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STATE OF THE EVIDENCE 2021

Modifications Aiming to Optimize Acute Malnutrition Management in Children under Five

AUGUST 2021

Photo by
LYS ARANGO
For Action Against Hunger Kenya

Suggested Citation

Action Against Hunger USA (2021). State of the Evidence 2021: Modifications Aiming to Optimize Acute Malnutrition Treatment in Children Under Five. New York, NY.

Acknowledgements

Many thanks to the following Action Against Hunger USA members for their support in developing, reviewing, and validating this document: Maria Wrabel; Heather Stobaugh; Sarah King; Imelda Awino; Ellyn Yakowenko; and Michelle Brown. We are deeply grateful to the following individuals for their review and thoughtful contributions to these summaries: Andrew Beckingham, Save the Children; Jessica Bourdaire, World Food Programme, CORTASAM; Pilar Charle Cuellar, Action Against Hunger Spain; Suvi Kangas, International Rescue Committee; Emily Keane, Save the Children; Sajia Mehjabeen, Save the Children; Kevin Phelan, ALIMA; Kirrily de Polnay, MSF; and Sophie Woodhead, UNICEF.

This document is made possible by the generous support of the American people through the United States Agency for International Development (USAID). The contents are the responsibility of Action Against Hunger USA and do not necessarily reflect the views of USAID or the United States Government.

Acronyms

CHV	Community health volunteer
CHW	Community health worker
CMAM	Community-based management of acute malnutrition
ComPAS	Combined Protocol for Acute Malnutrition Study
cRCT	Cluster-randomized control trial
EAC	Expanded admission criteria
FBF	Fortified blended food
ICCM	Integrated community case management
IRC	International Rescue Committee
LOS	Length of stay
MAM	Moderate acute malnutrition
MANGO	Modelling an Alternative Protocol Generalizable to Outpatient study
MSF	Medecins San Frontieres
MUAC	Mid-upper arm circumference
NR	Non-response
OptiMA	Optimizing treatment for acute MAlnutrition study
OTP	Outpatient therapeutic program
RCT	Randomized controlled trial
RUSF	Ready-to-use supplementary food
RUTF	Ready-to-use therapeutic food
SAM	Severe acute malnutrition
TSFP	Targeted supplementary feeding program
WaSt	Wasting and stunting
WAZ	Weight-for-age Z-score
WHZ	Weight-for-height Z-score

Introduction

Acute malnutrition impacts almost 50 million children under five each year (1), with the COVID-19 pandemic putting an additional 6.7 million children at risk (2). Children suffering from acute malnutrition are at significantly higher risk of morbidity and mortality (3,4). Community-based management of acute malnutrition (CMAM) has brought malnutrition treatment closer to home, increasing both coverage and access with high levels of effectiveness compared to inpatient, facility-based treatment. However, challenges remain in meeting the needs of all acutely malnourished children worldwide. For example, less than 20% of children with severe acute malnutrition (SAM) have access to treatment (5).

To address these challenges, organizations and governments have implemented "simplified approaches", which Action Against Hunger USA defines as: a range of modifications and innovations to standard CMAM protocols with the aim of simplifying and streamlining operations, maximizing coverage, reducing overall costs, and optimizing cost-effectiveness. Furthermore, the COVID-19 pandemic presented unparalleled challenges to service continuity in the management of acute malnutrition, reducing children's access to treatment. Addressing these concerns drove further implementation of these modifications and innovations, led by UNICEF and Global Nutrition Cluster guidance (6,7).

While many innovations have been tested to optimize CMAM service delivery, this summary focuses on those six modifications included in the global operational guidance on management of acute malnutrition in children aged 6-59 months in the context of COVID-19.[1] These six CMAM protocol modifications – often discussed under the umbrella of "simplified approaches" – include:

1. Family MUAC
2. Reduced frequency of follow-up visits during treatment
3. Modified admission and discharge criteria to treatment programs
4. Combined treatment/protocol of MAM and SAM
5. Modified (or reduced) dosage of therapeutic or supplementary foods during treatment
6. Acute malnutrition treatment by community health workers (CHWs)

This summary assesses the current state of evidence on each approach in tabular form, providing: the definition and objectives; evidence of effectiveness; operational considerations (e.g., training, staffing, and logistics); cost considerations and evidence on cost-effectiveness; operational successes and challenges; and areas for future research and learning. This document is not intended to endorse any particular approach. Rather, it aims to objectively present the state of the existing evidence on each approach, so as to inform decision-making among practitioners looking to further test, refine and implement such approaches. The initial search was conducted in December 2020, with a follow-up search conducted in August 2021.

Further resources can be found at: https://acutemalnutrition.org/en and https://www.simplifiedapproaches.org/

[1] Other approaches not assessed within this evidence summary include, for example, CMAM Surge, CMAM mHealth, and Management of At-Risk Mothers and Infants (MAMI).

Family MUAC

Description: Family MUAC (sometimes referred to as Mother-led MUAC) is an approach that equips caregivers, through training and provision of MUAC tapes, to detect acute malnutrition in their own children at the household level by measuring MUAC and edema themselves in order to improve early case identification and referral for treatment.

- Primary Objectives: Improve earlier detection and treatment of acute malnutrition; empower caregivers to monitor and take action to address their children's nutritional status
- Secondary Objectives: Improve program coverage by screening and referring more children for treatment; reduce contact between health workers, CHWs, and community members during COVID-19

Evidence Summary: The theory behind Family MUAC is strong and an increasing number of governments and implementing organizations are adopting the approach in numerous contexts. While it is currently one of the most widely implemented adaptations, the evidence base for Family MUAC continues to grow. A recent UNICEF rapid review identified six peer-reviewed articles and 38 implementation resources and case studies (8). Peer-reviewed evidence to date focuses largely on demonstrating that caregivers can measure MUAC and assess edema with the same level of accuracy as trained community health workers (9–13). Robust evidence is lacking regarding effectiveness and cost-effectiveness on improving early treatment, identifying and referring clinical danger signs, how the approach should handle MAM cases in the event that MAM treatment is unavailable, and best practices to ensure an effective program design, including the behavior change component.

What Do We Know?				What Don't We Know?
Effectiveness	Operational Considerations	Cost Considerations	Strengths and Challenges	
Three non-randomized studies found that caregivers can assess MUAC and edema as accurately as CHWs (9,10,14). However, this ability may decrease over time, according to an LQAS survey (8) An efficacy study in Niger found that Family MUAC led to earlier detection and fewer hospitalizations (10) One single-arm study found a positive association between training caregivers and recovery, likely due to changed health-seeking behaviors (12) Operational evidence indicates that Family MUAC can improve the frequency of screenings compared to CHW screenings (8,15) One pilot study indicated that Family MUAC combined with training on clinical danger signs could be used to monitor children's progress through treatment (13)	Supplies and Logistics Insufficient MUAC tapes remains a challenge for scaling (15) Preference for color-coded over the numbers-only MUAC tapes sometimes used for screening pregnant and lactating women (9,15) Training Varied training models accrue different costs (e.g., conference room space; transportation; incentives for caregivers; care group volunteer incentives, etc.) Contextualized, low-literacy training tools needed (15) Frequent refresher trainings may prevent decline in measurement accuracy over time (8) Staffing Potential increase in admissions from caregiver referrals may increase demands on treatment facilities, requiring resources (15) Refresher trainings and follow-ups may increase staff workload (15) Careful planning is needed to determine most appropriate roles for CHWs regarding training, supervision, confirming referrals, and/or hands-on screening (8,15)	Little evidence exists regarding cost-effectiveness of the overall approach Family MUAC may have higher initial costs for training (e.g., training at multiple levels, transportation and incentive costs for caregiver groups, refresher training, etc.) but may be more cost-effective than traditional CHW-based screening models in the longer-term (10) An initial increase in caregiver referrals and admissions may increase costs in the short-term; however, early identification and therefore reduced risks of medical complications and LOS in the program may reduce costs in the long term (9,14)	Strengths High acceptance by community and caregivers (15) Increased understanding of program eligibility improves relationship between caregivers and health staff (15) Implementation is usually considered low risk, and often does not require significant policy changes Challenges Accuracy of caregiver referrals varies widely (9–11) Difficult to ascertain coverage and sustainability of Family MUAC services (8) Lack of standard M&E indicators to understand impact on nutrition program performance and coverage (15,16) Family MUAC has not been proven to increase coverage of AM treatment, given other significant and multiple barriers (e.g., distance to health facilities) (8) Limited resources for MUAC tapes constrain scaling, leaving Family MUAC often targeted only to high-risk families (15) Frustration among caregivers self-referring children to clinics in contexts without services Policy revisions may be necessary before full and sustained integration into health systems (8,16) Categorical Family MUAC reporting (red, yellow, green) may not align with numerical reporting in health information systems (15) Referrals from caregivers may be undercounted if CHWs first confirm and refer going to the health center (8)	What is the impact of Family MUAC on clinic-level outcomes (e.g., early treatment, time to recovery, complications/hospitalizations, recovery rates)? Do these results change when implemented at scale and in different contexts? (17) What impact do training format, supervision, and support have on caregiver learning, retention, and accuracy? What is the most optimal frequency of screening? (17) How effective is Family MUAC in identifying MAM? (17) How effectively do caregivers identify clinical danger signs and refer for treatment, both before and while their child is enrolled in a treatment program? (13) To what extent does this approach address context-specific coverage barriers? What are the most useful indicators for monitoring, evaluation, and learning? How cost-effective is Family MUAC compared to traditional CHW screenings, at scale and in different contexts? What are the most effective low-literacy/numeracy tools for use by community members to detect acute malnutrition? (18) How can Family MUAC be used to detect acute malnutrition in other age groups?

Operational Guidance and Resources

- Family MUAC Community of Practice (19)
- Mother-MUAC: Guidelines for training of trainers. ALIMA, July 2016 (20)
- Mother-led MUAC Tools, World Vision, April 2017 (21)
- PB Mère Boite à Outils, World Vision, November 2018 (22)
- GOAL Family MUAC Tool, 2019 (23)
- M&E Tools for the Family MUAC Approach, International Medical Corps, 2019 (24)
- Family MUAC in the Context of COVID-19: Guidance Note, GOAL, April 2020 (25)
- Family MUAC Approach in the Time of COVID-19: Implementation guidance for programme managers. Save the Children, July 2020 (26)

Reduced Frequency of Follow-up Visits

Description: An approach that reduces the frequency of and extends the time between follow-up visits in which caregiver brings their child back to the clinic for assessment and receipt of therapeutic/supplementary foods when enrolled in a CMAM program. In this approach, visits for SAM children without medical complications often shift from weekly to every 14 days or monthly; visits for MAM children shift from every two weeks to monthly. Reduced frequency of follow-up visits has most often been implemented in emergency contexts with limited accessibility (e.g., long travel distances, difficult terrain, or insecurity) and also during the COVID-19 pandemic. When implementing this approach, some implementors have CHWs conduct home visits in between visits or have higher-risk children return for more frequent visits than lower-risk children.

- Primary Objectives: Improve access to services and uptake by reducing travel burdens for caregivers; prioritize resource allocation to high-risk children who may return for more frequent visits
- Secondary Objectives: Reduce crowding at sites, enabling social distancing in the context of COVID-19 and IPC more generally; reduce risk to caregivers and staff in insecure contexts by minimizing travel

Evidence Summary: While implementation of reduced frequency of follow-up visits may be wide, documentation and collated evidence regarding the approach is limited. Some documentation includes a peer-reviewed publication summarizing results from a nonrandomized pilot intervention study (27) and operational evidence from MSF in Northeast Nigeria (28). Initial findings indicate adequate MUAC and weight gain, as well as more flexible programming options (e.g., enabling service providers in emergency contexts to offer services as security and access allow). Further research is needed on impacts of reduced frequency of visits in comparison with most commonly practiced frequency of follow-up visits on program outcomes; adherence and household use of RUTF; and cost-effectiveness.

What Do We Know?				What Don't We Know?
Effectiveness	Operational Considerations	Cost Considerations	Strengths and Challenges	
May improve access to services and uptake by reducing demand on caregivers' time and resources (15) Results from a pilot study tracking weight and MUAC gain through the first month of programming using a reduced frequency of therapeutic food distribution found that weight and MUAC gain were satisfactory, though weekly clinic visits for anthropometric monitoring may have biased these results (27) Most participants in the pilot study correctly allocated the monthly ration early in treatment (27) Operational findings indicated that reduced frequency of visits could enable treatment of more children given the reduced level of site/clinic-level resources needed to treat each child (28). This may also include opportunities for increased outreach and screening services if less staff time is required at site/clinic level (15)	Supplies and Logistics Potential increases in sharing and selling of therapeutic/supplementary foods due to increased size of rations distributed (15) Partially shifts responsibility for supply management and dosing regimen adherence to caregivers (15) Staffing May reduce clinic staff's workload as daily caseloads decline (15) Alters staff responsibilities if staff are providing support at household level between visits (15) May require more sensitization and support to caregivers during visits on how to monitor child's status between visits (e.g., complications, weight loss, appetite, etc.), increasing workload	Has the potential to reduce both burden and cost for caregivers and program implementers alike (15) Reduced frequency of visits may allow for increased coverage (improving program access, reducing caregiver opportunity costs, etc.) and cost efficiencies at scale (27) Costs may increase if reduced frequency of visits is associated with increased LOS from challenges with dosing regimen adherence or deterioration between visits	Strengths Reduces caregiver financial and time costs for participation in the program (15) Enables continued service provision in unstable or insecure contexts (28) Challenges Concerns exist if rapid deterioration of enrolled children occurs and may not be identified quickly with reduced frequency of follow-up visits (15) Larger ration sizes may trigger increased sharing, potentially increasing LOS and non-response rates Caregivers may struggle to store larger rations of RUTF/RUSF properly and safely at home	What is the impact of reduced frequency of follow-up visits on recovery and other program outcomes? What is the comparative effectiveness and cost-effectiveness between standard visits, reduced frequency of follow-up clinic visits, and reduced frequency visits with CHW/CHV home visits between clinic visits? (15) What is the optimal frequency of follow-up visits in the context of combined SAM/MAM protocols, from both clinical and operational perspectives? (28) What challenges do caregivers have in supply management and storage at home (e.g., pressure from family or community members to share the ration, insufficient storage space, potential safety risks, increased sales and sharing of commodities, etc.) and how can these be mitigated? (15)

Operational Guidance and Resources

- UNICEF, WHO. Prevention, early detection and treatment of wasting in children 0-59 months through national health systems in the context of COVID-19: implementation guidance. New York; 2020 Jul.

Modified Admission and Discharge Criteria

Description: Under standard protocol, three criteria—weight-for-height Z-scores (WHZ), mid-upper arm circumference (MUAC), and edema—are used to determine admission for and discharge from acute malnutrition treatment. The most common modification is using only MUAC and edema as admission and discharge criteria, which often also includes an increase in MUAC thresholds for admission to capture children otherwise admitted by WHZ. The most common shift in admission thresholds consists of changing the OTP admission threshold from MUAC<11.5cm to MUAC<12.0cm or 12.5cm, leading to a combined SAM and MAM treatment in one join OTP/TSFP program and sometimes referred to as "expanded admissions criteria" (EAC) (see also "Combined Treatment/Protocol of SAM and MAM" table). It is recommended that use of a MUAC- and edema-only approach in an OTP should also include expanding the admission criteria. Another example of shifting admissions thresholds consists of changing TSFP admissions threshold from MUAC<12.5cm to MUAC<13.0cm. Also, recent research is also exploring modifications that consist of using weight-for-age Z-scores (WAZ) in combination with MUAC and edema as potential criteria to identify high-risk children with concurrent wasting and stunting (WaST); however, this has yet to be operationalized.

- Primary Objectives: Target children with acute malnutrition who are at highest risk of mortality
- Secondary Objectives: Simplify and streamline the admission process for treatment programs; facilitate CHW-led acute malnutrition treatment; align community-based screening methods with program admission criteria; reduce contact in the context of COVID-19 protocols by suspending weight and height measurements

Evidence Summary: The adoption of MUAC- and edema-only programming is based on a large body of evidence that indicates MUAC better identifies children at highest risk of near-term morality than WHZ in both clinic and outpatient settings (29–42); though long-standing debate continues as some evidence is presented that promotes continued use of WHZ (43,44). Because WHZ and MUAC often identify distinct groups of children, a shift to MUAC- and edema- only programs leave some concerned that children with low WHZ children will be underserved (35,43–49). Still given the associations between MUAC and mortality as well as the operational simplicity of MUAC, it has been suggested that increasing the MUAC threshold is more appropriate than combining MUAC and WHZ for identifying most children at highest risk of death (59). A 2020 evidence review identified 23 recent or ongoing projects, dating back to 2007, using MUAC-and edema-only admission (50). The evidence-base supporting the use of MUAC- and edema-only programming is comprised largely of retrospective analyses of program data (51–53), operational reports (54,55), and larger-scale trials (12,56). Evidence regarding expanded MUAC threshold in the context of MUAC- and edema-only programming comes mostly from retrospective analyses of patient data (29,53,57). There is limited evidence on cost-effectiveness, though initial findings indicate costs implications vary upon depending on context (56). Recent studies find that WAZ, MUAC, and edema (independently) best predict near-term mortality (58–60).

What Do We Know?				What Don't We Know?
Effectiveness	Operational Considerations	Cost Considerations	Strengths and Challenges	
Several studies demonstrate MUAC as a safe and appropriate anthropometric criterion for treatment as it predicts mortality better than WHZ or WHZ+MUAC (10,30,61), and targets younger, more vulnerable (54) and shorter children (62) MUAC gain corresponds with weight gain (53); default and LOS do not differ by MUAC/WHZ status at discharge (51,52) WHZ and MUAC often identify distinct groups of children as malnourished due to varying body shapes across different populations globally (35,43,44,46–49,63) Low WAZ + MUAC identifies children at highest risk of immediate death, while adding WHZ as an independent indicator does not increase sensitivity (59,64) Simulations predict that changing admission criteria from MUAC < 115mm and/or edema and/or WHZ<-3 to MUAC < 125mm and/or edema (without WHZ) would increase program caseload by 2.29 times (assuming 100% coverage); a change to MUAC < 115mm and WAZ < -3 would do so by 2.26 times (65) Increasing MUAC admission thresholds captures additional at-risk children, but not all of whom would have been admitted otherwise based on low WHZ (15,53,57)	Supplies and Logistics MUAC- and edema-only programming reduces equipment and job aides (scales, height boards, WHZ look-up charts), often not present in resource-limited settings (66) Larger caseloads associated with expanded MUAC admission thresholds require increased resources (15,53) Training MUAC- and edema-only programming is simpler and faster to train (54) MUAC- and edema-only programming facilitates low-literate populations' engagement in screening and referrals Staffing MUAC- and edema-only programming facilitates better patient flow, reduces staff workload, decreases caregivers' time at sites, and improves community understanding of program admission and discharge criteria (15,54) Increased MUAC thresholds raise demands on staff time and workload in areas with a high burden of acute malnutrition (15)	One study reports overall costs within a MUAC- and edema-only program that combined treatment of MAM and SAM using a reduced dosage were lower than those for standard protocol (56) Increased admissions increase associated costs in areas with a high burden of acute malnutrition (15) If OTP admission thresholds are increased to include MAM treatment, overall costs increase, but cost-effectiveness may decrease if cases are identified earlier in the progression of the disease and sustainably treated with shorter LOS (15)	Strengths MUAC- and edema-only programming enables simplified and streamlined operations (28,54) MUAC- and edema-only programming promotes coherence between community-level screening and admissions, enabling earlier identification and alleviating confusion between caregivers and staff (53,54,67) MUAC- and edema-only programming facilitates streamlined adoption of other simplified approaches (e.g., Family MUAC, modified dosage, combined treatment of SAM and MAM, treatment by CHWs) (56,66) Challenges Need to preposition or plan to procure sufficient resources before increasing admission thresholds to balance resources with increased caseloads (15) GAM prevalence rates used to set international nutrition and program targets are based on WHZ; use of MUAC- and edema-only programming may complicate resource allocation	What are the optimal admission and discharge criteria that best predict mortality risk and long-term negative outcomes? How do we balance this with limited resources and unmet need? (18) What are the optimal admission and discharge thresholds in different contexts to optimize full and sustained recovery (17,68–70)? How does body composition and immune function relate to full and sustained recovery from AM? Are there feasible indicators beyond anthropometrics could be helpful in optimizing admission/discharge criteria? What is the impact of MUAC- and edema-only admission on coverage? What are the program design and outcome implications associated with using WAZ or WaST? (17)

Operational Guidance and Resources

- Interagency Nutrition Meeting (2014). CMAM expanded admissions guidance (71)

Combined Treatment/Protocol of SAM and MAM

Description: Current CMAM protocols address SAM and MAM separately in two distinct programs (e.g., OTP and TSFP) often in separate locations (requiring transfers and referrals between programs) and with separate products, paperwork, monitoring, and logistics systems. Combined treatment incorporates treatment across the full spectrum of AM (both SAM and MAM) via one unified program, in one location. This approach can often, but does not always, use one nutritional product (i.e., RUTF). Another iteration of a combined protocol is known as the "expanded admissions criteria" (EAC), an approach used in emergency contexts to treat all AM children in one program when either OTP or TSFP services or supplies are unavailable, usually using MUAC- and edema-only admission and discharge criteria. This typically manifests in shifting OTP admission threshold from MUAC<11.5cm to MUAC<12.5cm in the absence of a TSFP (see also "Modified Admission and Discharge Criteria" table) (72,73).

- Primary Objectives: Simplify and optimize acute malnutrition treatment systems to streamline operations and improve cost-effectiveness and coverage
- Secondary Objectives: Enable continued treatment in the context of limited resources; expanded admission criteria broadens treatment availability when either OTP or TSFP services are unavailable

Evidence Summary: The evidence base for this approach consists of several studies with varied research designs, including: a cRCT in Sierra Leone (74), a multi-country cRCT in Kenya and South Sudan ("ComPAS")[2] (56,75), a single-armed feasibility study in Burkina Faso ("OptiMA"[3]) (12), operational findings by MSF-supported programs in Niger (76), a prospective cohort study in Somalia (77), and UNICEF operational findings in Somalia (78). A 2020 review identified 17 projects with combined treatment protocols admitting all children with AM (both SAM and MAM) into a single program, and an additional 20 that use one product (RUTF) (50). Further operational data from EAC programs also contribute to the evidence base (29,53,57). Evidence to date indicates that combined protocols are non-inferior to standard protocols (56,74), are more cost-effective regarding overall program costs (38), and may enable earlier treatment of acute malnutrition (12,74).

What Do We Know?				What Don't We Know?
Effectiveness	Operational Considerations	Cost Considerations	Strengths and Challenges	
Studies show that recovery rates for children treated in combined protocols were non-inferior to standard protocols (12,56,74), with no differences in LOS, average weight, and MUAC gain (56) In two studies where coverage was measured, coverage was not lower with the combined protocol than standard protocols (56,74)[4] When using one product (RUTF) in a combined treatment approach, weight gain was higher and default rates lower among children in the MAM phase who were treated with two RUTF sachets/day when compared to those treated with FBF. Admitting children for treatment at a less severe stage (e.g., MAM phase) may have prevented deterioration to SAM within the covered population (76) Retrospective patient data analyses indicates that the EAC approach captures additional at-risk children in the absence of either OTP or TSFP (71,78)	Supplies and Logistics Enables flexible programming in dynamic contexts, particularly in emergency settings where OTP or TSFP services may be inconsistent (28) Can lower loss to follow-up and children getting lost in the referral system between OTP and TSFPs Has the potential to streamline supply chain logistics, stock management, and training (28,56,66) Larger caseloads in areas without MAM treatment may increase demand on supplies and resources (15,53,78) Training Simplifies training for nutrition staff; staff report it is easier to understand and implemented with less assistance (66) Staffing Simplifies staff administrative responsibilities and reduced paperwork by streamlining patient records and eliminating referrals between programs (66) Enables increased CHW support at facility level and can improve CHW communication with communities during follow-up visits and mass campaigns (66)	Combined protocol costs are influenced by: dosing regimen, type of product(s) used, ratio of MAM:SAM caseloads, changes in LOS, and use of one supply chain (56) One study in Kenya and South Sudan found combined treatment (with reduced dosage) overall cost US$123 less per child recovered than standard protocol (56) In theory, combined treatment has potential to improve cost-effectiveness by streamlining administrative and logistics systems	Strengths Simplifies operations (procurement, logistics, training) with similar or improved program outcomes (56) Facilitates streamlined adoption of other simplified approaches (56,66) Accepted well by staff/communities (66) Improves continuity of care (28,56,77), which may enable earlier identification and treatment (12,74) EAC enables MAM treatment in contexts without TSFP (28,78) Challenges Likely to expand caseloads in contexts without current TSFP, increasing demands on scarce resources, especially product (28,77) Concerns exist that treating both MAM and SAM in the context of limited resources may divert resources away from more vulnerable SAM children	What are the impacts on coverage and caseloads when offering previously unavailable services for MAM? To what extent does combined treatment prevent deterioration from MAM to SAM? What are programmatic and supply chain cost savings from a combined treatment approach? (15) In treating MAM children in a combined protocol, what is the cost and cost-effectiveness of using one product (RUTF), which is more costly per unit than other MAM products (e.g., RUSF, FBF)? Would cost savings in streamlined logistical operations balance these increased costs? What impact does treatment of MAM caseloads in a combined treatment program have on health system capacity? How can separate UN agencies collaborate to support combined treatment?

Operational Guidance and Resources

- Simplified Protocol for Acute Malnutrition, Nutrition Cluster, April 2020
- Appendix D: Options for Exceptional Community-Based Management of Acute Malnutrition Programming in Emergencies, Global Nutrition Cluster, March 2017
- CMAM Expanded Admissions Guidance, Interagency Nutrition Meeting, September 2014

[2] The Combined Protocol for Acute Malnutrition Study (ComPAS) was a multi-country RCT by the International Rescue Committee (IRC), Action Against Hunger USA, and the London School of Hygiene and Tropical Medicine (LSHTM). Under the ComPAS intervention arm, children with clinically uncomplicated AM (defined as MUAC <12.5cm and/or edema) were enrolled for treatment in one program, with RUTF dosage calculated based on MUAC. (56)

[3] The Optimizing Treatment for Acute Malnutrition (OptiMA) study was a single-arm proof-of-concept trial in Burkina Faso, led by the Alliance for International Medical Action (ALIMA), the University of Bordeaux, and the Institut de Recherche en Sciences de la Sante. Children with MUAC <12.5cm and/or edema were enrolled for treatment, and RUTF was provided at a gradually reduced dose based on weight and MUAC. (12)

Modified (Reduced) Dosage of Therapeutic or Supplementary Foods

Description: For SAM treatment, current global standards call for therapeutic food (i.e., RUTF) dosage to be calculated based on a child's weight per day. This dosing regimen translates to providing a relatively smaller amount of RUTF at the beginning of treatment, while weight is low, followed by a gradual increase in ration size over the course of treatment as a child's weight increases. For MAM treatment, no global standards exist; in practice, the dosing of specialized food products for MAM (e.g., RUSF, FBF) vary but are typically based on a set amount of product dosed per day (e.g., 1 RUSF/day, 200g SC+/day) (72). A modified dosage approach includes moving away from weight-based dosing to a simpler and often reduced dosing regimen, with the aim of optimizing the dosage for recovery. A modified dosage approach consists of providing relatively larger rations at the beginning of treatment, during the more severe phases of AM, and smaller rations towards the end of treatment, during the less severe phases of AM. Various dosage regimens have been piloted, including: a standardized daily dose based on SAM vs. MAM MUAC status (ComPAS[4]), a gradual dose reduction as the child progresses through treatment (OptiMA[5]), weight-based dosage for early SAM treatment followed by a reduced, standard daily dose per day later on during less severe SAM and MAM phases (79), among other iterations (80).

- Primary Objectives: Optimize dosing for recovery to optimize cost-effectiveness of treatment; Improve program coverage, impact, and efficiency
- Secondary Objectives: Offer dosing guidance for protocols in which weight measurements are suspended as an IPC measure due to COVID-19

Evidence Summary: The evidence base comprises of results from a few studies with varying degrees of rigor and various operational data, including: a cRCT in Sierra Leone (74), the multi-country "ComPAS" study[5] (56,75), the single-arm "OptiMA" study[6] (12), the randomized non-inferiority "MANGO" trial[6] (80,81), a prospective cohort study by IRC in Somalia (77), and other operational reports and findings (28,79,82). A 2020 evidence review found 22 recent or ongoing projects integrating modified dosage (50). Existing evidence largely finds that overall program recovery rates using modified dosage were non-inferior to overall program recovery rates using weight-based dosage. However, some secondary outcomes and sub-analyses found differences across groups. ComPAS also found that, overall, less RUTF and lower total cost per child recovered with reduced dosage (56).

What Do We Know?				What Don't We Know?
Effectiveness	Operational Considerations	Cost Considerations	Strengths and Challenges	
All studies with randomized controls saw non-inferior recovery rates in reduced dosage arm (56,74,75,80,81) In a South Sudan and Kenya trial (ComPAS), no differences were observed in LOS, average weight gain, average MUAC gain (56) and relapse rates (75) In a Burkina Faso trial (MANGO), slower weight and height gain velocity was observed in the reduced dosage group, though no difference in LOS (80); trivial differences in body composition (81); daily energy intake was lower in reduced dosage group (83) Mixed results related to average weight gain across two studies—ComPAS (56) and MANGO (80)—may be due to different dosing regimens, with relatively smaller rations in MANGO (80), which saw slower weight gain in the reduced dosage arm, and relatively larger rations in ComPAS (56), which saw non-inferior weight gain in reduced dosage arm While some studies have produced insightful operational findings, without a control arm, conclusions cannot be drawn about the effectiveness of reduced dosage (12,28)	Supplies and Logistics Reduced dosage alleviates simplifies supply management; reduces burden on caregivers to transport and store supplies (15,80) Simplified, universal dosage enables greater efficiency in preparing rations ahead of distribution (15,28) Reduced dosage has been successfully used to continue treatment in the context of RUTF supply shortages (79,82) Training Training is easily implemented (15,28) Staffing Some modified dosage schedules reduce and streamline staff workloads (15,79)	Cost savings of reduced dosage are influenced by high recovery rates and lower LOS; SAM:MAM caseload ratios; and supply chain management (56) Children consume fewer sachets of RUTF under reduced dosage protocols, reducing costs of nutrition commodities and improving cost-effectiveness (12,56,74,84) Modified dosage in combination with a combined SAM and MAM treatment protocol may provide improved cost-effectiveness ratios, but incur overall higher costs due to the inclusion of MAM children in treatment	Strengths Simplifies treatment and could enable treatment of more children given improved cost-effectiveness Enables continued service delivery in the context of constrained RUTF supplies Challenges Reduced dosage for larger children may impact time to recovery and therefore LOS (15)	What is the optimal dosage to ensure effective treatment outcomes, particularly among extremely vulnerable children (very low weight, MUAC < 115mm, lower SES, etc.)? (12,18,85) What is the impact of reduced dosage on larger children (by weight)? (15) To what extent does modified dosage improve coverage by freeing up resources to allow treatment of more children? How does modified dosage impact longer-term outcomes (e.g. relapse) and other health outcomes (linear growth, body composition)? (17) What are the effectiveness and cost-effectiveness of combining modified dosage with other simplified approaches, such as CHW-led treatment and combined protocols? (17) What impact does modified dosage have on intra-household sharing, particularly among households with low socioeconomic status? (17) What is the cost-effectiveness of modified dosage of separate products for SAM and MAM treatment (e.g., RUTF and RUSF) versus modified dosage for a single product under unified treatment?

Operational Guidance and Resources

- Simplified Protocol for Acute Malnutrition, Nutrition Cluster, April 2020 (86)

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[4] The Combined Protocol for Acute Malnutrition Study (ComPAS) dosing regimen consisted of 2 sachets of RUTF/day if their MUAC was <115mm, and 1 sachet of RUTF/ day if their MUAC was 115mm to <125mm.

[5] The Optimizing Treatment for Acute Malnutrition (OptiMA) study dosing regimen consisted of 175 kcal/kg/day RUTF for children with MUAC < 115mm, 125 kcal/kg/day RUTF for children with MUAC 115-120mm, and 75 kcal/kg/day RUTF for children with MUAC 120-125mm

[6] The Modelling an Alternative Nutrition Protocol Generalisable to Outpatient (MANGO) study – dosing regimen consisted of the standard weight-based RUTF dose for the first two weeks of treatment, following by 1 sachet/day of RUTF for children < 7kg and 2 sachets/day of RUTF for children >7 kg.

Acute Malnutrition Treatment by Community Health Workers

Description: This approach shifts most or all components– including detection, admission, administration of medication and foods, follow-up visits, and discharge – of treatment for children with acute malnutrition (without medical complications) from a clinic/facility-based setting to a community-setting and is implemented by trained community health workers (CHWs). Most often, this CHW-led treatment of acute malnutrition approach is embedded within an Integrated Community Case Management (ICCM) program, often referred to as "ICCM+Nut" or "iCCM+SAM."

- Primary Objectives: Improve program coverage and early access to treatment; lower default rates; reduce treatment-seeking costs for caregivers enrolling their children
- Secondary Objectives: Decrease burden at resource-constrained facilities; encourage treatment integration in community-based programs; enable service continuity during COVID-19

Evidence Summary: There currently exists a robust evidence base in support of CHW-led SAM treatment. A 2019 systematic review assessed 12 peer-reviewed articles and 6 grey literature articles related to small-scale studies and pilots (87). A 2020 review identified 15 recent or ongoing projects regarding CHW-led treatment of acute malnutrition (50). Evidence generally shows that outcomes of CHW-led treatment of acute malnutrition programs are non-inferior to facility-based outpatient treatment, with improvements in default rates, program coverage, and sometimes cost-effectiveness. Questions remain regarding effectiveness of MAM treatment by CHWs, cost-effectiveness, long-term quality of care, and optimal training and incentives.

What Do We Know?				What Don't We Know?
Effectiveness	Operational Considerations	Cost Considerations	Strengths and Challenges	
Nine studies cited in a systematic literature review found that CHW-led treatment outcomes for SAM exceeded Sphere standards; of these, three studies assessed program coverage and all showed an increase (87) A randomized control study in Mali and a non-inferiority quasi-experimental study in Tanzania found improved cure rates, higher coverage, and reduced default rates compared to facility-based SAM treatment (88,89) One cRCT in Pakistan found no differences in SAM recovery, relapse, default, or mortality; compliance with RUTF dosage was higher in the facility-based treatment arm (90) A prospective study found that CHW-led SAM treatment decreased defaulter rates due to improved access, reduced travel requirements, and proximity of CHWs (91) Operational findings from pilot studies and early research trials indicate this approach may improve early detection of SAM and relieve pressure on health facilities (92) Quality of care studies demonstrate non-inferior (92) or appropriate (93,94) service provision at the community level by CHWs, enhanced by refresher trainings and regular supervision; however, one study showed unsatisfactory results (95) One study found that SAM children treated by supervised CHWs had better outcomes than those treated by unsupervised CHWs (96)	Supplies and Logistics Requires strengthening "last mile" delivery systems (e.g., monitoring supply transportation from health facilities to households) (15) CHW supply management (e.g., storage quality, CHW security) can be challenging (97) Providing transportation for CHWs (e.g., bicycles, motorbikes) enables easier fulfillment of responsibilities and wider coverage (98) Training Required training varies based on alignment of CHWs' existing capacity and education levels with job requirements Development of adapted tools is necessary to facilitate participation by low-literate CHWs (99–102); simplified protocols enable easier uptake (103) Frequent refresher trainings and supervision visits enhance quality of care (93,94) Staffing Adding SAM treatment to ICCM increases CHWs' workloads, suggesting the need for incentives or additional staff (15,103,104) Ensuring quality of care through close supervision and frequent refresher trainings may increase staff workloads	Most cost-effectiveness studies to date indicate reduced costs associated with CHW-led treatment compared to facility-based outpatient treatment (87,89,105), though cost savings are dependent on scale (103,106), demand for additional CHWs, quality of care, and caseload (107,108) One cost-effectiveness study found that for households receiving CHW-led treatment, the time receiving treatment was halved and households spent 3x less money than in the facility-based arm (107) Delivering treatment at household or community level shifts transportation and time costs from caregivers to CHWs (15,93,105)	Strengths Can increase service coverage, particularly in areas with few health facilities Close relationships between CHWs and communities facilitate trust and health seeking behavior (15) Reduces caregivers' time and costs (15) Integrating acute malnutrition with treatment of other childhood diseases can decrease mortality (109) Challenges Training, supervision, weak community health systems, and supply chain management remain big challenges to CHW-led treatment (103) Some national policies prohibit CHW administration of medications (e.g., antibiotics, deworming medication, etc.), which would limit ability to administer SAM treatment Integrating CHW-led acute malnutrition treatment into existing health structures requires collaboration between siloed health and nutrition governing bodies (87,110)	What is the impact of CHW treatment of acute malnutrition on program outcomes at scale contexts? (17,18) What level of incentives is optimal to motivate and retain CHWs delivering AM treatment services? What is the optimal level of supervision required to ensure appropriate quality of care in different contexts? How can this approach be adapted to contexts with different health system capacities and CHW profiles? (17,111) What is the optimal combination of CHW-led treatment with other modifications (simplified dosage, MUAC-only admissions, combined protocols, etc.)? How do caregivers, CHWs, and clinic staff perceive and accept the shift in responsibilities from clinic staff to CHWs?

Operational Guidance and Resources

- Toolkit for CHW Community-Based Treatment of Uncomplicated Wasting for Children 6-59 Months in the Context of COVID-19, International Rescue Committee and UNICEF, June 2020 (112)
- Simplified Tools for Community-Level Treatment of Acute Malnutrition, International Rescue Committee, 2017 (113)
- Learning Paper Series: Integrating Severe Acute Malnutrition into the Management of Childhood Diseases at Community Level in South Sudan, Malaria Consortium, 2013 (114)
- Training of Trainers on CMAM protocol of CHWs, Adaptation to COVID19 and combined protocol. Action Against Hunger, June 2020 (115)
- Monitoring Tools for CHWs Treating Acute Malnutrition. Action Against Hunger, 2020 (116)
- Summary of Evidence on SAM Treatment Provided by Lay Community Health Workers outside Health facilities, Action Against Hunger Spain, 2021 (117)
- Linking Nutrition & (integrated) Community Case Management: A Review of Operational Experiences, Lynette Friedman & Cathy Wolfheim, December 2014 (109)

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