PROGRAM EVALUATION OF INTEGRATED DELIVERY OF HEALTH AND NUTRITION SERVICES IN NORTHERN MALI

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Background

Child malnutrition remains a major public health problem worldwide, causing morbidity, mortality, and disability. It encompasses a variety of nutritional disorders, including weight loss, wasting, stunting, and micronutrient deficiencies (WHO, 2024). Around 45% of deaths in children under age 5 are linked to malnutrition, with the majority occurring in low- and middle-income countries (WHO, 2024).

Burden of Acute Malnutrition in Sub-Saharan Africa

Sub-Saharan Africa bears a disproportionate burden of child malnutrition, with the region experiencing higher morbidity and mortality rates from malnutrition than any other part of the world. Severe acute malnutrition (SAM) is one of the leading causes of morbidity and mortality among children below 5 years, with sub-Saharan Africa being the most affected region. Globally, an estimated 47 million children younger than 5 years have acute malnutrition, of which 70% are attributed to moderate acute malnutrition (MAM), with Africa and Asia bearing the greatest share of moderate acute malnutrition (Black et al., 2013).

Treatment Outcomes in Sub-Saharan Africa

Despite coverage challenges, outpatient treatment programs have demonstrated effectiveness when implemented properly. Multiple studies have found recovery rates between 53% to 82% for children enrolled in outpatient treatment programs. For MAM specifically, studies across the region show variable outcomes: one study in Ethiopia reported an overall recovery rate of 73% with a median time to recovery of 16 weeks (Rashid et al., 2022), while a study in rural Malawi demonstrated that 80% of children enrolled in outpatient treatment for moderate acute malnutrition recovered, with 4% defaulting and 0.4% dying (Maleta & Amadi, 2014).

Context-Specific Challenges in Mali

In mid-2023, the forced displacement of around 330,000 people as a result of the conflict in northern and central Mali exacerbated the food security crisis. Between June and October, the Gao and Tombouctou districts were classified, respectively, as Level 3 (Crisis) and Level 4 (Emergency) according to the Integrated Food Insecurity Classification (IPC, 2024). This situation has contributed to an upsurge in malnutrition nationwide, with 313,185 cases of SAM and 1.1 million cases of MAM among children aged 6 to 59 months, recorded in June 2023 and projected to May 2024 (IPC, 2024).

In the Gao region, rates of SAM and MAM reached 3.6% and 15.7% of children aged between 6 and 59 months (Republic of Mali, 2024). In addition, agricultural production fell in northern and central Mali due to insecurity and limited access to fertilizers. Disruptions to market supplies, including blockades and reduced trade flows, have led to shortages and soaring prices for basic foodstuffs.

Emergency Nutritional Response Program in Northern Mali

In November 2023, Lutheran World Relief (LWR), an international non-governmental organization (NGO) affiliated with Corus International, was awarded a 12-month emergency grant from the Gates Foundation to help respond to the nutritional crisis. LWR launched the project in the Gao and Tombouctou regions in partnership with the Association pour le Développement du Nord du Mali (ADENORD), a local NGO for social services. This partnership provided vitamin enriched flour (Vitablé) to malnourished children, as well as food vouchers to families of children identified by community health workers with MAM. These vouchers for local food commodities were used only after children completed treatment for acute malnutrition at health facilities (also referred to as “graduation food kits”). The program in Gao and Tombouctou also included hygiene promotion sessions and nutrition training for mothers.

The LWR nutrition program partnered with the USAID-funded MOMENTUM Integrated Health Resilience (MIHR) project to increase efficiency and effectiveness of service delivery. MIHR is led globally by IMA World Health (LWR's affiliate under Corus International) and in Mali by JSI Research and Training, Inc., to strengthen the capacity of regional health services and health facilities to provide and sustain quality care in reproductive health (RH), maternal, newborn and child health (MNCH), and nutrition in complex humanitarian contexts. More specifically, the MIHR Mali team approached LWR to fill the gaps in nutritional supplements in 11 health facilities caring for children with MAM and SAM in Gao and Tombouctou. At the time the project was launched, these facilities were facing stockouts of nutritional inputs.

Between March and July 2024, over 2,700 children suffering from MAM, as diagnosed by the community health workers in Gao and Tombouctou received Vitablé for supplementary feeding in targeted health centers. Among them, over 2,300 families also received vouchers enabling them to buy beans, milk, sugar, oil, rice, millet, and vegetable seeds in local markets.

Photo. Nutrition demonstration, Gao

Photo. Nutrition demonstration, Gao

To assess the effectiveness of this emergency response, Lutheran World Relief conducted a comprehensive evaluation of the integrated nutrition program implemented across nine health facilities in the Gao and Tombouctou regions between March and July 2024. The evaluation employed a mixed-methods approach, combining retrospective analysis of 1,806 child treatment records with 36 key informant interviews with primary caregivers. The study measured treatment outcomes against international Sphere standards while exploring barriers to care and the program's influence on healthcare-seeking behavior. The evaluation findings revealed not only exceptional clinical outcomes that exceeded international benchmarks, but also several unexpected results that challenge conventional assumptions about humanitarian programming effectiveness in conflict-affected settings.

Priority Recommendations

Based on the evaluation findings and a stakeholder results workshop, the following seven actions are recommended for implementation and scaling:

1. Scale the integrated service delivery model combining therapeutic feeding, food assistance, counseling, and hygiene promotion as the standard approach for nutrition programming in fragile settings.
2. Invest in male engagement strategies to address husband resistance to healthcare-seeking, which emerged as a significant but manageable barrier.
3. Digitize facility records through robust systems to replace vulnerable hard copy registers and enable real-time monitoring and planning.
4. Strengthen community health worker accessibility by providing contact information and formalizing peer referral networks.
5. Leverage increased healthcare trust built through the program to expand integrated services beyond nutrition to include immunization, maternal health, and family planning.
6. Implement facility mentorship programs using high-performing sites to share best practices and support underperforming facilities.

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7. Develop locally produced nutrition supplements with digital supply chain tracking to address stockouts and improve sustainability.

Unexpected Findings

Several findings emerged that contradict common assumptions about humanitarian nutrition programming:

Universal Satisfaction with Healthcare Staff: Despite operating in a conflict-affected region with resource constraints, zero negative feedback was recorded about healthcare staff across all 36 caregiver interviews, suggesting that quality service delivery is achievable even in challenging contexts.

Exceptional Adherence without Incentives: The program achieved 97% nutrition visit follow-up adherence without direct incentives. Qualitative data suggests this was driven primarily by visible health improvements and positive provider relationships.

Rapid Recovery Times: Treatment duration (28 days median) was significantly shorter than other Mali programs (40+ days) and regional studies, suggesting that the integrated approach may accelerate recovery.

Healthcare System Strengthening: 80% of key informant interview (KIIs) participants reported positive influence on future healthcare-seeking behavior, indicating that nutrition programs can serve as effective entry points for broader health system strengthening.

Data Quality Achievement: Despite hard copy registers and challenging conditions, the program achieved 99% accuracy in outcome classification, demonstrating that high-quality data collection is possible in humanitarian settings.

Evaluation Objectives

The primary objective of the evaluation was to estimate key treatment outcomes, according to the Sphere standards of program quality (Sphere Project, 2018), of the LWR nutrition program. The treatment outcomes assessed include:

- Recovery/cure rate among children 6 to 59 months of age receiving outpatient treatment for MAM at MIHR supported health facilities in the Gao and Tombouctou regions of Mali (primary outcome),
- Death rate (an indicator of quality of care),
- Default/drop-out rate (an indicator of acceptability and accessibility),
- Non-response to treatment rates, and
- Mean treatment duration among children 6 to 59 months of age receiving outpatient treatment for MAM or SAM without complications.

A secondary objective was to better understand the reasons caregivers returned or did not return with their children for recommended follow-up appointments once diagnosed with MAM and enrolled in the LWR nutrition program. This provides more in-depth information on the acceptability and accessibility of the nutrition care they received and helps determine if the LWR emergency nutrition program influenced families' decisions to seek care (or not) at a health facility.

Methods

Study Design

The evaluation employed primarily an observational study design using retrospective record review (RCR) at 9 of 11 MIHR-supported facilities.[1] Qualitative data, via KIIs, was collected to supplement quantitative data obtained through the RCR.

[2] Facility registers (n=316) for the program period were destroyed during flooding in the Boulgoundié facility, and registers (n=115) were torn to the point of ruin in the Toya facility in Tombouctou. Therefore, those facilities had to be excluded from the analysis.

Study Sites

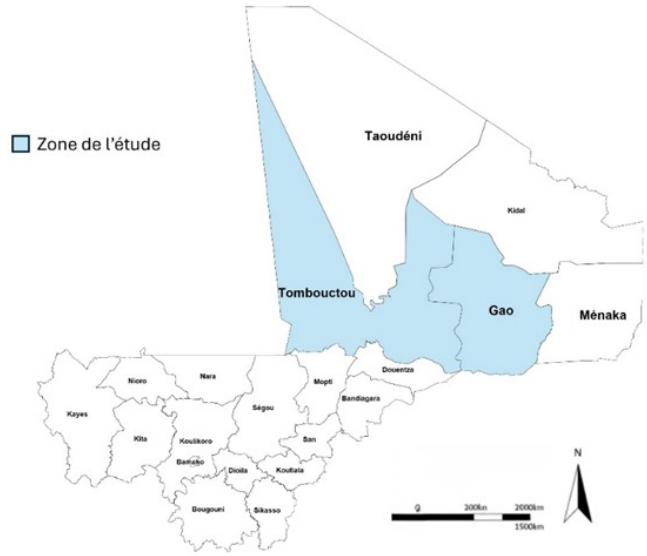
The evaluation covered nine health facilities across the health districts of Gao and Tombouctou, where the emergency nutrition program was implemented. The Gao health district is located in northeastern Mali and covers an area of 89,532 km². It has a population of around 377,564. Health care is provided by a second referral hospital, a referral health center (CSRéf), 49 community health centers, and a garrison infirmary. The district also has 125 community health workers, as well as a second referral military hospital. In addition, a number of private health facilities, including clinics, doctors' surgeries, and private dispensaries, increase the region's healthcare availability.

Table 1. Healthcare Facilities Included in the Evaluation

Facility Name	District	Catchment Population	Location Type
Bagoundjé	Gao	8,571	Peri-urban
Aljanabanbja	Gao	26,536	Urban
Château	Gao	20,630	Urban
Sossokoira	Gao	24,035	Urban
Wabaria	Gao	14,504	Peri-urban
Bellafarandi	Tombouctou	30,092	Urban
Kabara	Tombouctou	9,245	Urban
Hondobomo Koina	Tombouctou	10,504	Peri-urban
Sankoré	Tombouctou	59,395	Urban

The Tombouctou health district in northern Mali is marked by persistent insecurity, with frequent incidents of robbery, kidnapping, and murder. Covering an area of 496,611 km², it has an estimated population of 571,892. The district has a second referral hospital, a referral health center (CSRéf), 18 community health centers (CSCom), and 24 community health worker (ASC) sites. As in Gao, a number of private clinics, doctors' surgeries, and private pharmacies complete the range of healthcare services available to the population.

Figure 1. Map of the Nine Health Facilities included in the Evaluation



Study Population

The record review focused on children aged 6 to 59 months identified with MAM by community health workers between March and July 2024 in the health facilities supported by MIHR. The KIIs included primary caregivers of children (usually mothers) treated for malnutrition during the same period in the MIHR supported health facility catchment areas.

Data Collectors Training

A three-day in person training session was held from April 2 to 4, 2025 in Bamako, for the two field teams (Gao and Tombouctou), each composed of one study investigator, one data collector, and one data collection supervisor. This session ensured a common understanding of the objectives, data collection tools, and the study methodology. At the end of the theoretical training, a simulation was conducted to ensure that data collectors had mastered the questionnaire and data entry tools.

Administrative Procedures

Prior to field data collection, an information letter and two copies of the research protocol, validated by the National Ethics Committee, were submitted to the Directorate General of Health and Public Hygiene (DGSHP), which subsequently informed the regional health directorates of Gao and Tombouctou.

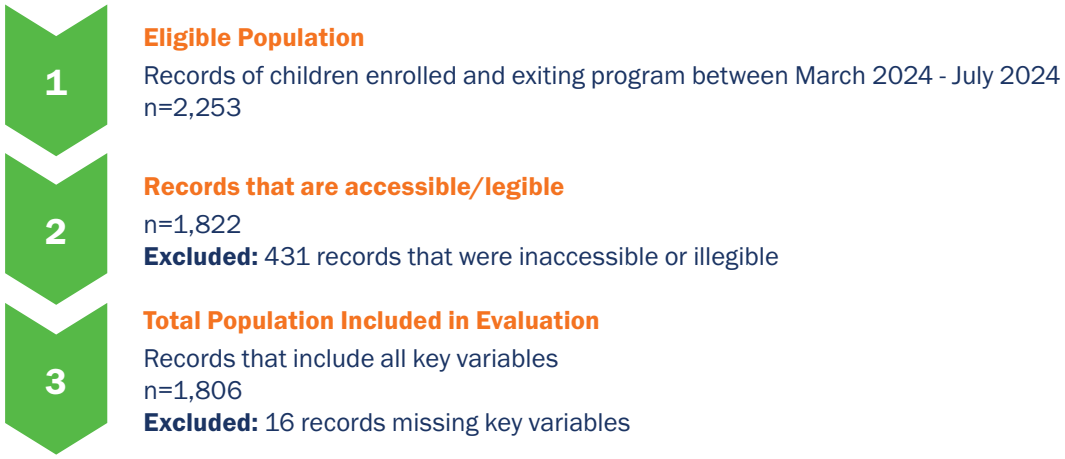
Sampling

Facility Registers

Children's records were eligible to be included in the evaluation if they participated in and exited the program between March and July 2024 (n=2,253). If the child had not exited by July 2024, they were not included, as not enough time would have passed to enroll, treat, document in registers, and determine outcomes before the project ended. Also, as noted, patient registers from two facilities had been destroyed and were unusable (n=431).

Of the 1,822 eligible and accessible records, the records of 1,806 were included (99%) in the evaluation. The 16 records not included were missing key variables needed for determining treatment outcomes, such as weight and length at either admission or upon exit.

Figure 2. Record Review Sampling



Note: The original protocol had a sample size calculation of 318 records, but it was more efficient to enter data for every child as data collectors went through the registers, rather than enumerating the registers, assigning unique identification numbers to the list of names, randomly selecting from that list, going back to registers to find the selected participants, and then entering the relevant data. Therefore, the study team made the decision to include all eligible children with accessible records in the evaluation.

Table 2. Data Coverage by Health Facility		
District/Facility	**Records Included/Total Program Participants**	**% Included**
Gao/Aljanabanbja	287/287	100%
Gao/Bagoundjé	195/196	100%
Gao/Bellafarandi	269/278	97%
Gao/Château	234/236	99%
Tombouctou/Hondobomo Koina	109/110	99%
Tombouctou/Kabara	152/153	99%
Tombouctou/Sankore	243/244	100%
Tombouctou/Sossokoira	248/249	100%
Tombouctou/Wabaria	69/69	100%
Total	**1,806/1,822**	**99%**

Key Informant Interviews: A total of 36 interviews with caregivers of children treated for MAM through the LWR program were conducted (20 in Gao, 16 in Tombouctou). Purposive sampling was used for the KIIs to ensure diverse representation. Caregivers within that sampling frame were ultimately selected using a random walk skip-pattern method, described further in the data collection section below. As the project was implemented in a larger number of facilities in Gao, a greater number of key informant interviews were conducted there.

Outcome Definitions

All definitions used in this evaluation are based on the 2017 Protocol de Prise en Charge Intégrée de la Malnutrition Aiguë au Mali (Ministere de la Santé et du Développement Social du Mali, 2017). Indicator targets are based on Sphere standards (Sphere, 2018).

Moderate Acute Malnutrition: A child is considered to have MAM if they meet any of the following criteria:

- Weight-for-length (WL) score Z score (P/T) between ≥ -3 and < -2 and/or
- Mid-Upper Arm Circumference (MUAC) between 115 mm and 125 mm, in the absence of edema

Severe Acute Malnutrition: A child is considered to have SAM if they meet any one or more of the following criteria:

- WL < -3 z-score (WHO 2006 unisex table) or
- MUAC < 115 mm or
- Presence of bilateral oedema (++ or+++ admission to URENI)[2]

Please note that the WLZ score is more sensitive than MUAC, but Community Health Workers (CHWs) only take MUAC measurements when in the community. Children with WLZ scores that would classify them as SAM were included in the program because their MUAC measurements taken by CHWs for enrollment fell in the MAM range.

Cured/Cure Rate: Patients are considered cured if they achieve:

WLZ-score ≥ -1.5 at two consecutive visits **and/or**

MUAC ≥ 125 mm at two consecutive visits

[2] The presence of edema (++ or +++) qualifies as SAM with complications. The LWR program did not treat children with SAM with complications, as they were referred to a higher level of care once they were screened at the facility.

The criterion used to determine the exit status must be the same as was used for admission. For example, if a child was admitted for treatment based on their WLZ score, they must meet the P/T Z score criterion for being cured. If a child was admitted based on their MUAC measurement, they must meet the MUAC cure criterion.

The Sphere Standard target for the cure rate for MAM and SAM without complications is >=75%.

Drop Out/Abandoned: A patient is considered to have dropped out of treatment if he or she misses two consecutive visits. The dropout rate is an indicator of the accessibility and acceptability of services.

The Sphere Standard target for drop out for MAM and SAM without complications treatment is <15%.

Mortality Rate

The Sphere Standard target for mortality is <3% for MAM and <10% for SAM without complications.

Non-response to Treatment: Patients are considered unresponsive to treatment under the following conditions:

- Failure to meet discharge criteria after 3 months of outpatient treatment
- No weight gain after 6 weeks
- Weight loss for more than 4 weeks in the program
- 5% weight loss at any time during treatment

Data Collection, Entry, and Management

A structured data abstraction tool was developed in Kobo Collect by the evaluation Data Lead based on the facility register data and the key variables needed for the evaluation. A minimum of two days were spent at each facility for data collection. Experienced local data collectors/record reviewers extracted required data from facility records and entered it directly into Kobo via tablets. Parameters, such as minimum and maximum allowable values, were built into the digital data collection tool to minimize data entry errors. Data were spot-checked nightly by supervisors for inconsistencies, and any errors identified were corrected the following day.

KIIs were conducted within the same nine facility catchment areas as the record review. Caregivers were identified through the LWR program participant registers and randomly selected using the random walk sampling method until the sampling frame was met. The random walk method entails systematic sampling with a fixed skip interval. The total number of child beneficiaries (for example, 280) was divided by the number of respondents to be interviewed (for example, eight women), resulting in a skip interval of 35. Accordingly, one key informant was selected at every 35th position in the register until the required sampling frame requirements were achieved. The sampling frame required KIIs with equal numbers of caregivers of male and female children and children in different age groups within the 6 to 59 months range. This method was applied across all health areas to ensure a balanced sample of respondents. After the participant provided written informed consent, pairs of trained interviewers conducted the KIIs in private locations, with one interviewer asking questions and one taking notes. The average interview time was approximately 30 minutes. All interviews were recorded, transcribed verbatim into French, and then translated into English for thematic analysis.

Ethical Considerations

This evaluation was approved by the Mali National Ethics Committee (CNESS approval number 202500-I). All members of the study team were certified in the protection of human subjects in research, either through the Collaborative Institutional Training Initiative (CITI) program or equivalent training. Data collectors received specific training in conducting interviews involving sensitive information, and in the principles of confidentiality and data protection. Written informed consent was obtained for all caregiver interviews, and interviews were held in private locations when feasible. Personal identification information (e.g., names, addresses, phone numbers), were not collected as part of the record review, and patients were assigned unique identification numbers. All electronic data was stored in password protected files and accessible only to the study team.

Data Analysis

Baseline characteristics and treatment outcomes of the study population are summarized as percent (n) for categorical variables or mean for normally distributed continuous variables and median for non-normally distributed continuous variables. All exit entries in facility registers (Cured, Drop out, Death, or Non-Response to Treatment) were systematically cross-checked against the definitions established in the 2017 Mali national guidance. There was high consistency between facility register and study team classification, with only 6 entries (<0.1%) in the facility registers being misclassified. These corrections were incorporated into the final analysis. The length of stay was calculated as the days from admission to discharge/exit, with discharge being the last visit the child was cared for at the health facility.

Results

Quantitative Findings: Facility Register Record Review

Study Population and Program Coverage

A total of 1,806 children aged 6 to 59 months who participated in and exited the nutrition program between March and July 2024 were included in the analysis. The study population was distributed across two districts: Gao (n=1,034, 57%) and Tombouctou (n=772, 43%). The mean age was 16.4 months (median 14 months), with ages ranging from 6 to 59 months. The sex distribution was 47% male and 53% female.

At admission, 86% of children presented with moderate acute malnutrition (MAM), 7% with severe acute malnutrition (SAM), and 7% with no wasting by WLZ classification.

Program adherence indicators showed an average of 3.56 visits per child and a completion rate of 99.2%. Dropout rates were recorded in five facilities, ranging from 0.7% to 1.8%, while one facility recorded a no-response rate of 1.1%.

Table 3. Patient Characteristics and Treatment Outcomes

Characteristic	Number (%)
District	
Gao	1,034 (57%)
Tombouctou	772 (43%)
Total Sample Size	**N = 1,806**
Demographics	
Female	961 (53%)
Male	846 (47%)
Age	
Mean age (months)	16.4
Minimum age (months)	6
Maximum age (months)	59
Median age (months)	14
Nutritional Status at Admission	
MAM	1,444 (86%)
SAM without complications	118 (7%)
No malnutrition (based on WLZ classification)	119 (7%)

Table 3. Patient Characteristics and Treatment Outcomes cont.	
Characteristic	**Number (%)**
Follow-up Visits	
Mean number of visits	3.6
Minimum visits	1
Maximum visits	7
Treatment Duration	
Mean duration (days)	30.6
Median time to recovery (MAM) (days)	28
Median time to recovery (SAM) (days)	28
Minimum duration (days)	0
Maximum duration (days)	107
Treatment Outcomes	
Cured	1,788 (99%)
Drop out	16 (1%)
Non-response to treatment	3 (<1%)
Death	0 (0%)

Treatment Outcomes and Nutritional Improvements

The evaluation demonstrated exceptional treatment outcomes that exceeded Sphere standards. Please note that due to limited variability in treatment outcomes, it was not appropriate to analyze and assess differences in outcomes by characteristics like sex of patient and region.

Overall, the recovery rate was 97.3%, and the median time to recovery was 28 days for both MAM and SAM cases. Anthropometric trends showed steady improvement from admission to exit: mean weight increased by 1.06 kg and MUAC by 7.9 cm, with the largest gains occurring within the first three visits.

Overall, the findings highlight strong program performance and positive nutritional improvements, while minor inter-facility variations suggest specific locations to target for reducing dropout rates and sustaining rapid recovery, particularly in SAM cases.

Data Quality Considerations

During the systematic data verification process, all exit status classifications in facility registers were cross-checked against the definitions established in the 2017 national guidance. This verification revealed only eight entries out of 1,806 (<0.1%) being misclassified. Specifically, two children initially marked as “abandoned/drop out” had actually met target weight criteria at their third visit and should have been classified as “cured” based on national standards. These corrections were incorporated into the final analysis. Additionally, a small number of cases with implausible weights (above 50 kg/110 lbs) were excluded from analyses involving the weight variable. The high accuracy rate (99%) in outcome classification demonstrates robust data quality and suggests that facility staff were applying national protocols appropriately.

Qualitative Findings: Key Informant Interviews

Key Informant Interview Characteristics	
Characteristic	**Number (%)**
District	
Gao	20 (56%)
Tombouctou	16 (44%)
Total Sample Size	**N = 36**
Demographics	
Female	36 (100%)
Age	
Mean age (years)	29.8

A total of 36 interviews were conducted with primary caregivers (usually mothers) of children who participated in the LWR nutrition. The interviews explored program acceptability, barriers to participation, and the influence of the intervention on healthcare-seeking behavior (see Appendix A for the KII guide).

Follow-up Appointment Adherence

The qualitative findings revealed remarkably high adherence to follow-up appointments, with 35 out of 36 participants (97%) reporting complete adherence to all scheduled visits. Only one participant reported missing appointments, attributing this to "getting the wrong day."

Motivations for High Adherence

Participants consistently cited health-focused motivations for maintaining perfect attendance including prevention of relapse and ability to see improvements/recovery. As one respondent in Gao said, *"If I skipped appointments it would be a problem because the child would relapse,"* and another stated that, *"[I came] because I saw that it was vital for the child's health and I noticed that the child was gaining weight."*

Program Acceptability

Participants expressed overwhelmingly positive views of the therapeutic food (Vitablé) and food kits provided. As one participant in Tombouctou stated, *"Since the child started taking Vitablé we have seen improvement in him and he has quickly gained weight."* Another stated, *"I like Vitablé because it's easy to prepare."*

Appetite stimulation: *"Vitablé helped stimulate the child's appetite because he used to eat Vitablé a lot."* Caregiver, Gao

Rapid results: *"I've noticed a marked improvement in my children's condition after two or three days of Vitablé consumption."* Caregiver, Gao

Minor issues identified included children's flavor preferences (with clear preference for banana over strawberry or vanilla flavors) and occasional initial mild side effects that resolved quickly.

Food Kit Satisfaction

Universal acceptance was reported for the graduation food kits, which typically included rice (10kg), millet (10kg), sugar (5kg), milk powder, oil, beans, hand-washing devices, and soap with statements including, *"I enjoyed the whole kit"* and *"My family consumed all the foodstuffs and I really liked the contents."* All food items were culturally appropriate with no reported dietary restrictions or culturally incompatible items.

Healthcare-Seeking Behavior

Positive Influence on Healthcare Utilization

Approximately 80% of participants reported that the nutrition positively influenced their healthcare-seeking behavior, as the following quotes illustrate.

"It really influenced my attendance at the center, as I became very familiar with the health people." Caregiver, Gao

"Through this program, I've gained a lot of trust in the center's agents to take care of my child." Caregiver, Tombouctou

"It was an opportunity for me to correct the fear I had of coming to CSCom for a consultation." Caregiver, Gao

Continued Healthcare Seeking

All participants reported subsequent healthcare visits for various conditions including malaria treatment, antenatal care, respiratory infections, and other childhood illnesses.

"My participation in this program has made me realize that by coming to the health center, the child will encounter fewer illnesses." Caregiver, Gao

"My participation in this program has motivated me to come every time I'm needed, and to direct other women in need to come." Caregiver, Tombouctou

Barriers to Access

Despite the overall positive experience, participants identified several manageable barriers, including Household-Level Constraints, such as domestic responsibilities competing with clinic visits, husband resistance to taking children for care at facilities, and transportation costs. As one participant from Gao stated, *"Sometimes it's our husbands themselves who prevent us from bringing the children to CSCom."* While generally reliable, some participants also mentioned occasional stockouts of nutritional inputs, requiring alternative coping strategies.

Healthcare Provider Relationships

Remarkably, no negative comments about healthcare staff were recorded across all 36 interviews. Instead, participants consistently praised them with statements such as, *"I come here because of the quality of the staff at this center"* and *"The welcome and availability of the service greatly influenced my decision."* This universal positive feedback about healthcare staff appears to have been a key factor in high follow-up adherence and continued healthcare-seeking behavior post-program.

Discussion

This evaluation provides encouraging evidence of program effectiveness, with cure rates exceeding Sphere standards, low drop-out rates, and zero reported mortality. The 99% cure rate achieved in this LWR program exceeds the typical recovery rates of 53 to 82% reported in other similar outpatient nutrition programs across sub-Saharan Africa (Kangas et al., 2022, Lopez-Ejeda et al., 2024; Rashid et al., 2022). The average length of treatment (30.6 days) in the LWR program was also notably shorter than that documented

in two recent studies of facility and community-based treatment for MAM among children ages 6 to 59 months in Mali (length of treatment was approximately 40 days in both studies) (Kangas et al., 2022; Lopez-Ejeda et al., 2024), as well as studies from other sub-Saharan African countries where median recovery times for MAM were longer (e.g., 16 weeks in Ethiopia) (Rashid et al., 2022).

Integration of Quantitative and Qualitative Findings

The quantitative outcomes are corroborated by the qualitative findings, which offer insights into the underlying reasons for program success. The 97% follow-up adherence documented in the qualitative interviews helps explain the 99% cure rate, as consistent engagement with treatment protocols is essential for nutritional recovery. The KIIs show that this adherence was driven by visible improvements in children's health, positive relationships with healthcare providers, and strong acceptability of the therapeutic food and overall program.

The universal acceptance of both the therapeutic food (Vitablé) and graduation food kits by the caregiver respondents demonstrates strong cultural compatibility. Participants' descriptions of rapid improvements in their children's health and the ease of food preparation suggest that the program was well-aligned with local preferences and practical considerations.

Perhaps most significantly, the qualitative findings reveal substantial spillover effects beyond nutritional outcomes. Approximately 80% of participants reported that the program positively influenced their healthcare-seeking behavior, with many overcoming previous fears or barriers to accessing health services. The positive feedback on healthcare staff quality and the absence of any negative staff-related feedback suggests that the program strengthened the patient-provider relationship and built trust in the health system.

The success of the integrated approach underscores the value of combining nutritional supplements, food assistance, and nutrition counseling, particularly in emergency contexts where comprehensive support is most needed.

However, challenges such as poor data quality, inconsistent protocol adherence, and environmental constraints like flooding and extreme heat highlight the fragility of service delivery systems. The qualitative findings identified additional, but manageable, barriers including household constraints (domestic responsibilities, husband resistance), transportation costs, and occasional supply chain interruptions.

Stakeholder Evaluation Results Workshop

A stakeholder workshop was held in Bamako in July 2025 to share and validate the evaluation results. The meeting was attended by twenty participants including a representative of the Director General of Health and Public Hygiene (DGSHP), leadership from the MIHR and LWR nutrition response projects, chief medical officers from both districts, National Ethics Committee members, and implementing partners.

The workshop achieved its primary objective of presenting the evaluation findings and gathering stakeholder feedback on the recommendations. Discussions focused on clarifying technical aspects of the evaluation, including cure rate calculations, input stockouts, target beneficiary definitions, and sustainability planning. A key outcome of the workshop was the validation and refinement of recommendations for **four stakeholder groups:**

Health Facilities (CSCOM and CSRéf): All recommendations were endorsed, including strengthening integrated interventions, supporting community campaigns involving men to reduce resistance to women accessing care, improving caregiver skills in nutrition and self-screening, structuring peer support networks, making nutritional inputs accessible through mobile strategies, and strengthening formative supervision for data quality.

Ministry of Health: Participants approved recommendations for digitizing nutrition records, developing procurement plans incorporating partner input, and sharing supply management plans with districts. Two additional recommendations were proposed: ensuring internet access in remote areas and using evaluation results to initiate discussions on more rigorous studies of Vitablé for MAM management.

Implementing Partners: Recommendations were refined to focus on supporting Ministry digitalization efforts and sharing procurement plans with government, while removing redundant frameworks and rewording quantity compliance recommendations.

Donors: Participants recommended funding a second project phase with geographic expansion given positive results, and supporting Ministry deliberations on Vitablé validation for MAM treatment.

Overall, the DGSHP representative expressed satisfaction with the evaluation quality and emphasized Vitablé's strategic importance as a sustainable alternative during supply disruptions. The workshop concluded with commitments from all stakeholders to incorporate approved recommendations into future nutrition initiatives in Mali.

Recommendations

Based on the evaluation results and the stakeholder results workshop, the following recommendations are presented for consideration.

Maintain and Scale Successful Elements

- Preserve the integrated service delivery model: The combination of therapeutic feeding, food assistance, and counseling should be maintained as core program components.
- Continue community-based screening: The CHW system for active case finding demonstrated high community acceptance.
- Maintain high-quality staff training: The universally positive staff evaluations suggest strong provider preparation and positive attitudes, which should be sustained and replicated.
- Preserve supply chain reliability: Consistent availability of therapeutic food (Vitablé in Mali) was crucial for maintaining participant confidence and adherence.
- Facility data digitalization efforts should be prioritized through linkages with government-led health data initiatives. Robust EMR systems, such as OpenMRS integrated with DHIS2, designed specifically for low-resource settings, should be considered.

Address Identified Barriers

- Strengthen male engagement: Implement targeted community awareness programs involving men to address husband resistance to women seeking healthcare for their children.
- Improve transportation support: Consider transport vouchers or mobile service delivery for remote areas where distance and costs create barriers.
- Enhance community health worker accessibility: Distribute contact information for community health workers to improve access to screening and referral services.
- Address supply chain gaps: Strengthen procurement and distribution systems to minimize stockouts of nutritional inputs, potentially through locally produced nutrition supplements and digital supply chain tracking and forecasting applications.
- Improve coverage for vitamin A supplementation (45.9%) and deworming (42.4%), targeting facilities with lower uptake.

Potential Program Enhancements

- Product improvements: Consider offering flavor variety for therapeutic foods, with particular attention to the preferred banana flavor noted by participants.
- Quantity optimization: Evaluate potential increases, and associated costs, in graduation food kit quantities based on family feedback, particularly for rice, sugar, milk, and millet.
- Information dissemination: Enhance community education about malnutrition signs, treatment importance, and available services to address knowledge gaps.

Capitalize on Healthcare System Strengthening

- Leverage increased trust: Build on the positive relationships established through the nutrition program to strengthen broader primary healthcare utilization.
- Expand integrated services: Consider incorporating other health interventions (immunization, maternal health, family planning) into nutrition platforms to maximize the trust and familiarity established.
- Peer advocacy programs: Harness participants' willingness to encourage other women to seek care by formalizing peer support and referral systems.
- Knowledge sharing and facility mentorship: Use facility-level performance differences to share best practices and provide mentoring to underperforming sites, strengthening overall program quality and consistency.

Monitoring, Evaluation, and Quality Assurance

- Maintain outcome tracking: Continue monitoring cure rates, treatment duration, and follow-up adherence as key performance indicators.
- Regular supervision: Strengthen supportive supervision to ensure continued data quality and protocol adherence, especially around anthropometry.
- Consider a follow up study to assess relapse incidence among program participants as well as continued use of health services by program participants to assess sustained impact on healthcare-seeking behavior.
- Support national MOH efforts to digitize patient and facility records. Hard copy data is disproportionately susceptible to destruction and error.
- Include future economic analysis to assess cost-effectiveness of the integrated nutrition approach and the use of Vitablé.

Limitations

A key limitation of this evaluation is the absence of a control or comparison group. The analysis focused solely on children who participated in the program, which limits the ability to attribute observed outcomes solely to the program. Without a counterfactual, it is not possible to assess how children with similar nutritional status would have fared in the absence of this specific programming. This limitation also restricts the ability to control for external factors, such as seasonal food availability or other health interventions that may have influenced recovery outcomes. As a result, the reported cure rates and service utilization improvements, while encouraging, should be interpreted with caution. Future evaluations should consider including a matched comparison group or utilizing quasi-experimental methods (e.g., difference-in-differences) to strengthen causal inferences about program effectiveness.

Data source limitations include reliance on hard copy facility registers as the sole source of quantitative data. While systematic cross-checking of exit status classifications against national standards revealed high data quality (99.9% accuracy), other limitations remain including potential inconsistencies in anthropometric measurement techniques across staff and facilities, missing baseline severity stratification data, and limited information about treatment fidelity and concurrent interventions. The evaluation period (March to July 2024) may not capture seasonal variations in program performance, and the exclusion of two facilities with destroyed registers introduces potential selection bias.

Qualitative limitations include potential social desirability bias in participant responses, particularly the universally positive feedback about healthcare staff, which may reflect reluctance to criticize services. The qualitative sample, while purposively selected, represents a subset of program participants and may not capture the experiences of those who dropped out or had negative experiences. Additionally, interviews were conducted in the post-program period, which may have led to recall bias regarding specific experiences and motivations during treatment.

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CORUS

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Appendix A. Key Informant Interview Guide: Primary Caregivers Adults and Emancipated Minors, (married) ages 15 years and older

Screening		
A1.	What is your age? MUST BE at least 15 years old. If under 15 years, end the interview.	Age in Years _____ If <15 stop interview
A2.	Are you the primary caregiver for the children in your household? If not the primary caregiver, end the interview.	☐ Yes ☐ No STOP INTERVIEW
A3.	Has the participant provided informed consent?	☐ Yes ☐ No STOP INTERVIEW
A4.	Have you had a child diagnosed with malnutrition?	☐ Yes ☐ No STOP INTERVIEW
Nutrition		
B1.	How many children under 5 years of age live in your household?	_____
B2.	How many are aged 0-5 months?	_____
B2.a	[If B2 >0] Are you the primary caregiver for the children in your household? If not the primary caregiver, end the interview.	
B3	How many are aged 6 to 23 months?	_____
	[If B3>0] Are they given complementary foods?	☐ Yes ☐ No

1. If any of your children were diagnosed as malnourished (Moderate Acute Malnutrition or Severe Acute Malnutrition), did they receive treatment at a treatment center or clinic? **If yes, skip to question 3.**
2. If not admitted to a treatment center, how was the child's malnutrition treated or addressed? **Skip to question 6 after this for those that DID NOT receive treatment at a clinic/facility.**
3. If your child was admitted to a treatment center or clinic, did you keep all follow-up visits?
   If not, why did you not keep all of the child's follow-up visits?
   Probe: What was the main reason you did not keep all of your child's follow-up visits?
   If yes, what was the main reason you kept your child's follow-up visits?
4. What nutrition messages or advice did you receive during a clinic visit or community meeting?
5. How did the flour you received as part of the program help your child's nutrition? What did you like or not like about the flour?
6. Did you and your child finish the nutrition program and receive the food kit at the end? **If no, skip to question 7**.
   a. **If yes**, What did you like or not like about the food kit? Were there foods in there that are not eaten by your family? Which ones?
7. Has your child experienced any nutrition related issues since receiving or finishing their treatment for MAM? If so, what types of issues?
8. Are there barriers that prevent mothers with at-risk infants from accessing emergency nutrition services? How can we overcome these barriers in the future?
9. Do you seek care at a health facility for anything besides malnutrition visits? Like when you or your child is sick or injured?
   a. If yes, what is your main reason for seeking care at a facility?
   b. If no, what is your main reason for not seeking care at a facility?

Appendix B: Supplemental Tables: Study Population, Nutritional Status, Program Coverage, and Treatment Outcomes

Table 1: Study Population Characteristics by Facility and District

District	Facility	Total	Mean age months	Median age months	Min age months	Max age months
Gao	Aljanabanbja	287	15.24	14	6	59
Gao	Bagoundjé	195	15.19	13	6	48
Gao	Château	234	14.93	13	6	31
Gao	Sossokoira	248	16.78	14	6	59
Gao	Wabaria	69	16.75	16	6	47
Tombouctou	Bellafarandi	269	17.49	13	6	59
Tombouctou	Hondobomo Koina	109	13.43	12	6	36
Tombouctou	Kabara	152	18.7	18	6	39
Tombouctou	Sankoré	243	18.16	18	6	59
	Total	**1806**	**16.4**	**14**	**6**	**59**

Table 2: Study Population Distribution by Sex and Facility

District	Facility	Total	Male (n)	Female (n)	Male (%)	Female (%)
Gao	Aljanabanbja	287	137	150	48%	52%
Gao	Bagoundjé	195	88	107	45%	55%
Gao	Château	234	120	114	51%	49%
Gao	Sossokoira	248	113	135	46%	54%
Gao	Wabaria	69	34	35	49%	51%
Tombouctou	Bellafarandi	269	125	144	46%	54%
Tombouctou	Hondobomo Koina	109	45	64	41%	59%
Tombouctou	Kabara	152	80	72	53%	47%
Tombouctou	Sankoré	243	103	140	42%	58%
	Total	**1806**	**845**	**961**	**47%**	**53%**

Table 3: Nutritional Status by Classification at Admission						
WLZ category	**n**	**Weight mean**	**Weight SD**	**Weight p25**	**Weight p50**	**Weight p75**
MAM	1556	7.58	1.39	6.7	7.4	8.2
None	127	7.65	1.77	6.55	7.2	8.2
SAM	123	7.08	1.42	6.4	6.8	7.5
Total	**1806**	**7.55**	**1.43**	**6.6**	**7.3**	**8.2**

WLZ category	**n**	**Length_mean**	**Length_SD**	**Length_p25**	**Length_p50**	**Length_p75**
MAM	1556	74.24	7.59	69	73	78
None	127	70.54	7.84	65.5	69	73
SAM	123	74.82	8.43	69.75	72.5	78
Total	**1806**	**7.55**	**1.43**	**6.6**	**7.3**	**8.2**

WLZ category	**n**	**MUAC mean**	**MUAC SD**	**MUAC p25**	**MUAC p50**	**MUAC p75**
MAM	1556	121.09	2.85	120	120	123
None	127	120.91	2.33	120	120	122
SAM	123	120.33	3.68	120	120	122
Total	**1806**	**121.03**	**2.88**	**120**	**120**	**123**

Table 4: Distribution of Nutritional Status by Age Group (WLZ Classification)			
WLZ category	**Age group**	**Count**	**Proportion**
MAM	12-23m	774	87%
SAM	12-23m	65	7%
None	12-23m	52	6%
MAM	24-59m	316	88%
SAM	24-59m	19	5%
None	24-59m	26	7%
MAM	6-11m	466	84%
SAM	6-11m	39	7%
None	6-11m	49	9%
MAM	Total	1556	86%
SAM	Total	123	7%
None	Total	127	7%

Table 5: Coverage of Key Nutritional Interventions by Facility				
Facility	**n**	**Vitamin A coverage**	**Albendazole / Mebendazole coverage**	**Vitablé coverage**
Aljanabanbja	273	0.0%	37.7%	100
Bagoundjé	188	81.4%	69.7%	100
Bellafarandi	244	0.0%	0.0%	100
Château	230	100.0%	92.2%	100
Hondobomo Koina	79	97.5%	64.6%	100
Kabara	136	0.0%	0.0%	100
Sankoré	219	0.0%	0.0%	100
Sossokoira	243	100.0%	65.4%	100
Wabaria	67	100.0%	82.1%	100
Total	**1679**	**45.9%**	**42.4%**	**100**

Table 6: Program Visit Patterns, Duration, and Adherence by Facility						
Facility	**n**	**Avg visits**	**Avg program duration**	**Completion rate**	**Dropout rate**	**No response rate**
Aljanabanbja	287	3.38	25.2	99.3%	0.7%	0.0%
Bagoundjé	195	3.03	21.13	100.0%	0.0%	0.0%
Bellafarandi	269	3.54	34.88	98.1%	0.7%	1.1%
Château	234	3.5	23.55	100.0%	0.0%	0.0%
Hondobomo Koina	109	2.94	42.25	98.2%	1.8%	0.0%
Kabara	152	3.8	28.88	99.3%	0.7%	0.0%
Sankoré	243	3.93	45.73	100.0%	0.0%	0.0%
Sossokoira	248	3.73	24.19	98.4%	1.6%	0.0%
Wabaria	69	4.59	41.13	100.0%	0.0%	0.0%
Total	**1806**	**3.56**	**30.6**	**99.2%**	**0.6%**	**0.2%**

Table 7: Baseline Anthropometric Measurements (Weight, Length, and MUAC) by Age Group at Admission						
Age group cat	**n**	**Weight mean**	**Weight SD**	**Weight SE**	**Weight CI lower**	**Weight CI upper**
12-23m	891	7.54	0.92	0.03	7.48	7.6
24-59m	361	9.19	1.72	0.09	9.01	9.36
6-11m	554	6.51	0.75	0.03	6.45	6.57
Total	**1806**	**7.55**	**1.43**	**0.03**	**7.49**	**7.62**

Age group cat	**n**	**Length mean**	**Length SD**	**Length SE**	**Length CI lower**	**Length CI upper**
12-23m	891	73.99	5.1	0.17	73.66	74.33
24-59m	361	83.02	8.75	0.46	82.12	83.92
6-11m	554	68.19	4.04	0.17	67.86	68.53
Total	**1806**	**74.02**	**7.73**	**0.18**	**73.66**	**74.38**

Age group cat	**n**	**MUAC mean**	**MUAC SD**	**MUAC SE**	**MUAC CI lower**	**MUAC CI upper**
12-23m	891	121.03	2.94	0.1	120.84	121.23
24-59m	361	121.82	2.86	0.15	121.53	122.11
6-11m	554	120.5	2.7	0.11	120.28	120.72
Total	**1806**	**121.03**	**2.88**	**0.07**	**120.89**	**121.16**

Table 8: Treatment Outcomes and Recovery Rates by Facility						
Facility	**n**	**Recovery rate**	**Recovery SE**	**Recovery CI lower**	**Recovery CI upper**	**Sphere recovery compliant**
Aljanabanbja	287	98.6%	0.01	96.7%	100.0%	Yes
Bagoundjé	195	99.5%	0.01	97.5%	100.0%	Yes
Bellafarandi	269	96.7%	0.01	94.7%	98.6%	Yes
Château	234	95.7%	0.01	93.8%	97.7%	Yes
Hondobomo Koina	109	94.5%	0.02	90.6%	98.4%	Yes
Kabara	152	94.7%	0.02	90.8%	98.7%	Yes
Sankoré	243	98.8%	0.01	96.8%	100.0%	Yes
Sossokoira	248	98.4%	0.01	96.4%	100.0%	Yes
Wabaria	69	95.7%	0.02	91.7%	99.6%	Yes
Total	**1806**	**97.3%**	**0.003**	**96.6%**	**98.1%**	**Yes**

Table 9: Anthropometric Changes (Weight and MUAC) from Admission to Exit by Facility						
Facility	**n**	**Weight change mean**	**Weight change SD**	**Weight change SE**	**Weight change CI lower**	**Weight change CI upper**
Aljanabanbja	287	1.05	0.4	0.02	1	1.1
Bagoundjé	195	0.97	0.26	0.02	0.93	1
Bellafarandi*	268	1.11	0.56	0.03	1.04	1.17
Château	234	1.16	0.44	0.03	1.1	1.22
Hondobomo Koina	109	0.73	0.34	0.03	0.66	0.79
Kabara	152	0.98	0.47	0.04	0.9	1.05
Sankoré	243	1.07	0.41	0.03	1.02	1.12
Sossokoira	248	1.29	0.34	0.02	1.25	1.33
Wabaria	69	0.78	0.31	0.04	0.7	0.85
Total	**1805**	**1.06**	**0.44**	**0.01**	**1.04**	**1.08**

Facility	**n**	**MUAC change mean**	**MUAC change SD**	**MUAC change SE**	**MUAC change CI lower**	**MUAC change CI upper**
Aljanabanbja	287	9.62	3.66	0.22	9.2	10.05
Bagoundjé	195	6.16	1.88	0.13	5.9	6.43
Bellafarandi*	268	9.79	3.82	0.23	9.33	10.25
Château	234	1.95	3.22	0.21	1.54	2.36
Hondobomo Koina	109	8.07	3.27	0.31	7.46	8.69
Kabara	152	10.52	3.35	0.27	9.99	11.05
Sankoré	243	5.76	2.25	0.14	5.48	6.04
Sossokoira	248	9.1	2.35	0.15	8.81	9.4
Wabaria	69	4.97	2.84	0.34	4.3	5.64
Total	**1805**	**7.49**	**4.1**	**0.1**	**7.3**	**7.68**

Table 10: Anthropometric Changes (Weight and MUAC) from Admission to Exit by Age Group						
Age Group	**n**	**Weight change mean**	**Weight change SD**	**Weight change SE**	**Weight change CI lower**	**Weight change CI upper**
12-23m	891	1.05	0.41	0.01	1.02	1.07
24-59m	361	1.18	0.47	0.02	1.13	1.23
6-11m	553	1.01	0.44	0.02	0.97	1.05
Total	**1805**	**1.06**	**0.44**	**0.01**	**1.04**	**1.08**

Age Group	**n**	**Weight change mean**	**Weight change SD**	**Weight change SE**	**Weight change CI lower**	**Weight change CI upper**
12-23m	891	7.39	4.22	0.14	7.12	7.67
24-59m	361	7.81	4.28	0.23	7.37	8.25
6-11m	553	7.43	3.77	0.16	7.12	7.75
Total	**1805**	**7.49**	**4.1**	**0.1**	**7.3**	**7.68**

Table 11: Median Time to Recovery by Malnutrition Severity (MAM/SAM)				
Facility	**WLZ category**	**N**	**Median time days**	**IQR time days**
Aljanabanbja	MAM	254	21	7
Bagoundjé	MAM	166	21	0
Bellafarandi	MAM	219	35	14
Château	MAM	202	21	9.5
Hondobomo Koina	MAM	70	28	29.5
Kabara	MAM	124	28	1.75
Sankoré	MAM	201	28	28
Sossokoira	MAM	220	24	4.25
Wabaria	MAM	61	34	14
Total	**MAM**	**1517**	**28**	**11**
Aljanabanbja	SAM	15	28	9
Bagoundjé	SAM	21	21	0
Bellafarandi	SAM	16	35	8.75
Château	SAM	18	23	9.5
Hondobomo Koina	SAM	6	26.5	44.25
Kabara	SAM	7	28	0
Sankoré	SAM	15	28	36
Sossokoira	SAM	19	28	4
Wabaria	SAM	3	49	9.5
Total	**SAM**	**120**	**28**	**8**

Table 12: Recovery Rates and Treatment Duration by Malnutrition Severity							
WLZ category	**N**	**Recovery rate**	**Treatment duration mean**	**Treatment duration SD**	**SE**	**CI lower**	**CI_upper**
MAM	1556	97.5%	30.0	16.1	0.0	97.5%	97.5%
SAM	123	97.6%	30.3	16.9	0.0	95.6%	99.5%
Total	**1679**	**97.5%**	**30.0**	**16.1**	**0.4**	**96.8%**	**98.2%**

Table 13: Anthropometric Progression by Program Visit		
Visit	**Mean weight**	**Mean MUAC**
1	7.81	123
2	8.13	125
3	8.41	127
4	8.74	129
5	8.57	127
6	8.73	128
7	9.55	128

Table 14: Growth Velocity (Weight and MUAC) Between Visit Intervals		
Visit interval	**Weight change**	**MUAC change**
V1-V2	0.32	2.14
V2-V3	0.31	2.11
V3-V4	0.31	1.87
V4-V5	0.24	1.69
V5-V6	0.29	1.45
V6-V7	0.3	1.77