Family MUAC training effectively improves caregiver-led malnutrition screening

Introduction

This brief summarizes key insights of the impact and cost-effectiveness of a pilot Family MUAC (Mid-Upper Arm Circumference) intervention in Amhara and Oromia regions of Ethiopia. Family MUAC is a scalable community-based approach used to screen children under five years old for early detection, referral and treatment of severe and acute malnutrition, one of the leading causes of illness and mortality among children under five in low-income countries, including in Ethiopia.

Periodic training and supervision influence caregivers' knowledge of malnutrition, their MUAC measurement skills, and their ability to detect early signs of malnutrition and edema, critical skills for timely referral and preventing complications. The pilot evaluated whether an intensive Family MUAC intervention—incorporating periodic caregiver training and supervision—yields greater impact and cost-effectiveness than the minimum approach in improving caregivers' knowledge and skills to accurately measure MUAC, assess edema, and enable early detection and referral. The study assessed accuracy of measurements by comparing caregivers' assessment results to those of trained enumerators and health extension workers.

Highlights of the Findings

The Family MUAC intervention:

- Improved understanding about the purpose of screening children for malnutrition.
- Resulted in a substantial increase in proportion of caregivers measuring MUAC—from 17.7% at baseline to 94% in the T2 (minimum treatment group) and from 25.7% to 97.4% in T3 (intensive treatment group).
- Improved the rate of MUAC measurement accuracy by 69.3 percentage points among caregivers in T2 and 67.3 percentage points in T3 compared to the control group (T1).
- Increased the rate of edema detection accuracy by 54.6 percentage points using the minimum approach (T2) and 62.2 percentage points using the intensive approach (T3) relative to the control (T1).
- Demonstrated the minimum approach is most cost-effective at improving MUAC measurement accuracy.

Background

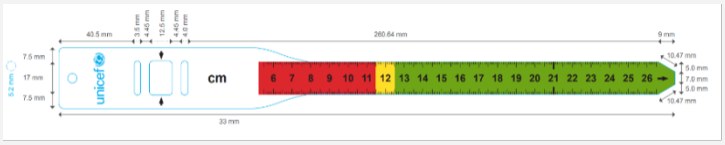
Malnutrition remains a critical public health challenge in Ethiopia, with persistently high rates of stunting, wasting, and underweight among children under five. Severe acute malnutrition (SAM) is a leading cause of under-five mortality, contributing to an estimated 8% of child deaths nationally.

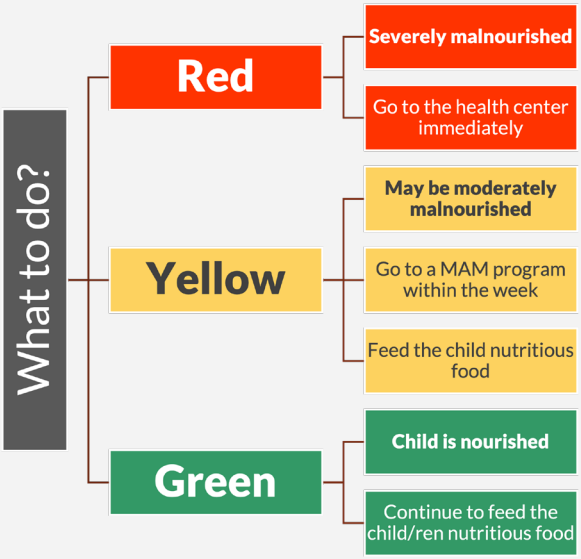
The assessed MUAC intervention was implemented as part of the Strengthening PSNP5 Institutions and Resilience (SPIR II) project, a five-year (2021-2026) initiative implemented by World Vision with its consortium partners CARE and ORDA with fundings from the United States government. SPIR II supported the government of Ethiopia's Productive Safety Net Program (PNSP) to improve food security, enhance resilience to shocks, and strengthen nutrition outcomes among rural households vulnerable to food insecurity in Oromia and Amhara regions.

The study was implemented in Daro Lebu, Doba, and Wadla Woredas, identified as priority one for high malnutrition burden.

The MUAC Tape

The MUAC (Mid-Upper Arm Circumference) tape is a simple, color-coded tool used to detect wasting in children. Measurements between 11.5 and 12.5 cm (yellow band) indicate moderate acute malnutrition (MAM), while measurements below 11.5 cm (red band) indicate severe acute malnutrition (SAM). During caregiver training, the tape and an accompanying color-coded graphic were used to support ease of interpretation. At monitoring visits, enumerators captured both the numerical measurements and the corresponding color codes.





Method

The study was implemented across nine kebeles, with three kebeles selected from each of the three woredas: Daro Lebu, Doba, and Wadla. The nine kebeles were randomly assigned to one of three study arms:

- Control arm **(T1)**—current local **standard** care with no Family MUAC intervention;
- Treatment arm 2 **(T2)**—the **minimum** Family MUAC intervention. Caregivers received initial basic training, MUAC tapes, and one supervision visit with on-the-job training;
- Treatment arm 3 **(T3)**—the **intensive** Family MUAC intervention. Caregivers received basic training, MUAC tapes, and supervision visits with on-the-job training every six weeks for the first six months and one visit every three months for the last six months.

A total of 1,463 households (mother–child pairs) were randomly selected from these kebeles and enrolled in the study. Eligible households included children aged 6–47 months at enrollment, allowing follow-up until age five. The sample size was generally evenly distributed across the three study arms. Of the enrolled households, 1,360 (93%) completed the study. Drop out was lowest in T3 with only 3.0% attrition, while T1 (control) recorded the highest dropout at 10.8%.

The brief presents evidence on the impact and cost-effectiveness of T2 and T3 using a difference-in-difference analysis, which reveal changes over time among intervention households relative to the control group.

Key Findings

This section presents key findings at project endline, providing insights on the effectiveness of caregiver-led screening in improving malnutrition detection and reducing the risk of severe acute malnutrition in children.

IMPROVED MUAC KNOWLEDGE AND UNDERSTANDING

The intervention increased understanding among caregivers about the purpose of assessing their children's malnutrition status. The training corrected a common misconception that MUAC results determined access to food aid and ready-to-use therapeutic foods. Some caregivers were initially reluctant to measure MUAC, worrying that they could be dropped from food-aid programs if their children were found healthy. Caregivers came to understand that red or yellow readings simply indicate their child's health risk rather than eligibility for therapeutic foods. For instance, one participant in qualitative interviews noted:

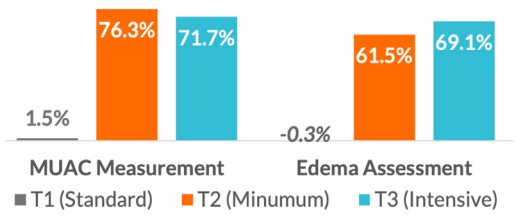
> *"We usually quarrel with the [Health Extension Worker] when they tell us that our children measured green because it means that we will not be accessing food aid but now I know that green means my child is healthy. We tended to be happy when they measured our children and tell us that he or she has red measurement because we will be given Plumpy Nut … but how I feel guilty [for quarreling]."*

Another participant noted: *"I am confident that giving extra food like one egg per day can improve the MUAC from yellow to green for my child."*

IMPROVED TENDENCY TO MEASURE MUAC

At baseline, few caregivers measured MUAC and edema. Endline results show a major improvement, with 94% of T2 caregivers measuring MUAC, up from 17.7%. In T3, those measuring increased from 25.7% at baseline to 97.4% at endline, while the control group marginally increased from 26.7% to 28.2% *(see Figure 1)*.

Fig. 1: The proportion of caregivers measuring MUAC and edema increased significantly in both study arms from baseline to endline



The difference-in-difference regression analysis revealed **the minimum Family MUAC intervention (T2) increased the likelihood of caregivers to measure MUAC by 72.7% while the intensive MUAC approach (T3) led to 67.6 percentage point improvement.** The difference in impact between the two approaches was not statistically significant.

The proportion of caregivers assessing edema improved to 74.5% from 13.0% among T2 participants, while it increased to 86.7% from 17.6% in the T3 group. The control group saw no change (20.5% to 20.2%). The regression analysis shows overall, **the minimum and intensive MUAC approaches increased the likelihood of assessing edema by 61 percentage points and 68.1 percentage points, respectively**, relative to the control group.

IMPROVED MUAC MEASUREMENT ACCURACY

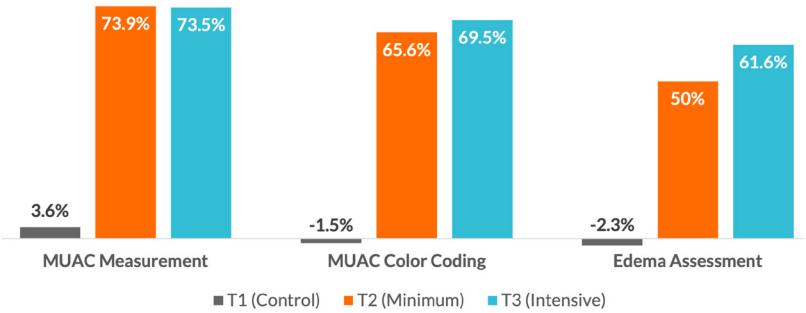
The proportion of caregivers that measures MUAC or edema accurately was low at baseline. The proportion of caregivers who measured MUAC accurately increased significantly from 15.4% at baseline to 89.3% at endline in T2, while T3 saw an increase from 21.9% to 95.4%. The control group saw a slight change from 22.3% to 25.9% by endline. Overall, regression analysis adjusting for other covariates revealed that caregivers in T2 (minimum MUAC) group had a 69.3 percentage point increase in measuring MUAC accurately, while those in T3 saw a 67.3 percentage point increase, relative to the control. Improvements in knowledge of MUAC tape colors is also similarly substantial across the two treatment arms *(see Figure 2)*.

IMPROVED EDEMA-DETECTION SKILLS

Similarly, both intervention groups (T2 and T3) demonstrated substantial improvements in the proportion of caregivers performing accurate edema assessments (see Figure 2). Accuracy rates increased significantly, from 12.5% to 62.5% in T2 and from 17.2% to 78.8% in T3.

A direct comparison of the two intervention methods indicated that **T3 produced a statistically significant higher number of caregivers who assessed edema accurately compared to T2**. In contrast, edema assessment accuracy in the Control group (T1) decreased by 2.3 points, from 19.3% at baseline to 17.0% at endline.

Fig. 2: MUAC measurement and color-coding accuracy improved significantly from baseline to endline in both the minimum (T2) and intensive (T3) arms; T3 caregivers showed higher accuracy in edema assessment



Regression analysis adjusting for covariates indicates **the minimum MUAC approach led to a 54.6 percentage point increase in rate of assessing edema accurately, while the intensive MUAC approached produced a 62.2 percentage point increase**.

EARLY DETECTION AND RELIABLE SELF-REFERRALS

Health facility data showed 152 caregiver self-referrals (75 in T2; 77 in T3) when malnutrition was suspected. In general, caregivers accurately identified all moderate acute malnutrition (MAM) and severe acute malnutrition (SAM) cases. This means no malnourished children were missed. However, there were few false referrals (positives), i.e., classifying health children as malnourished. The number of false positives was higher in referrals made by caregivers in T3. In T3, five children with normal MUAC were misclassified as MAM. T2 had four false positives (two MAM as SAM, two normals as MAM). Importantly, nearly all caregivers reported they would seek facility care for yellow or red MUAC results, with T3 caregivers more likely to involve family members in decisions to seek treatment.

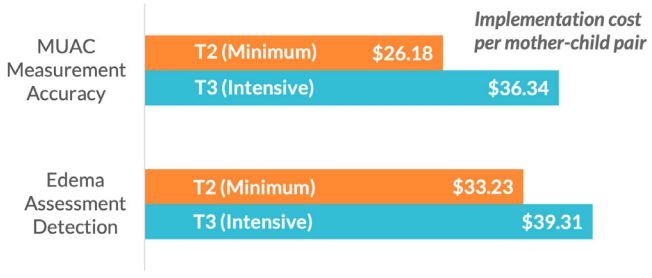
Family MUAC Cost-effectiveness

We assessed cost-effectiveness as the ratio of cost per unit gain in outcome, with lower ratios indicating better value for money. Results are reported for the study's primary outcome: the increase in the proportion of caregivers who accurately measure MUAC and/or assess edema. We calculated cost effectiveness ratios using impact estimates from the regression analysis and intervention costs for T2 and T3. We categorized and aggregated costs using a micro-costing approach based on reported expenditures across activities.

Overall, **the minimum MUAC approach (T2) provided better value for money than the intensive MUAC approach (T3). The minimum treatment cost $26.18 for each additional caregiver who could accurately measure MUAC, compared with about $36.34 under the intensive approach**. This suggests that additional training and supervision increased costs without commensurate gains in measurement accuracy *(see Figure 3)*.

Similarly, T2 cost $33.23 for each additional caregiver who could accurately assess edema, compared with $39.31 for T3, making T2 more cost-effective overall. This means that while T3 achieved higher edema assessment

Fig. 3: The standard approach is more cost-effective than the endhanced approach for each additional caregiver able to measure MUAC and edema accurately



accuracy, it did so at a higher cost. **However, if maximizing edema detection—critical for identifying severe acute malnutrition—is a priority, the higher-cost T3 approach may be justified**.

Conclusion

The Family MUAC intervention substantially strengthened caregivers' ability to measure and assess childhood malnutrition, fostering near-universal awareness and willingness among caregivers to measure children's MUAC and edema. Providing MUAC tapes with training and supportive supervision empowered caregivers to take more active roles in child nutrition, including engaging other family members—a practice not reported at baseline. Both T2 and T3 approaches produced large gains in enabling caregivers to accurately measure MUAC and assess edema, with **T3 showing only marginal advantages in edema assessment**. Despite some over-classification—particularly in T3—caregivers were effectively empowered to identify and self refer malnourished children, improving early detection. Given its comparable performance and superior cost effectiveness, **the T2 (minimum) approach emerges as the most practical for scale up while the more intensive T3 approach could be deployed in high-prevalence "hotspots" to maximize the detection of life-threatening edema cases**. Future efforts should focus on refining our training to improve specificity and reduce unnecessary referrals while expanding the reach of this efficient, community driven screening strategy.

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