consumption Scores (FCS):** is an indicator of the general quantity and quality of foods being consumed in a household, based on how many days any household members have consumed 9 distinct food groups within a 7-day recall period. Households are categorized into categories of severity based on their responses. FCS is often used as a proxy for quality of food consumed. Standard FCS thresholds are <21 for 'poor', 21-<=35 for 'borderline' and 35+ for 'acceptable'.
    b. **Household Hunger Scale (HHS):** measures the perceived hunger by asking the frequency a household has experienced three common experiences associated with hunger in the past 30 days (no food in the house, slept hungry, gone whole day and night without food). HHS is often used as a proxy for quantity of food consumed. Thresholds and categories used for analysis are those used for IPC AFI in South Sudan.
    c. **Livelihood Coping Strategies (LCS)** – measures what behaviours or actions that household are taking to cope with not having enough food or resources to get food. Ten coping strategies are asked about which are categorized as Emergency, Crisis, or Stress strategies.

6. **WASH** – indicators on main water source, access to latrines, distance/time to water source, and water treatment were asked.

Classifying malnutrition

Individual classification of nutritional status

Individual classifications for nutritional status by different anthropometric measurements are summarized in the table below for wasting, stunting, and underweight.

Table 7: Individual Malnutrition Classifications by WHO

Type of Malnutrition	Grade of Malnutrition	Anthropometric Indicators and Cut-offs
Wasting	Global Acute Malnutrition (GAM) Moderate & severe wasting	<-2 z-scores weight-for-height (WFH) and/or oedema
		<125mm mid-upper arm circumference and/or oedema
		Presence of bilateral pitting oedema
	Severe Acute Malnutrition (SAM) Severe wasting	<-3 z-scores weight-for-height (WFH) and/or oedema
		<115mm mid-upper arm circumference and/or oedema
		Presence of bilateral pitting oedema
Stunting	Global Chronic Malnutrition Global Stunting	<-2 z-scores height-for-age (HFA)
	Severe Chronic Malnutrition Severe Stunting	<-3 z-scores height-for-age (HFA)
Underweight	Global Underweight	<-2 z-scores weight-for-age (HFA)
	Severe Underweight	<-3 z-scores weight-for-age (HFA)

Population cut-offs for malnutrition

The table below defines the population cut-offs for determining the severity of the malnutrition when the prevalence of acute and chronic malnutrition is known. These levels are internationally agreed upon and provide an objective basis for developing responses to increased levels of acute and chronic malnutrition[7].To interpret proportions at a population level with meaning, absolute numbers are also necessary.

[7] *Physical Status: The use and interpretation of Anthropometry. Report of a WHO expert committee, 1995. Chapter 5, p208 & 212*

Table 8: WHO/UNICEF Classification for Severity of Malnutrition by Prevalence among Children 6-59 months[8]

LEVELS	PREVALENCE OF THRESHOLDS %		
	WASTING	OVERWEIGHT	STUNTING
Very low	<2.5	<2.5	<2.5
Low	2.5- <5	2.5- <5	2.5- <10
Medium	5- <10	5- <10	10- <20
High	10- <15	10- <15	20- <30
Very high	>=15	>=15	>=30

Table 9: IPC AMN Classifications for Severity of Malnutrition Prevalence among Children 6-59 months[9]

<table>
<tr><th rowspan="2">IPC AMN Phase Classification</th><th colspan="3">PREVALENCE OF THRESHOLDS %</th></tr>
<tr><th>WASTING by GAM by Weight for Height z-score</th><th>WASTING by GAM by Mid-Upper Arm Circumference[10]</th><th>Priority Response Objective</th></tr>
<tr><td>Acceptable</td><td><5</td><td rowspan="2"><5%</td><td>Maintain the low prevalence of acute malnutrition</td></tr>
<tr><td>Alert</td><td>5- <10</td><td rowspan="3">Strengthen existing response capacity and resilience. Address contributing factors to acute malnutrition. Monitor conditions and plan response as required.</td></tr>
<tr><td>Serious</td><td>10- <15</td><td rowspan="2">5 - <10%</td></tr>
<tr><td>Critical</td><td>15- <30</td><td rowspan="2">10 - <15%</td><td>Urgently reduce acute malnutrition levels through scaling up of treatment and prevention of affected populations</td></tr>
<tr><td>Extremely Critical</td><td>>=30</td><td rowspan="2">>= 15%</td><td>Urgently reduce acute malnutrition levels through significant scale up and intensification of treatment and protection activities to reach additional population reached.</td></tr>
<tr><td></td><td></td><td></td><td>Urgently reduce acute malnutrition levels through addressing widespread acute malnutrition and disease epidemics by all means</td></tr>
</table>

[8] *Threshold classification according to WHO 2018*

[9] *Threshold classification according to IPC Acute Malnutrition reference tables*

[10] IPC AMN classification by MUAC should only be done in the absence of GAM by WHZ data. Whether a higher or lower IPC AMN Phase is classified depends on the historical relationship between WHZ and MUAC in the unit of analysis. See IPC AMN Guidance for more details.

1.1.1 Data Cleaning and Analysis

The anthropometric and mortality data was analysed using ENA for SMART (Jan 2020 version). The other additional data (immunization, maternal nutrition, morbidity etc.) were analysed using R. Various statistics will be used to summarize the data including percentages, means, and median among others. The analysed data will be presented in both tabular and graphical presentations. The preliminary datasets will be available within 7 days after the last day of data collection, and the preliminary report within 14 days. The preliminary report will get feedback from REACH, before submission to the Nutrition Information Working Group (NIWG) for validation. Data cleaning of anthropometric and mortality results will include the following:

- **Check SMART Flagged children –** Input the anthropometric data into ENA and run the plausibility report. This should identify children without SMART Flagg. The children cannot be corrected this way, keep the child in the dataset as it contributes to our quality score.
- **Cleaning extreme MUAC values –** MUAC values <5cm or >20cm or likely errors and will be removed for children 6-59 months.
- **Cleaning reported deaths –** If date of death is available, removing reported deaths that occurred outside of the recall period of interest.

Results

A total of 556 households and 3382 individuals were included in the survey, the data collection starts on the March 15 to 25 2023. The average household size was 6.1 individuals per household. From the total household 87% have under five children and these children constitute about 26% of the total population and the total number of children included in the survey was 730. The proportion of male and female head of households was almost the same and 51% are female headed while the remaining 49% are male headed households. As the survey achieved the minimum number of children, households and clusters as per SMART guideline, there were not need to activate reserve clusters.

Table 10: Survey Sample and Non-Response

	Target	Achieved		Absent		Refused	
	N	N	% of Target	N	% of Target	N	% of Target
Children	479	730	152	3	7.5	1	2.5
Households	570	556	97.5	2	0.2	5	0.4
Clusters	48	47	98	N/A	N/A	N/A	N/A

Anthropometric Results

From 48 villages in Mayendit County, a total of 730 children aged 6-59 months (346 boys and 372 girls) were measured to assess acute malnutrition status. In this survey, 47 out of 48 (98%) clusters were surveyed with 556 households and 730 children measured for anthropometry.

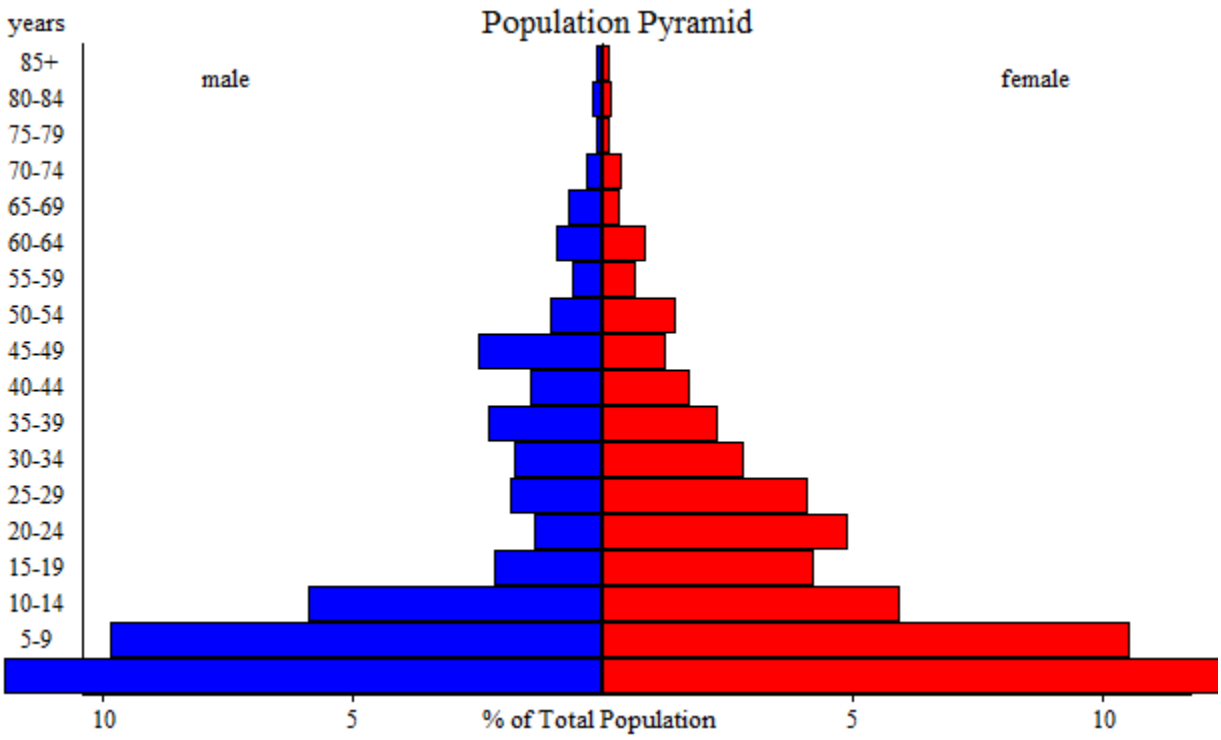
With respect to outliers, the data has been checked with +/-3 from the observed mean and those identified as outliers were flagged by SMART software as not being plausible either for height, weight, or age. The SMART flags were excluded from the analysis but not from the data. **In total, 12 data points were flagged for the weight-for-height z-score, hence, 718 children were analysed. Similarly, 723 (7 excluded) children were analysed for weight-for-age, and 666 (64 excluded) for heigh-for-age.**

This analysis was conducted using WHO 2006 standards.

Table 11: Distribution of age and sex of sample

	Boys		Girls		Total		Ratio
AGE (mo)	**no.**	**%**	**no.**	**%**	**no.**	**%**	**Boy:girl**
6-17	89	50.9	86	49.1	175	24.0	1.0
18-29	68	46.6	78	53.4	146	20.0	0.9
30-41	98	47.3	109	52.7	207	28.4	0.9
42-53	72	49.0	75	51.0	147	20.1	1.0
54-59	26	47.3	29	52.7	55	7.5	0.9
Total	353	48.4	377	51.6	730	100.0	0.9

Figure 2: Population age and sex pyramid



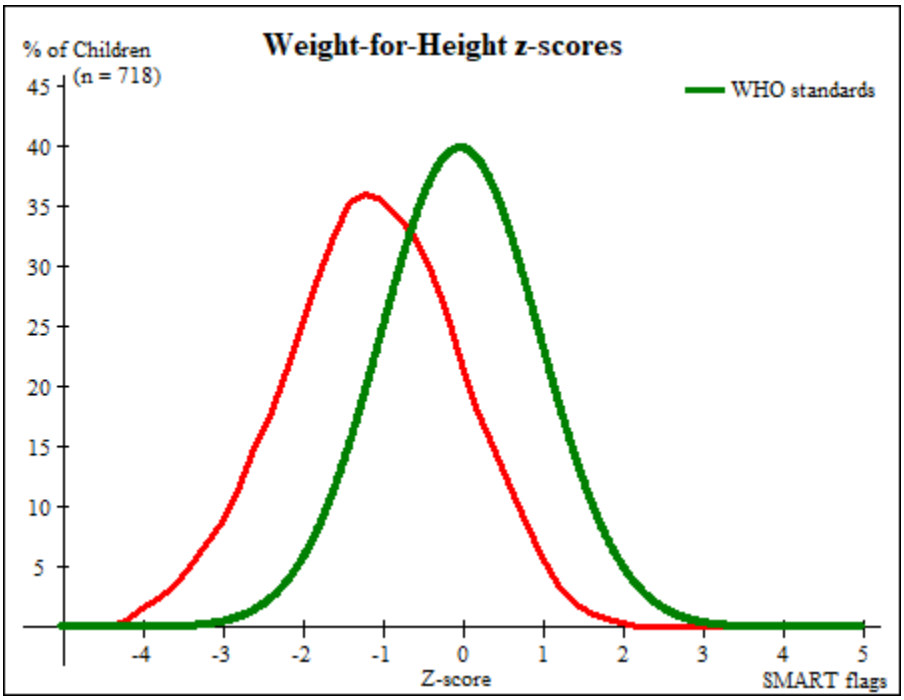
The prevalence of GAM defined as WHZ (WHZ<-2 and/or oedema) among children 6-59 months was estimated at 20.5% (16.8 – 24.7, 95% CI) (see table 13) and was categorized as "Critical" level as per IPC AMN classification.[11] As per the IPC guidelines, a GAM rate falling in the Critical phase require significant scale-up and intensification of treatment and protection activities to reach additional population affected (ibid). The prevalence of SAM per WHZ among children 6-59 months is 4.3% (2.9 – 6.4, 95% CI). No nutritional bilateral oedema case was observed during the assessment.

In the October 2019 SMART Survey conducted in Mayendit County by International Medical Corps (IMC), GAM was estimated at 13.6% (10.4-17.5, 95% CI)[12]. The current survey results show that a GAM rate of 20.5% (16.8-24.7, 95% CI) which was carried out in lean season is significantly different from the previous SMART survey which was conducted in post-harvest season. When comparing the current survey result with that of October 2019, the confidence intervals of the two surveys overlap with each other, indicating that the change may not be significant. However, statistical tests are necessary to prove whether the difference really is statistically significant or not. Accordingly, the change is statistically significant (p-value (0.0057) when analysed using CDC statistical calculator. Therefore, we can say that the nutritional status of the under-five

[11] IPC Technical Manual Version 3.1
[12] SP_IMC_Mayendit County Nutrition SMART Survey Final Report_102019.pdf

population in Mayendit County cannot be compared with October 2019, as there a significant change between the two estimates.

Figure 3: Gaussian curve for Weight-for-Height z-scores



The mean and standard deviation of Weight-for-Height in Z-score were -1.12 and 1.06 showing that the surveyed population has more malnourished children when compared to the WHO reference population and the quality of measurement is in the recommended range of 0.8 – 1.2. The community surveyed was found to be more homogenous than anticipated during the planning stage as shown by the Design Effect (DEFF) of 1.66 for WHZ where DEFF of 1.27 was used at the planning stage. Skewness and kurtosis were found to be -0.08 and -0.28 meaning that the data is normally distributed and authentic.

Table 12: Prevalence of acute malnutrition based on weight-for-height z-scores (and/or oedema) and by sex

	All n = 718	**Boys** n = 346	**Girls** n = 372
Prevalence of global malnutrition (<-2 z-score and/or oedema)	(147) 20.5 % (16.8 - 24.7 95% C.I.)	(75) 21.7 % (16.3 - 28.3 95% C.I.)	(72) 19.4 % (15.7 - 23.6 95% C.I.)
Prevalence of moderate malnutrition (<-2 z-score and >=-3 z-score, no oedema)	(116) 16.2 % (13.2 - 19.7 95% C.I.)	(59) 17.1 % (12.5 - 22.8 95% C.I.)	(57) 15.3 % (12.0 - 19.4 95% C.I.)

Prevalence of severe malnutrition (<-3 z-score and/or oedema)	(31) 4.3 % (2.9 - 6.4 95% C.I.)	(16) 4.6 % (2.8 - 7.5 95% C.I.)	(15) 4.0 % (2.3 - 6.9 95% C.I.)

The prevalence of oedema is 0.0 %

The overall GAM rate is 20.5 % (16.8 - 24.7 95% C.I.). SAM and MAM prevalence are higher in boys than girls and there is no bias in representation (P=0.374). The results exceed the critical cut off point of 15% as per WHO standard.

Table 13: Prevalence of acute malnutrition by age, based on weight-for-height z-scores and/or oedema

		Severe wasting (<-3 z-score)		Moderate wasting (>= -3 and <-2 z-score)		Normal (> = -2 z score)		Oedema	
Age (mo)	**Total no.**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**
6-17	172	22	12.8	47	27.3	103	59.9	0	0.0
18-29	145	1	0.7	26	17.9	118	81.4	0	0.0
30-41	202	2	1.0	16	7.9	184	91.1	0	0.0
42-53	144	5	3.5	19	13.2	120	83.3	0	0.0
54-59	55	1	1.8	8	14.5	46	83.6	0	0.0
Total	718	31	4.3	116	16.2	571	79.5	0	0.0

Children between the age of 6-17 months were most affected by both severe and moderate wasting. This might imply that there is poor complementary feeding practice as children of this age need additional calories apart from breastfeeding.

Table 14: Distribution of acute malnutrition and oedema based on weight-for-height z-scores

	<-3 z-score	**>=-3 z-score**
Oedema present	Marasmic kwashiorkor. 0 (0.0 %)	Kwashiorkor. 0 (0.0 %)
Oedema absent	Marasmic No. 38 (5.2 %)	Not severely malnourished. 692 (94.8 %)

The prevalence of GAM rate by MUAC was 5.6 % (3.9 – 4.7, 95% C.I.) and SAM rate was 0.3% (0.1 – 1.1, 95% C.I.). both SAM rate and MAM rate by MUAC was most prevalent among younger

children of 6-17 months. MUAC has been shown to be biased towards detecting malnutrition in younger children.

Table 15: Prevalence of acute malnutrition based on MUAC cut off's (and/or oedema) and by sex

	All n = 730	**Boys** n = 353	**Girls** n = 377
Prevalence of global malnutrition (< 125 mm and/or oedema)	(41) 5.6 % (3.9 - 8.0 95% C.I.)	(19) 5.4 % (2.7 - 10.4 95% C.I.)	(22) 5.8 % (4.1 - 8.3 95% C.I.)
Prevalence of moderate malnutrition (< 125 mm and >= 115 mm, no oedema)	(39) 5.3 % (3.7 - 7.7 95% C.I.)	(18) 5.1 % (2.4 - 10.4 95% C.I.)	(21) 5.6 % (3.8 - 8.1 95% C.I.)
Prevalence of severe malnutrition (< 115 mm and/or oedema)	(2) 0.3 % (0.1 - 1.1 95% C.I.)	(1) 0.3 % (0.0 - 1.9 95% C.I.)	(1) 0.3 % (0.0 - 2.0 95% C.I.)

Table 16: Prevalence of acute malnutrition by age, based on MUAC cut off's and/or oedema

		Severe wasting (< 115 mm)		**Moderate wasting (>= 115 mm and < 125 mm)**		**Normal (> = 125 mm)**		**Oedema**	
Age (mo)	**Total no.**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**
6-17	175	2	1.1	32	18.3	141	80.6	0	0.0
18-29	146	0	0.0	5	3.4	141	96.6	0	0.0
30-41	207	0	0.0	2	1.0	205	99.0	0	0.0
42-53	147	0	0.0	0	0.0	147	100.0	0	0.0
54-59	55	0	0.0	0	0.0	55	100.0	0	0.0
Total	730	2	0.3	39	5.3	689	94.4	0	0.0

The tables below clearly show that we can capture more children with acute malnutrition (wasting) with weight for height (WHY) than with MUAC measurements. Rates of malnutrition found through MUAC are much lesser than that of results obtained with weight for height measurements. About 4.5% (33 cases) were detected by both methods and if we were to use only WHZ we would have missed about 0.05% (8 cases) and if only used MUAC for detecting acute malnutrition we would have missed 95% (147 cases).

Table 17: Prevalence of combined GAM and SAM based on WHZ and MUAC cut off's (and/or oedema) and by sex*

	All n = 730	**Boys** n = 353	**Girls** n = 377
Prevalence of combined GAM (WHZ <-2 and/or MUAC < 125 mm and/or oedema)	(155) 21.2 % (17.3 - 25.7 95% C.I.)	(79) 22.4 % (16.8 - 29.1 95% C.I.)	(76) 20.2 % (16.3 - 24.7 95% C.I.)
Prevalence of combined SAM (WHZ < -3 and/or MUAC < 115 mm and/or oedema	(32) 4.4 % (3.0 - 6.4 95% C.I.)	(16) 4.5 % (2.8 - 7.4 95% C.I.)	(16) 4.2 % (2.5 - 7.0 95% C.I.)

*With SMART or WHO flags a missing MUAC/WHZ or not plausible WHZ value is considered as normal when the other value is available

Table 18: Detailed numbers for combined GAM and SAM

	GAM		**SAM**	
	no.	**%**	**no.**	**%**
MUAC	8	1.1	1	0.1
WHZ	114	15.6	30	4.1
Both	33	4.5	1	0.1
Oedema	0	0.0	0	0.0
Total	155	21.2	32	4.4

Total Population: 730

Underweight is a nutritional indices that measures the weight of a child in comparison to age. According to WHO 2006 growth standards on which our analysis was based, weight for age Z-score of < -2 SD and > -3 SD is considered as moderately underweight and z- score of < -3 SD is considered as severely underweight.
We found the overall prevalence of underweight to be 20.1% (16.9 - 23.6, 95% C.I.), the age and sex breakdown of the data is described in the tables below.
The overall prevalence of underweight was greater among boys than girls with results showing statistically significant difference (p-value= 0.002), and as indicated below more boys are malnourished compared to girls.

Figure 4: Gaussian curve for Weight-for-Age z-scores

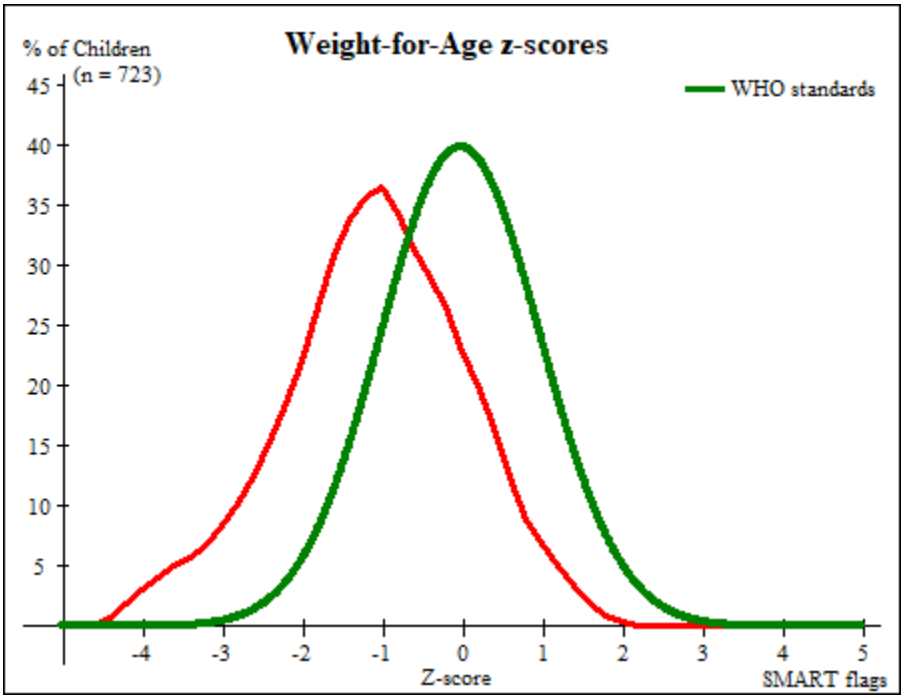


Table 19: Prevalence of underweight based on weight-for-age z-scores by sex

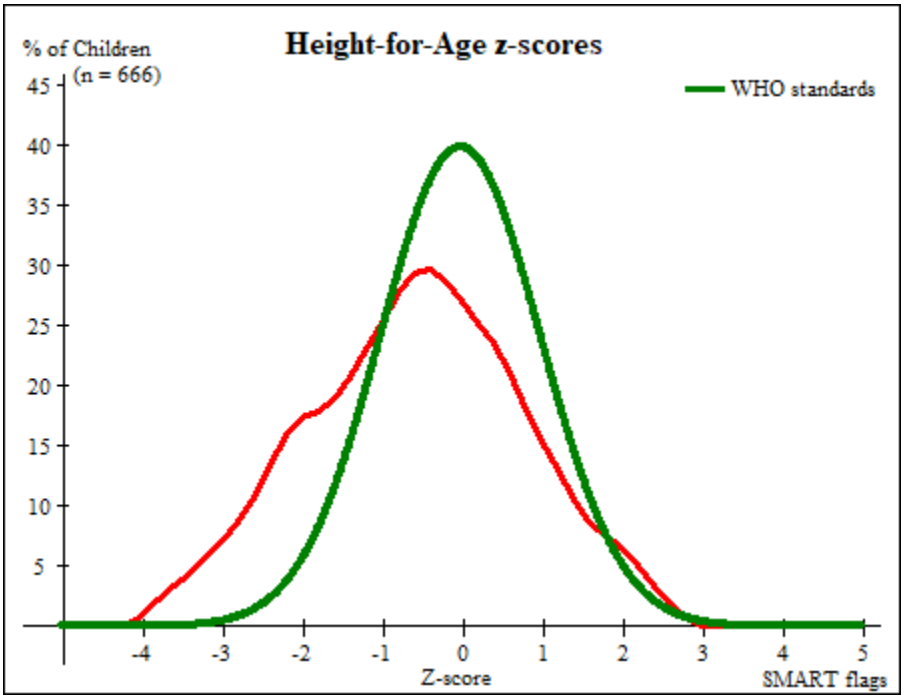
	All n = 723	**Boys** n = 351	**Girls** n = 372
Prevalence of underweight (<-2 z-score)	(145) 20.1 % (16.9 - 23.6 95% C.I.)	(80) 22.8 % (18.5 - 27.8 95% C.I.)	(65) 17.5 % (14.0 - 21.6 95% C.I.)
Prevalence of moderate underweight (<-2 z-score and >=-3 z-score)	(101) 14.0 % (11.7 - 16.6 95% C.I.)	(52) 14.8 % (11.8 - 18.4 95% C.I.)	(49) 13.2 % (10.1 - 17.0 95% C.I.)
Prevalence of severe underweight (<-3 z-score)	(44) 6.1 % (4.2 - 8.7 95% C.I.)	(28) 8.0 % (5.1 - 12.3 95% C.I.)	(16) 4.3 % (2.6 - 7.0 95% C.I.)

Table 20: Prevalence of underweight by age, based on weight-for-age z-scores

		Severe underweight (<-3 z-score)		Moderate underweight (>= -3 and <-2 z-score)		Normal (> = -2 z score)		Oedema	
Age (mo)	**Total no.**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**
6-17	174	15	8.6	28	16.1	131	75.3	0	0.0
18-29	142	14	9.9	19	13.4	109	76.8	0	0.0
30-41	206	11	5.3	28	13.6	167	81.1	0	0.0
42-53	146	3	2.1	23	15.8	120	82.2	0	0.0
54-59	55	1	1.8	3	5.5	51	92.7	0	0.0
Total	723	44	6.1	101	14.0	578	79.9	0	0.0

The results for underweight also shows that the prevalence is more severe in younger children (6-29 months) as they constitute almost two-third (66%) of the cases compared to their older (30-59 months) counterparts.

Figure 5: Gaussian Curve for Height-for-Age z-scores



Stunting is an indices that show an inability to attain a certain height expected for age. It usually reflects the persistent, cumulative effects of poor nutrition and other problems that are often intergenerational, which is caused by failure to receive adequate nutrition over a long period of

time and is also affected by recurrent and chronic illness. It shows the overall socio-economic stand of a community beyond nutritional factors.
The overall prevalence for stunting adjusted to p value of 1 was found to be 7.5%.
The distribution curve of height-for-age Z-scores (Figure 4 above) of the sampled children is shifted to the left of that of the reference population with a mean of –0.56 (±1.33 standard deviation) and relatively shorter curve. This indicates that the surveyed population is very much stunted compared to the reference population.

Table 21: Prevalence of stunting based on height-for-age z-scores and by sex

	All n = 666	**Boys** n =	**Girls** n =
Prevalence of stunting (<-2 z-score)	(106) 7.5%		
Prevalence of moderate stunting (<-2 z-score and >=-3 z-score)			
Prevalence of severe stunting (<-3 z-score)			

Table 22: Prevalence of stunting by age based on height-for-age z-scores

		Severe stunting (<-3 z-score)		**Moderate stunting (>= -3 and <-2 z-score)**		**Normal (> = -2 z score)**	
Age (mo)	**Total no.**	**No.**	**%**	**No.**	**%**	**No.**	**%**
6-17	164	0	0.0	9	5.5	155	94.5
18-29	124	8	6.5	22	17.7	94	75.8
30-41	185	12	6.5	27	14.6	146	78.9
42-53	138	3	2.2	20	14.5	115	83.3
54-59	55	1	1.8	4	7.3	50	90.9
Total	666	24	3.6	82	12.3	560	84.1

Table 24 below shows the summary of mean Z-score with their standard deviation, design effect and the number of children with flag signs that were excluded in the analysis.

Table 23: 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	718	-1.12±1.06	1.66	0	12
Weight-for-Age	723	-1.09±1.13	1.24	0	7
Height-for-Age	666	-0.56±1.33	1.09	0	64

* contains for WHZ and WAZ the children with Oedema.

Mortality results

The survey achieved a total of 3,382 individuals and retrospective mortality data collected over 105 days of recall period (5th of December, 2022 until the mid-day of the data collection period).

Table 24: Mortality Rates

CMR (total deaths/10,000 people / day): 0.51 (0.33-0.79, 95% CI)
U5MR (deaths in children under five/10,000 children under five / day): 0.23 (0.06-0.93, 95% CI)

The total number of deaths reported during the recall period were 18 (2 under 5 children and 16 adults), giving a result of Crude Death Rate (CDR) 0.51 (0.33 – 79, 95% C.I.) and Under 5 years Death Rate (U5DR) of 0.23 (0.06 – 0.93, 95% C.I.); indicating both below the emergency threshold (1.14/10,000 deaths per day for total population and 2.3/10,000 deaths per day for children under five) for both under five children as well as crude mortality rate for the whole population. Thus, health situation considered as stable as confirmed by crude and under-five mortality rates results.

Table 25: General Demographic Info on Mortality Sample

Average Household Size	6.1
Mid-Interval Population	3382
% of children Under-5 years	25.7
Birth Rate	1.18
In-Migration Rate (Joined)	0.84
Out-Migration Rate (Left)	3.27
Design Effect for CDR	1

Table 26: Broad Causes of Death

	%
Illness	50%
Trauma/Injury	33.3
Other	16.7

Table 27: Location of Death

	%
Place of Current Residence	72.2
During Migration	0
Place of Last Residence	11.1
Other	16.7

About 72% of deaths occurred in the present location of residence and about half of the causes of death reported are associated with illness (50%) followed by trauma/injury (33.3%) and unknown constitutes the least (16.7%).

Child Morbidity and Access to Health Care

In order to assess the prevalence of main disease in children 6-59 months, a retrospective morbidity data was collected in those children with a two-week recall period. Accordingly, the survey result showed that almost a third, 27.7% (24.3 – 31.1, 95% C.I.) of children, had suffered at least one episode of illness in the 2 weeks prior to data collection. Fever, cough and diarrhoea were the most reported illnesses, accounting for fever which is 74.3%, cough 40.8%, and diarrhoea 29.1% of surveyed children (6-59 months) respectively. The most common disease children are facing in the area, according to the respondents, is malaria as most of the area have stagnant water which provides an environment for mosquitos to breed where people live nearby.

Table 28: Prevalence of reported illness in children in the two weeks prior to interview (n=206)

	6-59 months
Prevalence of reported illness	27.7 % (24.3 – 31.1, 95% C.I.)

Table 29: Symptom breakdown in the children in the two weeks prior to interview (n=206)

	6-59 months
Diarrhoea	29.1 % (22.8 – 35.0, 95% C.I.)
Cough	40.8 % (34.0 – 47.6, 95% C.I.)
Fever	74.3 % (68.4 – 80.6, 95% C.I.)
Measles	1 % (0.0 – 2.4, 95% C.I.)
Other	4.4 % (1.9 – 7.3, 95% C.I.)

Table 30: Health care seeking behaviour reported by caretakers of sick children 6-59 months of age (n=193)

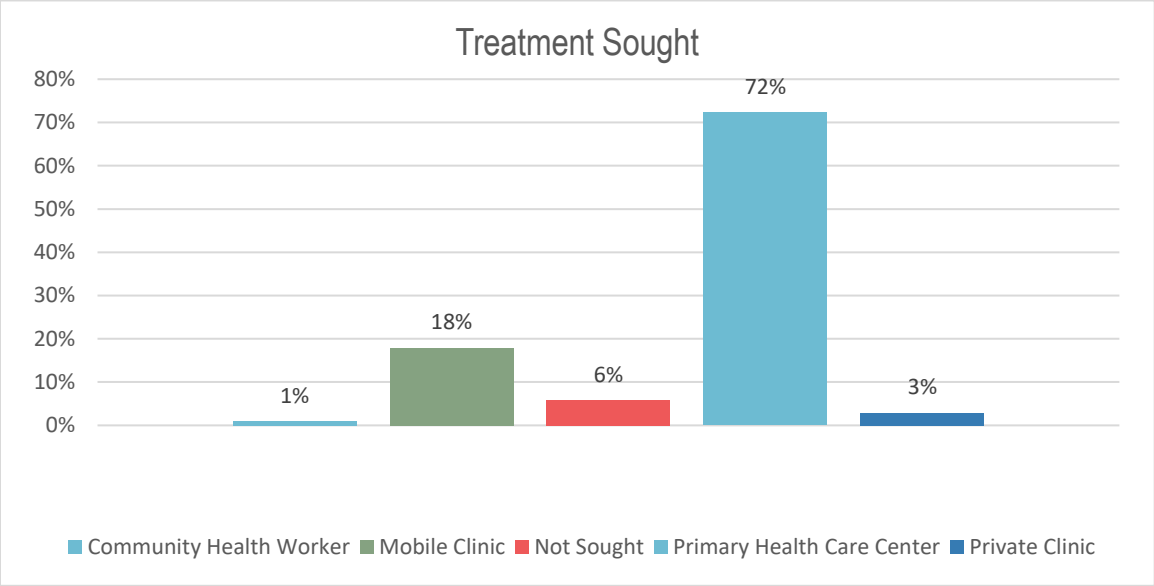
	6-59 months
No treatment sought	5.8 % (2.9 – 9.7, 95% C.I.)
Primary Health Care Centre	72.3 % (66.0 – 78.2, 95% C.I.)
Hospital	0 % (0.0 – 0.0, 95% C.I.)
Other	21.8 % (16.0 – 28.1, 95% C.I.)

Children 6-59 months who had been sick in the two weeks prior to data collection are more likely to be malnourished than their counterparts who had not been ill. Generally, ill children are more at risk of malnutrition than the healthy children.

The majority (93.7%) of children (6-59 months) who had reportedly been ill in the 2 weeks prior to data collection (n=193) had reportedly been brought to a health facility for treatment, with the reported types of facilities differing depending on the distance and accessibility. A similar number received their treatment either in public/private clinic and mobile clinics. Amongst the children who had reportedly been ill, 5.8% had not sought for treatment at all, while insignificant (0.5%) sought treatment from traditional healers and community health workers as can be seen in the figure below.

Most of the areas have access to health facilities more specifically primary health care centres, despite mostly they are out of medicine, and have access to them. Some of the areas in southern Mayendit such as Dablual Payam have access issues to health care centres as they are flooded all year round and PHCC are located mostly either in Thakker or Rubkuai.

Figure 6. Treatment Sought



Nutrition and Health Program Coverage

Table 31: Measles Vaccination Coverage for children 9-59 months

	Measles (with card)= 39%	**Measles (with card or confirmation from mother)= 79.5%**
YES	(No. 284) 39.4 % (35.7 – 43.1, 95% C.I.)	(No. 563) 79.5 % (76.4 – 82.2, 95% C.I.)

Figure 7. Measles vaccination

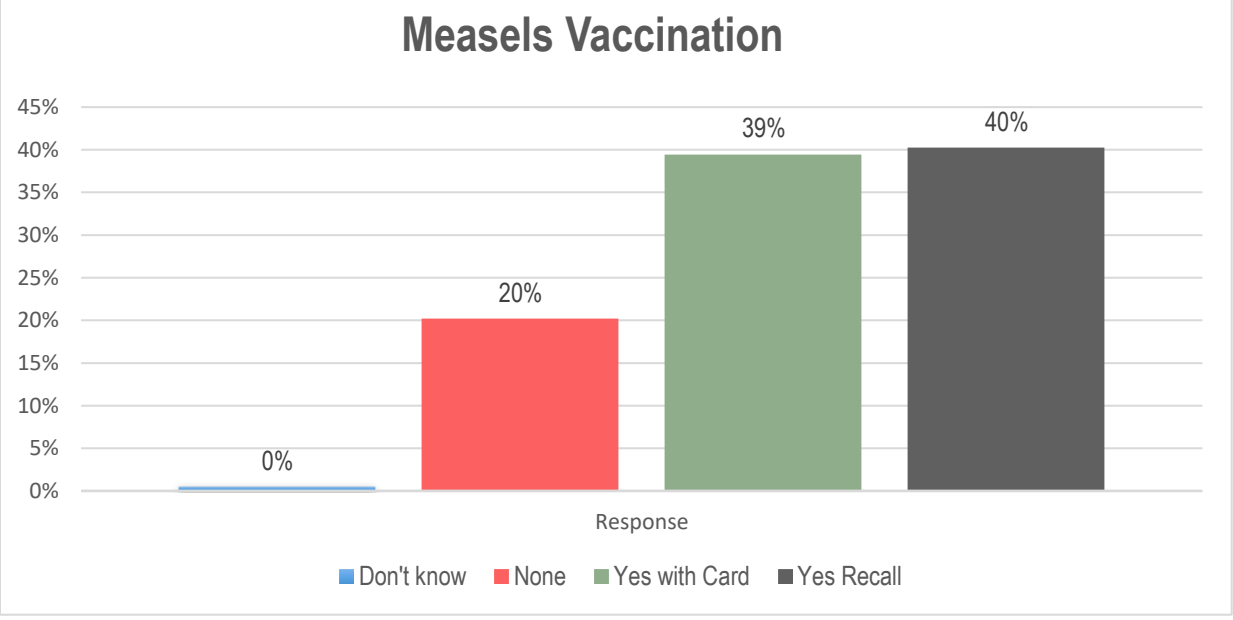
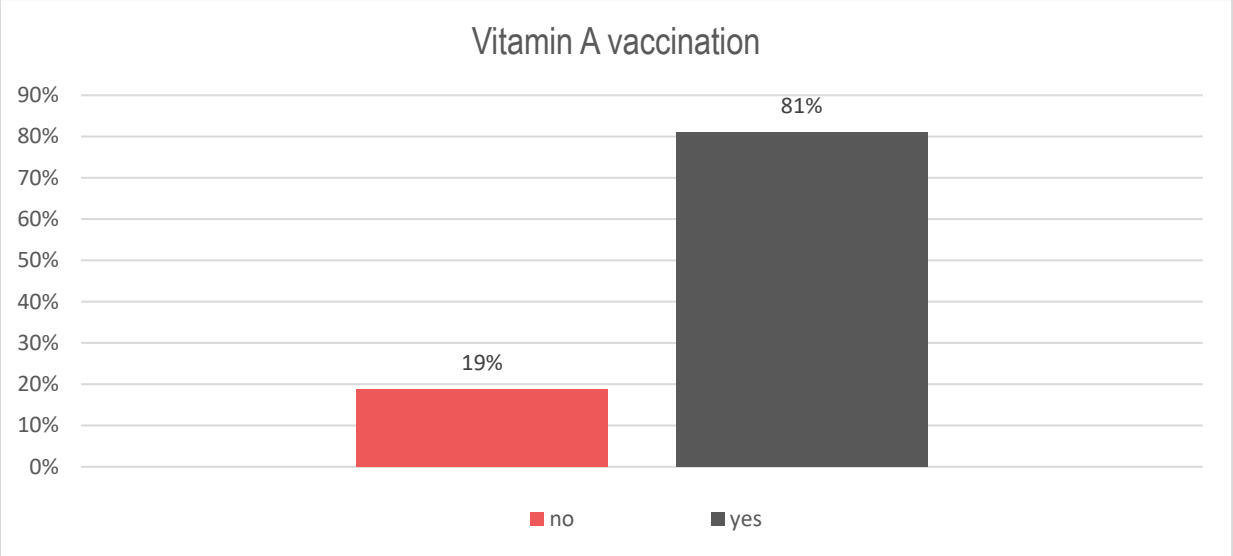


Table 32: Vitamin A (6-59 months) and Deworming Treatment (12-59 months) Coverage

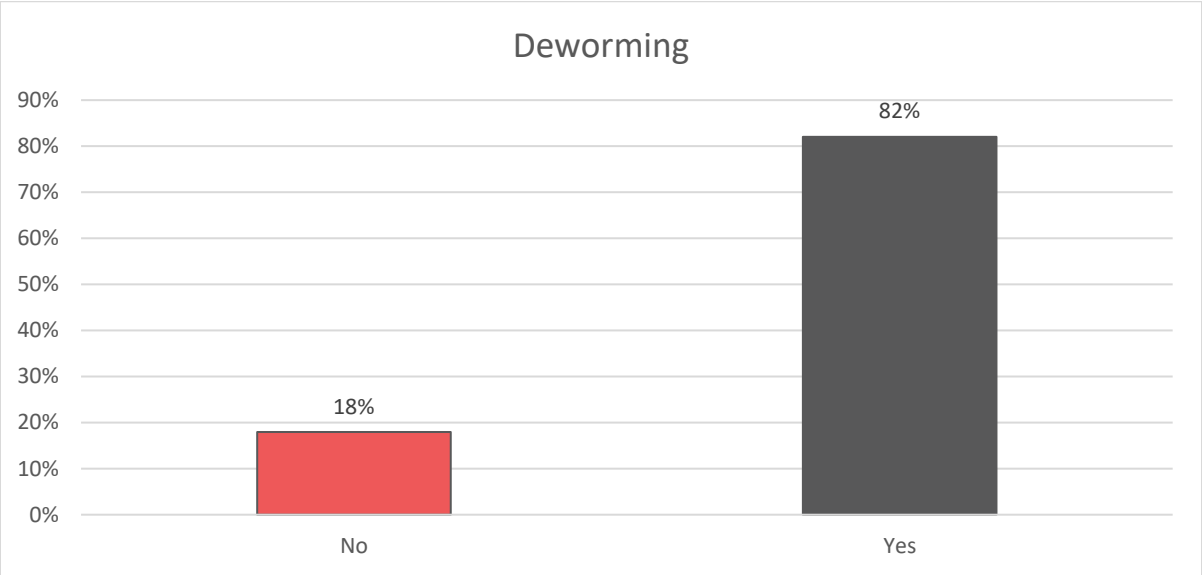
	Vitamin A Supplementation last 6 months n= 81.1 %	**Deworming Treatment last 6 months n= 82 %**
YES	(No. 597) 81.1 % (78.4 – 83.6, 95% C.I.)	(No. 521) 82 % (78.9 – 84.9, 95% C.I.)

Figure 8. Vitamin A Coverage: % of children (6-59 months) reportedly having recieved Vitamin A supplementation in the 6 months prior to data collection



During the assessment, the survey team showed a picture of vitamin A capsules and deworming tablets for mothers and caregivers to recall if their children had received them in the past 6 months prior to data collection. As it can be seen in figure 8 above, among children 6-59 months, 81.1%, (n=597, 78.4 – 83.8, 95% C.I.) had reportedly received vitamin A supplementation and as shown the figure 9 below around 82 % (n=521, 78.9 – 84.9, 95% C.I.) of children aged 12-59 months had received deworming capsules at least once in the 6 months prior to data collection.

Figure 9. % of children (12-59 months) who had reportedly received deworming capsules in the 6 months prior to data collection



Infant and Young Child Feeding Practice (IYCF)

Proper feeding of infants and young children can increase their chances of survival and also promote optimal growth and development, especially in the critical window from birth to 2 years of age.

Information regarding child feeding practices was collected for all children aged 0-23 months and analysed as described below. The sample sizes obtained in this type of survey for IYCF practices are small and the results should therefore only be interpreted as an indication; they should not be taken as representative of the population's knowledge and practices.

In this survey, mother/caretakers of 176 children aged 0-23 months were interviewed. The mothers/caretakers were interviewed about the IYCF practices of their children between the ages of 0-23 months in line with the revised indicators for assessing IYCF practices by WHO & UNICEF (2021).[13] The findings of the survey are presented in the following tables, graphs, and discussions.

Ever Breastfed

When mothers were asked whether their children were ever breastfed, 90.9% (n=160, 95% CI, 86.4-94.9) of children 0-23 months had reportedly been breastfed at some point in their lifetime. Out of those ever-breastfed children, 89.8% (n=158, 95% CI, 85.2 - 94.3 had reportedly been initiated to breastfeeding immediately within one hour of birth, as per WHO recommendation.

[13] Indicators for assessing infant and young child feeding practices (WHO 2021)

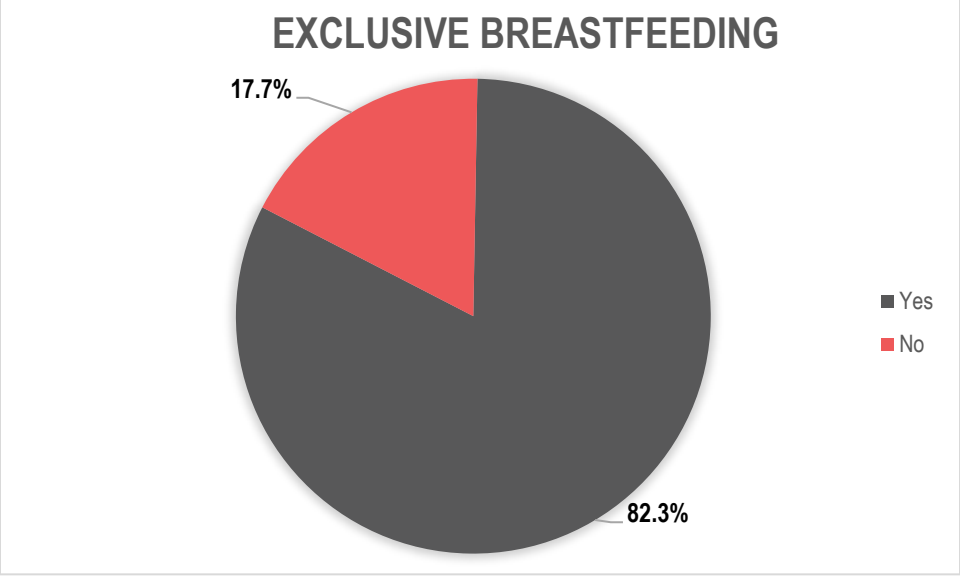
Table 33. IYCF: Child ever breastfed and early initiation of breastfeeding

IYCF (Ever Breastfed & early Initiation)				
Indicator Name	Age group	n	%	95% CI
Child ever breastfed	0-23 months	160	90.9	86.4-94.9
Breastfeeding initiation	0-23 months	158	89.8	85.2-94.3

Exclusive breastfeeding (EBF)

The WHO Global Strategy for IYCF recommends that infants be exclusively breastfed until they turn six months of age. Exclusive breastfeeding is the safest and healthiest option for children everywhere, guaranteeing infants a food source that is uniquely adapted to their needs while also being safe, clean, healthy, and accessible. Evidence suggests that infants in low- and middle-income countries who received mixed feeding (foods and liquids in addition to breast milk) before six months were nearly three times more likely to die than those who were exclusively breastfed.[14] Exclusive breastfeeding protects against diarrhoea, lower respiratory infections, acute otitis media and childhood overweight and obesity.[15] Accordingly, 82.3% (n=116, 95% CI, 75.9-88.7) of children 0-5 months had reportedly been exclusively breasted, exceeding UNHCR's standards[16], according to which the proportion of exclusively breastfed infants (0-5 months) in emergency context should be ≥ 70%.

Figure 10. % of surveyed children 0-5 months who had reportedly been excursively breastfed



[14] Guidelines on optimal feeding of low birth-weight infants in low- and middle-income countries (who.int)
[15] ibid.
[16] Infant and young child feeding threshold - UNHCR Emergency Handbook

Continued breastfeeding

Children should continue breastfeeding for two years or beyond as per the global WHO IYCF recommendations.[17] Children who are still breastfed after one year of age can meet a substantial portion of their energy needs with breast milk in their diet. Continued breastfeeding is also vital during illness: while sick children often have little appetite for solid food, continued breastfeeding can help prevent dehydration while also providing the nutrients required for recovery.

Accordingly, children aged 12-23 months were assessed based on the recall period of the previous 24 hours and the finding suggested that 82.3% of children have received continued breastfeeding as illustrated in the table below.

Table 34. Continued breastfeeding of 12-23 months of children.

Continued breastfeeding practice (12-23 months)				
Indicator Name	Age group	n	%	95% CI
Continued breastfeeding	12-23 months	116	82.3	75.9 – 88.7

Minimum Dietary Diversity

WHO guiding principles recommend that children aged 6-23 months be fed a variety of foods to ensure that nutrient needs are met.[18] Food group diversity is associated with improved linear growth in young children. A diet lacking in diversity can increase the risk of micronutrient deficiencies, which may have a damaging effect on children's physical and cognitive development. One study found that little or no consumption of nutrient-dense foods such as eggs, dairy products, fruits and vegetables between 6 months and 23 months was associated with stunting[19].

On this regard, the survey findings show that only about a third (36 %) of surveyed breastfed & non-breastfed children (6-59 months) received food from at least 5 of 8 food groups (including breast milk) as per IYCF guideline recommendation. Findings thus suggest that meals were likely not adequately diverse for most of the children aged 6-23 months, indicating a limited diversity in terms of nutrients received.

17 WHO & UNICEF (2003). Global Strategy for Infant and Young Child Feeding

18 WHO (2005): Guiding principles for feeding non-breastfed children 6-24 months of age

19 WHO & UNICEF (2021). Indicators for assessing infant and young child feeding practices: definitions and measurements, p 8

Minimum Acceptable Diet

Among both breastfed and non-breastfed children, "meat, poultry, fish, or eggs should be eaten daily, or as often as possible" as per WHO guiding principles.[20] There is evidence that children who consume eggs and flesh foods have higher intakes of various nutrients important for optimal linear growth. Consuming eggs is associated with increased intakes of energy, protein, essential fatty acids, vitamin B_{12}, vitamin D, phosphorus, and selenium, and with higher recumbent length. Introduction of meat as an early complementary food for breastfed infants is also associated with improved protein and zinc intake[21].

As per the survey result in Mayendit, only 16.6% (n=29, 95% CI, 11.4-21.7) of surveyed children aged 6-23 months had received a minimum acceptable diet in the in the 24 hours prior to data collection.

Women's Nutritional Status by MUAC

A total of 169 pregnant and lactating women (PLW) were measured using MUAC to identify PLW nutritional status. PLW's nutritional status is important, because malnourished PLW cannot provide the required nutritional intake for infants, especially for those under 6 months. From the total PLW, about 49.4% were lactating, 48.2 % are pregnant while the remaining 2.4 % were pregnant-lactating women. Accordingly, it seems PLW nutritional status seems good as only 11.8 % (n=20, 95%CI 7.1 - 16.6) fell below the 230 mm MUAC measurement.

Contributing Factors

Water, Sanitation, and Hygiene (WASH)

Source of Drinking Water

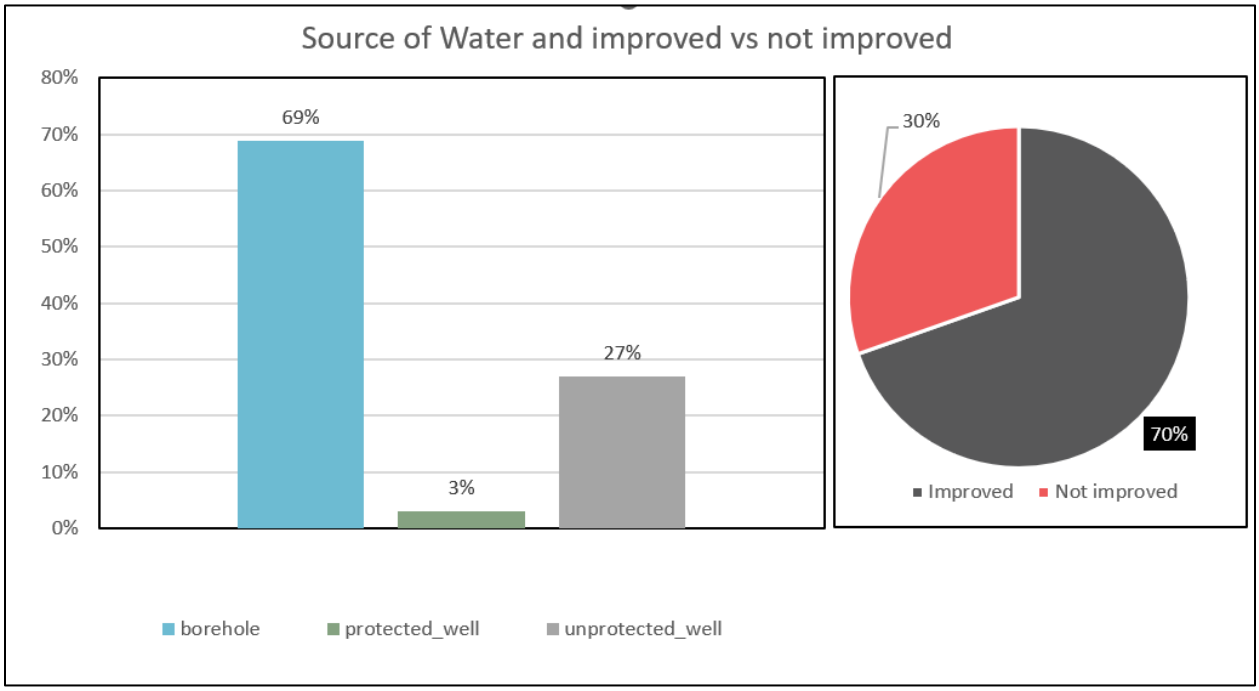
Consumption and use of unsafe water can cause diarrhoea, which can prevent children from getting the nutrients they need to survive, ultimately leading to malnutrition. Malnourished children are also more vulnerable to waterborne diseases like cholera. Inadequate access to minimum water, hygiene, and sanitation is estimated to account for around 50 per cent of global malnutrition.[22] During the assessment, a set of systematically grouped close ended questions were asked to respondents, which were then automatically coded as an improved or unimproved source of water in the database. About a third of survey respondents 30.4 % (n=169, 95% CI, 26.4-34.2) reported fetching their water from unimproved water sources. Figure 12 below shows the main reported sources of water used by respondents.

[20] WHO & UNICEF (2021). Indicators for assessing infant and young child feeding practices: definitions and measurement methods

[21] Guiding principles for feeding non-breastfed children 6-24 months of age.pdf

[22] 4 things you need to know about water and famine (UNICEF 2022)

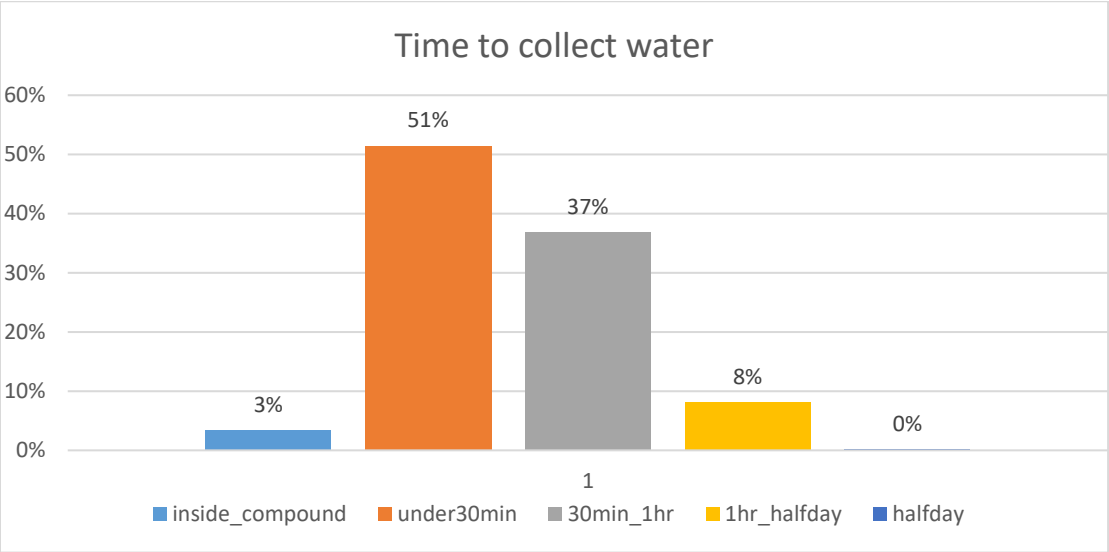
Figure 11. % of respondents per main source of water reportedly used for household consumption



Time Taken to Collect Water

The other important indicator assessed in relation to the above indicator is the time it took the households to collect water, keeping in mind queuing time and variation between villages with respect to distance are not included or taken into consideration during the analysis. Just about half of respondents (51.4%) could reportedly access their main household water source within less than 30 minutes, followed by those households who reported being able to access the source of water between 30 minutes and 1 hour (36.9%). However, 8.1 % of households reported traveling more than an hour to half day to fetch water from their main source.

Figure 12: % Of households per reported time it takes them to collect water from their main water source



Water treatment used

Unsafe water is among the main sources of life-threatening, waterborne diseases. This indicator therefore assesses the prevalence of households using effective methods for treating drinking water, which is particularly relevant as one of the main child morbidity issues in the assessed area was incidence of diarrhoeal disease, amongst other factors. Diarrhoea can be addressed by improving access to safe water, promotion of water treatment, improving sanitation and hygiene promotion as well as focusing on the home management of childhood illness.

The majority of interviewed households 73.2 % (n=407, 95% CI, 69.4-76.6) reported doing nothing to the water prior to consumption collected either from improved or unimproved sources at household level. Considerable number of households reported use of chlorine 20.5 % (n=114, 95% CI, 17.3 - 23.9) and boiling water 4.1 % (n=23, 95% CI, 2.5-5.8) as a water treatment method. The remaining 2.2 % (n=12, 95% CI, 1.1 - 3.6) reported using clothes to filter water.

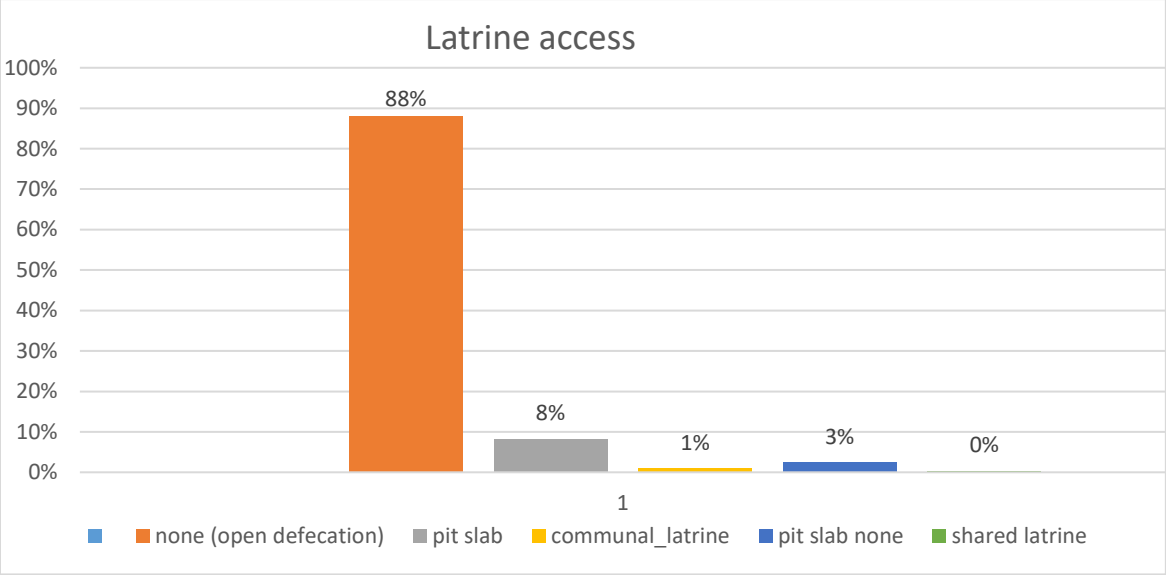
Hygiene and sanitation

This combined indicator measures the affected population's access to a sufficient number of safely located latrines with functioning handwashing facilities, which is a crucial precondition for ensuring a sanitary environment and preventing diseases. Lack of access to safe latrines in the household is key contributing factor to morbidity, which can in turn lead to elevated malnutrition and mortality rates. When the households were asked if they have access to safe excreta disposal in their households, overwhelming majority of households (87.9%) (n=489, 95% CI, 84.9 – 90.6) responded not having access to such sanitation facilities and using open defecation instead. Only 8.3 % (n=46, 95% CI, 5.9 – 10.8) of households reported having access to pit latrines with a slab and 2.5 % (n=14, 95% CI, 1.3 – 4.0) are using pit latrine without slab

while the remaining 0.9 % (n=5) used 0.9 % (n=5) and 0.4 (n=2) have reported to say are using communal latrine and shared latrine respectively.

A complementary indicator for the above is access to soap for handwashing; washing hands with soap is one of the most effective way of preventing life-threatening diarrheal diseases. The indicator therefore assesses the proportion of households having soap available for their use. Accordingly, only 4.5 % (n=25, 95% CI, 2.9-6.5) of households reported having access to soap (not confirmed by enumerators) and 8.8 % (n=49, 95% CI, 6.5 -11.3) reported having access to soap (confirmed by enumerators), while most households (86.7% (n=482, 95% CI, 83.8-89.7) reported not having access to soap.

Figure 13. % Of households per type of latrine they reported having access to the latrine

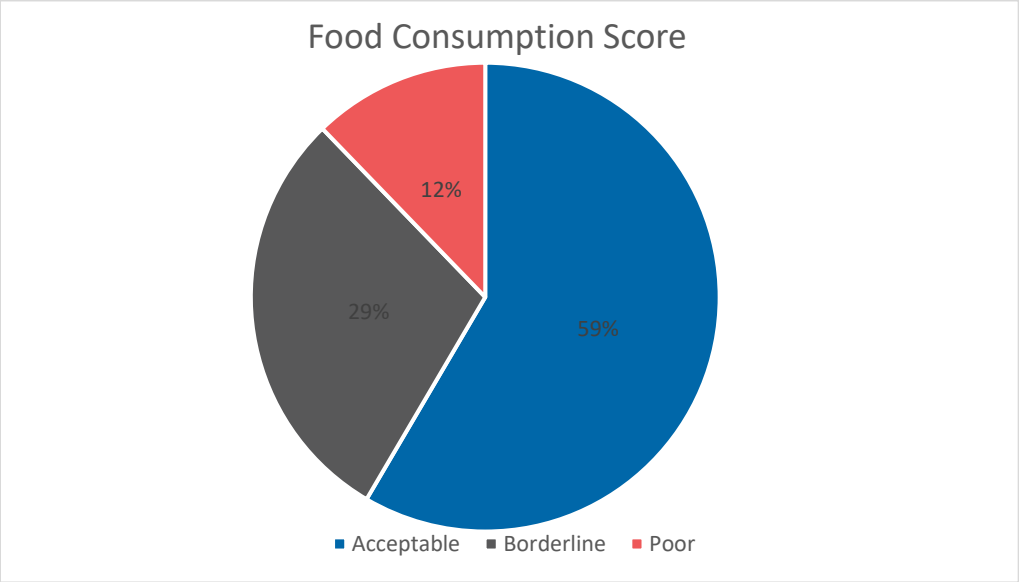


Food Security and Livelihoods (FSL)

Food Consumption Score

The FCS is considered as a proxy indicator of current food security status. It's a composite score based on the types of food eaten, its frequency and relative nutrition importance of different food groups. The indicator is calculated based on the past 7-day food consumption recall for the household and classified into three categories: poor consumption (FCS= 0 to 21); borderline (FCS = 21.5 to 35); and acceptable consumption (FCS=>35.0).

Figure 14. Proportion of households per FCS

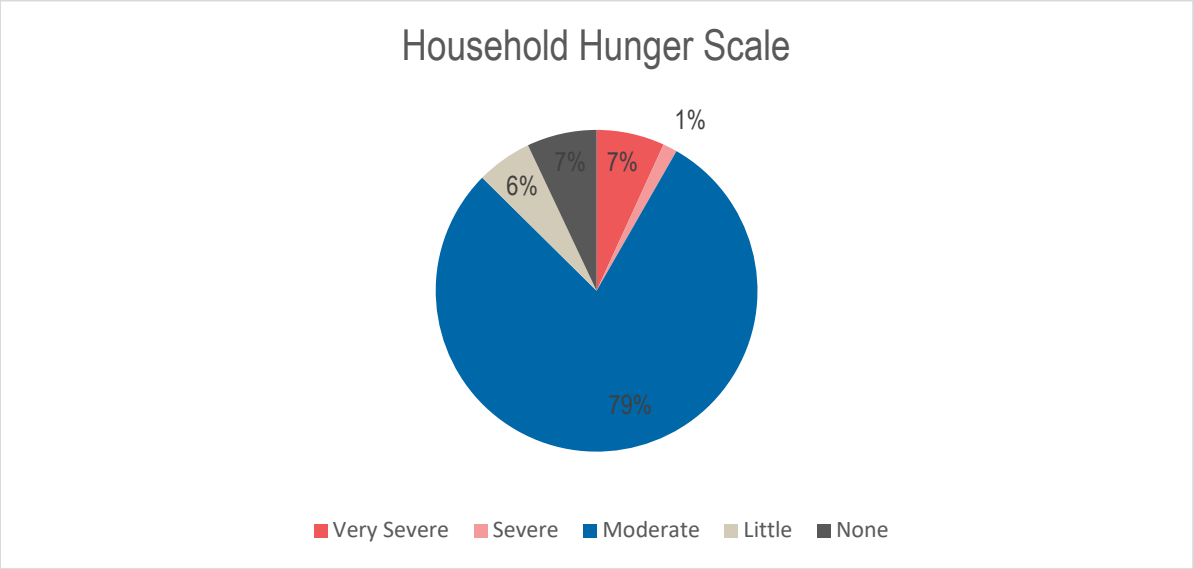


According to the survey result, more half of the residents (58.5 %, n=325) of respondents had acceptable consumption followed by borderline consumption (29.3 %, n=163) and 12.2 % (n=68) having poor consumption score in the past seven days prior to the survey.

Household Hunger Scale (HHS)

HHS is a proxy indicator of household's food access that captures insufficient food quantity based on the physical consequences of hunger experienced in a household over the past 4 weeks/30 days prior to the survey date. It measures whether households fall into moderate or severe categories of hunger or whether they experienced little/no hunger. Using this composite indicator, a respondent can score between zero and six depending on their answers. Individuals scoring from zero to one experience the least hunger and respondents scoring six will experience the most hunger. Hence, the index was calculated and the scores are categorized as none or lighter hunger (HHS= 0-1), moderate hunger (HHS= 2-3) and sever hunger (HHS= 4-6).

Figure 15. Proportion of households per HHS category



According to the findings, about 79.1% (n=321) have experience moderate hunger while 6.8 % (n=38) experienced very severe and 1.4% (n=8) have suffered severe hunger situation in the past 4 weeks. While 5.6 % (n=31) and 7.0% (n=39) of sampled households reported hunger as little or none respectively.

Household Income Source

The main activities that the households engaged in the last 3 months to earn income reported as selling of different items (41.2 %, n=229), humanitarian assistance (27 %, n=150) and selling of animal products (11.2 %, n=62).

Almost all of sampled households reported their household was affected by some type of shocks in the last 6 months prior to the survey; mainly by high food prices (39.6 %, n=220) followed by flooding (35.1 %, n= 195) and loss of or reduced employment for any household member (12.3 %, n=68).

4. Discussion

Nutritional status

During the actual data collection period 556 households from 47 clusters were visited for mortality, child and maternal nutrition, and other contextual factor information (FSL and WASH). A total of 730 children of 6-59 months were assessed for anthropometric survey from the planned 479 children, however, 718 children information analysed, with 12 were excluded from the analysis by the SMART flag as they were out of range values.

The prevalence of GAM among the sampled children was estimated at 20.5% (16.8-24.7 95% C.I.) and SAM prevalence was 4.3% (2.9- 6.4 95% C.I.) based on Weight-for-Height and the presence of bilateral oedema. During the survey, no children have been identified with nutritional bilateral oedema. The current nutrition status of the county is classified as "critical" based on IPC AMN technical guideline classification thresholds. The prevalence is higher both on MAM and SAM cases and also there is no representation bias (P=0.374)
The current malnutrition status of the County compared to the most recent survey result conducted in October 2019 has shown some deterioration; however, there is a statistically significant difference observed (P-value=0.0057), so we cannot conclude it has really deteriorated as the null hypothesis will be rejected. Another factor to consider is the timing of survey is different as the former was conducted in harvest season while the current conducted in lean season.

Mortality

Mortality results for CDR and U5MR were 0.51 and 0.23, respectively, and both fall below the emergency levels.

Causes of malnutrition

A total of 206 (27.7%) children 6-59 months had been reported sick in the two weeks prior to data collection. These children were more frequently found to be malnourished as compared to their counterparts who had not been reported ill. When compared to the IMC (International Medical Corps) SMART survey conducted in Mayendit in 2019 (this survey was used for planning this survey), there is significant difference between the number of children having been reported ill as compared to our data (*p*-value=0.0000). Among children who were reported ill, the incidence of diarrhoea episodes was (n=60 29.1%). Other leading reported symptoms were fever (n=153, 74.3%) and cough (n=84, 40.8%). The situation is likely to deteriorate further given the strong dry season will continue throughout the month of March and April. The community is recommending to stock the health facilities with necessary medicines such as anti-malaria drugs as they said the facilities are out of stock most of the time.
When it comes to IYCF practices, we can see that the current feeding practices are not sufficient to cover the children's nutritional needs because the flooding has been obstacle for some nutritional service and as well for the community to have variety of food for household consumption as only 36% of children 6-23 months of age have got the minimum dietary diversity requirement and furthermore only 17% of these children have got the minimum

acceptable diet which comprises both dietary diversity and meal frequency. Children who are unable to get the minimum nutrition requirement are highly at risk of malnutrition.
More than one-third of households are using water for household consumption from non-improved water source coupled with 73% of households do not treat their water before use. This might expose the wider community to water borne disease such as diarrhoea more specifically children under five, and pregnant and lactating women are more vulnerable to malnutrition.

5. Conclusions

The survey result shows that the GAM rate is 20.5 % (16.8 - 24.7, 95% C.I.), this value lies in the critical category according to IPC-AMN guideline. The SAM rate is 4.3 % (2.9 - 6.4, 95% C.I.) which is considerable even though there was no child found with nutritional oedema.
The very high GAM rate could be associated with current food insecurity situation in the area due to the recent flooding that damaged crops, poor feeding practice of infants and young children. Considering these aggravating factors: including high level of food insecurity (attributed to several factors including economic decline, climatic shocks/flooding which is the issue in the county all year round including this year), low production, macro-economic shocks like increased price of food, and other factors, could result in deterioration of food security in the coming months as well and thus needs close monitoring of the situation.
There is a need to generally improve and increase the continuity of the comprehensive nutrition intervention since the GAM rate is critical in the county. Development projects around WASH, livelihood and social food security are needed to tackle the long-term effects of malnutrition in the community.

6. Recommendations and priorities

Nutrition

The GAM rate was 20.5% which indicates the current nutritional status of Mayendit county is critical. Accordingly

- ⇨ Continue, strengthen and scale up the current nutrition service delivery in order to reach areas that are difficult to access such as Dablual.
- ⇨ Scale-up multi-sectoral response as malnutrition prevention mechanism
- ⇨ Early identification of cases by conducting active screening
- ⇨ Increase awareness of the community in terms of diversifying diets to improve current nutritional status.
- ⇨ Avail necessary nutrition inputs to nutrition sites as some of the feedbacks from the community during data collection was those children identified as malnourished onsite didn't receive nutrition materials for some times, even though are enrolled in the programmes by nutrition actors like UNIDOR and IRC as well as international agencies such as UNICEF

Most of IYCF indicators show poor child feeding practice (EIBF= 89.8%, ExBF=82.3%, CBF=82.3%, MDD=36%, MAD=16.6%).

- ⇨ Strong work required in promoting optimal behaviours regarding IYCF that highlight effective food utilization and balanced diets and sufficient intake of important food groups

Health programme coverage

All vaccination coverages (Vit A = 81.1%, Measles = 79.5% and Deworming = 82%) are below the sphere standards that requires to strengthen vaccination campaign to be conducted to address all parts of the county. The recommended coverage for both Vitamin A and Measles Vaccines is >95%[23].

Almost one-third of the children (27.7%) have some illness in the recall period of two weeks and from those majority (93.7%) have sought treatment. Despite the proportion of children who sought treatment is high, those who didn't seek medical treatment is not insignificant. Hence, health promotion programmes should be strengthened especially to those hard-to-reach areas like Dablual so that children are brought to health care service and get treatment.

Contributing Factors

WASH

The findings show that about a third (30%) are using water from non-improved sources, majority (73.2%) are not using water treatment and large number of households (88%) use open defecation as well as almost similar amount (86.7%) does not have soap access. Accordingly, the following recommendations are proposed:

- ⇨ WASH actors need to scale-up access to safe water facilities in the county.
- ⇨ Provision of water treatment chemicals should be improved.
- ⇨ Strengthen hygiene promotion activities. CHD should lead these actions in collaboration with implementing partners like Samaritan's Purse and support from inter agencies such as UNICEF and/or WHO.

FSL

The food consumption score shows 12% are under poor food consumption and 29% are on borderline. On the other hand, only 13% does not experience food shortage in their household and given the fact that almost one-third (27%) of households' income is considered to be humanitarian assistance and almost all have experienced different shocks the following actions are proposed.

- ⇨ It is important to continue the general food distribution.
- ⇨ Improve household food security through education on effective food utilization and optimum diet.

[23] https://www.spherestandards.org/handbook-2018/

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We would like to give thanks to the entire Mayendit communities especially who were randomly selected and village chiefs who participated in the survey, the community members who gave their full time in escorting the teams from house to house and all the selected households, more especially the mothers and caregivers who dedicated their full time to responding the questionnaire and allowing their children to be measured by the survey team.

Finally, our sincere thanks to all the survey participants, including the supervisors, team leaders' enumerators and the canoe rowers for endurance and dedication of their time during the survey which enabled us to obtain quality data from very hard to reach areas some of which requires hours walking to access the areas.

Appendices

Appendix 1 - Plausibility Report

Plausibility check for: SSD2301 REACH_SSD_Mayendit_SMART_survey_ENA_File.as

Standard/Reference used for z-score calculation: WHO standards 2006

(If it is not mentioned, flagged data is included in the evaluation. Some parts of this plausibility report are more for advanced users and can be skipped for a standard evaluation)

Overall data quality

Criteria	Flags*	Unit	Excel.	Good	Accept	Problematic	**Score**
Flagged data	Incl	%	0-2.5	>2.5-5.0	>5.0-7.5	>7.5	
(% of out of range subjects)			0	5	10	20	**0** (1.6 %)
Overall Sex ratio	Incl	p	>0.1	>0.05	>0.001	<=0.001	
(Significant chi square)			0	2	4	10	**0** (p=0.374)
Age ratio(6-29 vs 30-59)	Incl	p	>0.1	>0.05	>0.001	<=0.001	
(Significant chi square)			0	2	4	10	**0** (p=0.285)
Dig pref score - weight	Incl	#	0-7	8-12	13-20	> 20	
			0	2	4	10	**0** (6)
Dig pref score - height	Incl	#	0-7	8-12	13-20	> 20	
			0	2	4	10	**2** (9)
Dig pref score - MUAC	Incl	#	0-7	8-12	13-20	> 20	
			0	2	4	10	**2** (9)
Standard Dev WHZ	Excl	SD	<1.1	<1.15	<1.20	>=1.20	
.			and	and	and	or	
.	Excl	SD	>0.9	>0.85	>0.80	<=0.80	
			0	5	10	20	**0** (1.06)
Skewness WHZ	Excl	#	<±0.2	<±0.4	<±0.6	>=±0.6	
			0	1	3	5	**0** (-0.08)
Kurtosis WHZ	Excl	#	<±0.2	<±0.4	<±0.6	>=±0.6	
			0	1	3	5	**1** (-0.28)
Poisson dist WHZ-2	Excl	p	>0.05	>0.01	>0.001	<=0.001	
			0	1	3	5	**5** (p=0.000)
OVERALL SCORE WHZ =			0-9	10-14	15-24	>25	**10** %

The overall score of this survey is 10 %, this is good.

Appendix 2 - Assignment of Clusters

Geo Unit	Pop size	CL		Geo Unit	Pop size	CL		Geo Unit	Pop size	CL
Dhornyadabek	760			Jaak	840			Tharuor	498	
Payol	624	1		Wotier	870			Pantiang	365	
Tarnyol	656			Mangoi	860	RC		Chotnyala	830	37
Ngopnyang	628			Lual 1	735			Dhornyiet	606	
Pulriethni	611			Lual 2	725			Wuliet	243	
Wit	643	2		Gopnyang	740	18		Kurduong	225	
Diet	591			Noriah	706			Wangkoang	365	
Ruatruat	697			Kuerlam	671			Kuanydiet	387	
Kuloy	630			Toljoap	759			Kotluony	346	38
Pulbar	785	3		Korow	769	19		Machuoy	291	
Wiedhornyagai	657			Kuerleah	1065			Wichiel	377	
Nyalotdeng	637			Paguol	1095	20		Nyijuor	360	
Wiedhel	790			Kur	1135			Watwat	394	
Buor	830	4		Tuor	1090			Thorkoata	372	
Kuew	770			Kombo	1140	21		Puokbuor	374	
Dhorjany	830			Kuernyabath	1040			Tuoclel	403	39
Kertuok	800	5		Luom	1080	22		Dhiok	286	
Buoth	795			Goap	1080			Thargoth	465	
Kepngai	775			Pulchara	1040	23		Dhorpor	486	
Dablual	780	6		wangbela	939			Nyinlieth	397	
Koat	710			Tiethpiny	1086			Lokmanjiew	457	
Pagaw	710			Kapiny	365			Wicpuol	336	40
Dhorlel	650			Barguong	1500	24		Jiziere	385	
Mayian	570	7		kombo	440			Kuoy	413	
Dagual	565			Bargok	1520	25		Chieh	600	
Chuech	555			Kotrial	1523			Malou	507	
Dok	632			KuorTongping	916	26		Puolthoak	608	41
Paykongbol	752	8		Bartut	1018			Dhordeet	582	
Noroiah	647			Muonjur	814			Gap	522	
Kangkoi	740			Kotier	962	27		Puolwuor	385	
Koat	642			Pulnyangui	826			Dhorkoang	617	
Panmanchak	632	9		Kuorwai	1004	RC		Dhornyater	541	42
Pantuok	617			Chotjiok	1034			Paguony	496	
Panyakria	622			Nyajiek	628			Their	545	

Thokpankoata	622			Wangduar	786	28		Koah	596	
Dhiach	855	10		Pantot	646			Buony	690	
Dhiok	855			Panganloluok	520			Dirbang	602	43
Thargoth	865			Dhorchok	453			Tuochuach	667	
Dhor-nori	830	11		Chidar	1047	29		Majak	556	
Panyang	840			Dhorliepnyak	1138			Wangkor	385	
Thobi	840			Chuothdier	986			Luoy	746	44
Pekuari	785	12		Laikach	992	30		Dhorchoat	535	
Kuoch	654			Dhorchiengkuong	945			Rupdiem	670	
Gony	689			Dhorchiengbang	440			Bathlar	1086	45
Pulchar	679	13		Chweh	1452	31		Thieptutni	809	
Rupkuita	728			Hoah	1162			Dhorphar	603	
Dhornyamai	721			Dhornyanhial	461	32		Dhormkeah	538	
Cherkah	515			kuandin	1020			Thor meat	578	46
Pekchier	520			Wangkoang	1110			Chuoke	507	
Pekmill	505	RC		Goang	885	33		Nyianygany	640	
Dhiling	505			Nyagang	1247			Dhorlokaber	589	
Dhorchawic	390			Nyinyar	523			Zorthier	645	
Barguong	390			Dabul	1352	34		Zorkewni	521	47
Kueryiey	380			Dhorjaak	1352			Geziere	270	
Kuerkecher	390			Tutnyang	264	RC		Buompieny	743	
Kuong	270	14		Nyal2	995			Kaopieny	700	
Rupduong	270			Jokuoh	847			Yat	474	RC
Dhorlieth	710			Joktuong	262			Dhorgok	507	
Pulchaor	705			Lual	256			Ritgoah	591	
Tangkueh	715	15		Tuoy	826	35		Papline	552	
Thanygol	810			Porokou	725			Riergoak	416	
Thorkan	840			Thuokpantuoy	484			Dhor boni	197	
Leah	835	16		Koat	122			Thowkuok	224	
Nyabar	631			Gier	394			Kaingol	143	48
Tingkath	618			Lathtang	605	36		Latwich	377	
Mow	641			Tuongjuoi	270			Padeah	486	
Kuerbowaw	601			Changlual	414			Chotchar	506	
Bear	591	17		Panyang	346					

Appendix 3 – Standardization Test Results

Standardisation test results					Precision				Accuracy		OUTCOME			
Weight		subjects	mean	SD	max	Technical	TEM/mean	Coef of rel	Bias from	Bias from median			From	From
		#	kg	kg	kg	TEM (kg)	TEM (%)	R (%)	Bias (kg)	Bias (kg)			Supervisor	Median
	Supervisor	10	12	3.2	0.4	0.15	1.3	99.8	0	0.09	TEM poor	R value good	Bias good	Bias acceptable
	Enumerato	10	12	3.1	0.2	0.07	0.6	99.9	0.14	0.1	TEM accep	R value good	Bias poor	Bias acceptable
	Enumerato	10	12	3.1	0.2	0.11	0.9	99.9	0.09	0.05	TEM poor	R value good	Bias accep	Bias acceptable
	Enumerato	10	12	3.1	1.1	0.25	2.1	99.3	0.09	0.1	TEM reject	R value good	Bias accep	Bias poor
	Enumerato	10	11.9	3.2	1	0.29	2.4	99.2	0.65	0.62	TEM reject	R value good	Bias reject	Bias reject
	Enumerato	10	12	3.2	0.5	0.16	1.3	99.8	0.2	0.19	TEM poor	R value good	Bias poor	Bias poor
	Enumerato	10	12	3.2	0.3	0.12	1	99.9	0.15	0.12	TEM poor	R value good	Bias poor	Bias poor
	Enumerato	10	12	3.1	0.2	0.07	0.6	100	0.09	0.06	TEM accep	R value good	Bias accep	Bias acceptable
	Enumerato	10	12.1	3	0.5	0.12	1	99.8	0.22	0.16	TEM poor	R value good	Bias reject	Bias poor
	Enumerato	10	12	3.1	0.2	0.09	0.7	99.9	0.12	0.07	TEM accep	R value good	Bias poor	Bias acceptable
	Enumerato	10	12.1	3	1.8	0.42	3.5	98.1	0.2	0.16	TEM reject	R value acc	Bias poor	Bias poor
	Enumerato	10	12	3.1	0.1	0.04	0.4	100	0.14	0.09	TEM accep	R value good	Bias poor	Bias acceptable
	Enumerato	10	12	3.1	0.7	0.23	1.9	99.4	0.13	0.1	TEM reject	R value good	Bias poor	Bias acceptable
	enum inter	12x10	12	3	-	0.35	2.9	98.7	-	-	TEM reject	R value acceptable		
	enum inter	12x10	12	3.1	-	0.39	3.3	98.4	-	-	TEM reject	R value acceptable		
	inter enum	13x10	12	3	-	0.36	3	98.6	-	-	TEM reject	R value acceptable		
	TOTAL intr	12x10	-	-	-	0.42	3.5	98.1	-	-	TEM reject	R value acceptable		
	TOTAL+ su	13x10	-	-	-	0.41	3.4	98.2	-	-	TEM reject	R value acceptable		
Height		subjects	mean	SD	max	Technical	TEM/mean	Coef of rel	Bias from	Bias from median			From	From
		#	cm	cm	cm	TEM (cm)	TEM (%)	R (%)	Bias (cm)	Bias (cm)			Supervisor	Median
	Supervisor	10	89.4	13.4	9.3	2.13	2.4	97.4	0	0.71	TEM reject	R value acc	Bias good	Bias acceptable
	Enumerato	10	90.4	12.3	0.3	0.07	0.1	100	1.52	1.08	TEM good	R value good	Bias reject	Bias poor
	Enumerato	10	89.3	13.1	1	0.3	0.3	99.9	1.01	0.5	TEM good	R value good	Bias poor	Bias acceptable
	Enumerato	10	90.1	13.3	4.9	1.56	1.7	98.6	1.18	0.91	TEM reject	R value acc	Bias poor	Bias poor
	Enumerato	10	89.5	13.5	3.3	0.74	0.8	99.7	0.59	0.75	TEM poor	R value good	Bias accep	Bias acceptable
	Enumerato	10	89.3	12.8	3	0.9	1	99.5	1.09	0.97	TEM poor	R value good	Bias poor	Bias poor
	Enumerato	10	89.1	13	1.1	0.4	0.4	99.9	1.34	0.82	TEM good	R value good	Bias poor	Bias poor
	Enumerato	10	90.1	13.3	0.9	0.26	0.3	100	1.05	0.58	TEM good	R value good	Bias poor	Bias acceptable
	Enumerato	10	89.7	13.2	0.1	0.02	0	100	1.4	0.75	TEM good	R value good	Bias reject	Bias acceptable
	Enumerato	10	90.2	13.6	0.1	0.04	0	100	1.18	0.69	TEM good	R value good	Bias poor	Bias acceptable
	Enumerato	10	89.8	13.4	1.6	0.54	0.6	99.8	0.98	0.33	TEM accep	R value good	Bias poor	Bias good
	Enumerato	10	90.6	12.5	0.1	0.03	0	100	1.59	1.11	TEM good	R value good	Bias reject	Bias poor
	Enumerato	10	90.3	12.9	2	0.57	0.6	99.8	1.2	0.85	TEM accep	R value good	Bias poor	Bias poor
	enum inter	12x10	89.9	12.9	-	1.07	1.2	99.3	-	-	TEM poor	R value good		
	enum inter	12x10	89.9	12.8	-	1.15	1.3	99.2	-	-	TEM poor	R value good		
	inter enum	13x10	89.8	12.8	-	1.19	1.3	99.1	-	-	TEM poor	R value good		
	TOTAL intr	12x10	-	-	-	1.28	1.4	99	-	-	TEM poor	R value good		

MUAC		subjects	mean	SD	max	Technical	TEM/mean	Coef of rel	Bias from	Bias from median			From	From
		#	mm	mm	mm	TEM (mm)	TEM (%)	R (%)	Bias (mm)	Bias (mm)			Supervisor	Median
	Supervisor	10	143.6	7.1	7	2.56	1.8	86.9	0	1.65	TEM accep	R value re	Bias good	Bias acceptable
	Enumerato	10	147.9	6.9	10	2.24	1.5	89.6	4.95	3.77	TEM accep	R value re	Bias reject	Bias reject
	Enumerato	10	142.3	6.3	5	1.67	1.2	92.9	1.95	2.58	TEM good	R value po	Bias accep	Bias poor
	Enumerato	10	149.8	7.3	20	6.11	4.1	30.3	7.44	6.36	TEM reject	R value re	Bias reject	Bias reject
	Enumerato	10	142.8	6.8	5	1.14	0.8	97.2	3.69	2.84	TEM good	R value ac	Bias reject	Bias poor
	Enumerato	10	144.2	8.3	11	3.51	2.4	82.1	3.02	3.08	TEM reject	R value re	Bias reject	Bias reject
	Enumerato	10	142.4	5.5	10	3.14	2.2	67.2	2.9	2.66	TEM poor	R value re	Bias poor	Bias poor
	Enumerato	10	146	5.9	7	1.67	1.1	91.9	3.44	2.17	TEM good	R value po	Bias reject	Bias poor
	Enumerato	10	145.4	5.2	10	2.25	1.5	81.4	3.54	1.97	TEM accep	R value re	Bias reject	Bias acceptable
	Enumerato	10	147.4	7.5	1	0.59	0.4	99.4	4.25	3.25	TEM good	R value go	Bias reject	Bias reject
	Enumerato	10	145.6	6.1	5	1.77	1.2	91.6	2.83	1.57	TEM good	R value po	Bias poor	Bias acceptable
	Enumerato	10	151.9	6.6	1	0.22	0.1	99.9	8.68	7.61	TEM good	R value go	Bias reject	Bias reject
	Enumerato	10	144.7	6.4	5	1.38	1	95.4	2.62	1.86	TEM good	R value ac	Bias poor	Bias acceptable
	enum inter	12x10	145.8	7.2	-	4.16	2.9	67	-	-	TEM reject	R value reject		
	enum inter	12x10	145.9	6.9	-	4.49	3.1	57.8	-	-	TEM reject	R value reject		
	inter enum	13x10	145.7	7.1	-	4.24	2.9	63.8	-	-	TEM reject	R value reject		
	TOTAL intr	12x10	-	-	-	5.06	3.5	48.8	-	-	TEM reject	R value reject		
	TOTAL+ su	13x10	-	-	-	4.98	3.4	50.4	-	-	TEM reject	R value reject		

Suggested cut-off points for acceptability of measurements

Parameter		MUAC mm	Weight Kg	Height cm
individual	good	<2.0	<0.04	<0.4
TEM	acceptabl	<2.7	<0.10	<0.6
(intra)	poor	<3.3	<0.21	<1.0
	reject	>3.3	>0.21	>1.0
Team TEM	good	<2.0	<0.10	<0.5
(intra+inte	acceptabl	<2.7	<0.21	<1.0
and Total	poor	<3.3	<0.24	<1.5
	reject	>3.3	>0.24	>1.5
R value	good	>99	>99	>99
	acceptabl	>95	>95	>95
	poor	>90	>90	>90
	reject	<90	<90	<90
Bias	good	<1	<0.04	<0.4
	acceptabl	<2	<0.10	<0.8
	poor	<3	<0.21	<1.4
	reject	>3	>0.21	>1.4

Appendix 4 – Local Event Calendar

Month		Annual Events / Season	2018	2019	2020	2021	2022	2023
1	Jan	New year CPA	59	50 New year CPA	38 New Year CPA	26 New Year CPA	14 New Year CPA	2 New Year CPA
2	Feb	Velentine Day	58	49 Velentine Day	37 Velentine Day	25 Velentine Day	13 Velentine Day	1 Velentine Day
3	Mar	8th Women day	57	48 8th Women day	36 8th Women day	24 8th Women day	12 8th Women day	0 8th Women day
4	Apr	Easther Field preparation for farming	59 Easther Field preparation for farming	47 Easther Field preparation for farming	35 Easther Field preparation for farming	23 Easther Field preparation for farming	11 Easther Field preparation for farming	
5	May	Labour Day 16th May SPLM/A Day Cultivation throughout may	58 Labour Day 16th May SPLM/A Day Cultivation throughout may	46 Labour Day 16th May SPLM/A Day Cultivation throughout may	34 Labour Day 16th May SPLM/A Day Cultivation throughout may	22 Labour Day 16th May SPLM/A Day Cultivation throughout may	10 Labour Day 16th May SPLM/A Day Cultivation throughout may	
6	Jun	Cultivation	57 Cultivation	45 Cultivation	33 Cultivation	21 Cultivation	9 Cultivation	
7	Jul	9th Indipendence day 30th Matryes Day Cultivation	56 9th Indipendence day 30th Matryes Day Cultivation	44 9th Indipendence day 30th Matryes Day Cultivation	32 9th Indipendence day 30th Matryes Day Cultivation	20 9th Indipendence day 30th Matryes Day Cultivation	8 9th Indipendence day 30th Matryes Day Cultivation	
8	Aug	15th St Mary Day Eating Maize	55 15th St Mary Day Eating Maize	43 15th St Mary Day Eating Maize	31 15th St Mary Day Eating Maize	19 15th St Mary Day Eating Maize	7 15th St Mary Day Eating Maize	
9	Sep	Harvesting of Maize	54 Harvesting of Maize	42 Harvesting of Maize	30 Harvesting of Maize	18 Harvesting of Maize	6 Harvesting of Maize	
10	Oct	St Comboni Day Harvesting of Surghum	53 St Comboni Day Harvesting of Surghum	41 St Comboni Day Harvesting of Surghum	29 St Comboni Day Harvesting of Surghum	17 St Comboni Day Harvesting of Surghum	5 St Comboni Day Harvesting of Surghum	
11	Nov	X-mass preparation	52 X-mass preparation	40 X-mass preparation	28 X-mass preparation	16 X-mass preparation	4 X-mass preparation	
12	Dec	25th Chrismass	51 25th Chrismass	39 25th Chrismass	27 25th Chrismass	15 25th Chrismass	3 25th Chrismass	