TREATMENT OF WASTING USING SIMPLIFIED APPROACHES

A Rapid Evidence Review

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Contents

I. Background on simplified approaches **3**

II. Objectives **4**

III. Methodology **5**

IV. Results **6**

A. Overview of the evidence 6

B. Overview of simplified approaches projects 10

C: Outcomes: effectiveness and gaps (nutritional outcomes) 13

V. Discussion **21**

A. MUAC-only admission 21

B. Modified dosage 22

C. Management of acute malnutrition by community health workers 23

D. Screening acute malnutrition at the community level 24

E. Concluding remarks 24

Bibliography **26**

Annex 1 **31**

I. Background on simplified approaches

Simplified approaches, rather than being a single prescriptive approach, include a range of adaptations to treatment protocols and programmes for the community-based management of acute malnutrition (CMAM). These approaches aim to improve coverage and/or reduce costs, and may include but are not limited to:

- Use of one product – ready-to-use therapeutic food (RUTF) – to treat wasting, including both moderate and severe acute malnutrition
- Screening using mid-upper arm circumference (MUAC) at community level (Family-MUAC)
- Delivery of acute malnutrition management by community health workers (CHWs)
- Admission for all children with MUAC <125mm and/or oedema
- Modified dosage of RUTF (including reduction over the course of recovery)
- Reduced visits to health facility during treatment
- Discharge criteria based on MUAC >125mm
- MUAC-only admission

These approaches are being tested globally, predominantly in the West and Central Africa region, with the support of UNICEF and a host of international donors. A one-size-fits-all approach is not appropriate, as any adaptation should be dependent on the context and health system. As such, a variety of implementers across a range of countries are trialing different combinations of the simplified approaches, depending on the individual priorities at national level. In some instances, implementers are trialing these approaches through rigorous research studies, while in others they are included as part of an operational response or a pilot.

The number of different adaptations grew over time as needs to simplify or adapt the protocol for treatment evolved due to a changing context. For example, a modified dosage of RUTF can be a useful approach for CHWs who have not received the same extensive training as other medical staff, or in contexts with a high caseload and lack of resources. The use of simplified tools (such as a coloured MUAC tape or simplified register) or protocols (an easier and quicker calculation of dosage) can both contribute to empowering low-literacy communities and alleviating the workload of health staff in areas where there is a high-burden of malnutrition.

The evolution of the simplified approaches can be broadly split into three phases. The **first phase** of simplified approaches (2006–2009) began in Asia (Myanmar with a modified RUTF dosage in 2009 by Action Against Hunger (ACF);[1] and Bangladesh in 2009 with a CHW approach by Save the Children International[2]) and in West and Central Africa with an integrated management of acute malnutrition/use of one product/MUAC-only admission with several operational experiences of Médecins Sans Frontières (MSF) in the Niger[3] and other countries on the continent.

1 James et al, 2015

2 Sadler et al, 2011

3 Defourny et al, 2007; Phelan et al, 2015

The **second phase** of the simplified approaches (2009–2015) included countries from the eastern part of the African continent, testing treatment delivered by CHWs (in Malawi, Ethiopia, South Sudan). This approach was then extended to West and Central Africa (first in Mali[4] and Angola[5]) where other simplifications such as a reduced schedule of RUTF in the Niger[6] and the region's first experience using a modified dosage associated with the integrated management of acute malnutrition in Sierra Leone[7] were being implemented.

During the **third phase** (2016–2020), simplified approaches were widely extended to West and Central Africa, which is now the region registering the highest number of documented simplified approaches. These include treatment by CHWs, Family-MUAC screening, integrated management of acute malnutrition, use of a single product, MUAC-only admission, and modified dosage. The ComPAS (*Combined Protocol for Acute Malnutrition*) and OptiMA (*the Optimizing treatment for acute Malnutrition*) studies have also been developed, tested and/or expanded in several countries over the last five years.

As a result of recent and ongoing pilots in the region to test implementation in new contexts (e.g., urban settings, emergency areas) the evidence base for simplified approaches is growing, while outstanding questions, such as how to identify the optimal dosage for recovery are also being addressed. There is a need to compile the evidence of what works and use it to inform next steps.

Prior to this evidence review, a database including global evidence on the simplified approaches was developed and classified by simplified components or groups of simplifications to help track all of the different projects. A timeline on simplified approaches was also created to start identifying all simplified approach projects and their related evidence from 2007 to 2020, with a focus on the West and Central Africa region. This review, while initially conducted by the UNICEF West and Central Africa Regional Office, is global in scope. Throughout this document these studies and operational responses will be referred to as projects. Adaptations and simplifications are terms used interchangeably.

II. Objectives

This rapid review aims to provide an overview of the current evidence and practice on the treatment of acute malnutrition using simplified approaches. This review compiles evidence related to simplified approaches for the treatment of wasting and provides a synthesis of the variety of protocols. This review also provides a synthesis of evidence on treatment outcomes, highlighting some characteristics and discussions around outcomes, and presenting gaps identified by researchers and implementers.

The specific objectives of the review are to:

1. Provide an overview of the different simplified approaches (by simplification, country, admission and discharge criteria, type of dosage, etc.)

4 Alvarez Morán. et al, 2018

5 Morgan et al, 2015.

6 Isanaka et al, 2017

7 Maust et al, 2015

2. Present a clear overview of the available evidence on the effectiveness of simplified treatment, ongoing debates and outstanding research questions

III. Methodology

The rapid review examines peer reviewed literature, grey literature (final reports, online publications) and other unpublished evidence (consisting mainly of protocols, internal reports, webinars, briefs). Effectiveness of the simplified approach is assessed through standard programme indicators (nutritional outcomes) and/or their compliance with Sphere standards, when data are available.

- Treatment effectiveness (Sphere standard):
  - » Defaulted rate
  - » Death rate
  - » Recovery rate
- Quality of recovery process:
  - » Non-response rate
- Dosage effectiveness:
  - » Recovery rate/non-response rate

Search strategy

- Review of electronic bibliographic databases to locate peer reviewed literature: *PubMed* and *ClinicalTrials*. This type of evidence was also obtained directly through authors sharing their protocols.
- Review of the *Field Exchange* website and the *State of Acute Malnutrition* website to locate evidence from research studies and operational pilots in order to provide an overview of the simplified approaches to-date.
- Review of websites of non-governmental organizations known to be implementing simplified approaches to treatment: Alliance for International Medical Action (ALIMA), ACF, International Rescue Committee (IRC), and World Vision.
- Review of reference lists of relevant studies and papers that have been identified by the database searches to identify further studies of interest.
- Use of Google and *ClinicalTrials* to identify recent and upcoming evidence and operational experiences of programme implementers, which had not yet documented.

The search structure consisted of the following key words:

Community-based management of acute malnutrition; mid-upper arm circumference; reduced or optimized dosage; simplified protocol; simplified approaches; combined protocol; integrated treatment of acute malnutrition; Family-MUAC; CHW approach; delivery of treatment at the community level; reduced visits to health facility during treatment; expanded admission criteria; MUAC-only programming.

IV. Results

A. Overview of the evidence

In total, 63 resources have been included in this review: 19 protocols ,16 peer reviewed evidence papers, 10 Emergency Nutrition Network papers, 5 proposals, 3 trials, 4 reports, 3 documents on preliminary results/protocol, 1 information sheet, 1 terms of reference document and 1 webinar presentation.

Among these 63 resources, 36 unique projects trialing simplified approaches were identified (one project can be related to several documents). The available evidence on simplified approaches covers 21 countries: 10 in West and Central Africa, 6 in Eastern and Southern Africa, 4 in South Asia, and 1 in the Middle East and North Africa *(including in a multi-country secondary analysis to design ComPAS dosage table)*.

This evidence indicates that most projects have been implemented on the African continent, especially in the West and Central Africa region where the Niger (5), Mali (4) and Burkina Faso (3) have registered the highest number of simplified approaches projects per country. Full list of projects below:

	Dates	Country	Title of project	Organization	Design
1	2006	Niger	Management of moderate acute malnutrition with RUTF in Niger	MSF	Intervention (with no comparison)
2	2009	Malawi	The Use of Home-Based Therapy with Ready-to-Use Therapeutic Food to Treat Malnutrition in a Rural Area during a Food Crisis	Washington University	-
3	2009	Myanmar	Low-dose RUTF protocol and improved service delivery lead to good programme outcomes in the treatment of uncomplicated SAM: a programme report from Myanmar	ACF	Analysis of individual records of a programme
4	2009-2010	Bangladesh	Community Case Management of Severe Acute Malnutrition in Southern Bangladesh	Save the Children	Prospective cohort study
5	2012	Ethiopia	CMAM in Ethiopia	UNICEF	Intervention (with no comparison)
6	2012-2013	Angola	Use Therapeutic Food (RUTF) based on a community case management (CCM) model.	World Vision	Intervention (with no comparison)
7	2013	South Sudan	Integrating severe acute malnutrition into the management of childhood diseases at community level in South Sudan	Malaria Consortium	-
8	2013-2015	Sierra Leone	Project Peanut Butter	Project Peanut Butter	Cluster-randomized, unblinded, controlled clinical trial
9	2014	Niger	Outpatient treatment of severe acute malnutrition: response to treatment with a reduced schedule of therapeutic food distribution	MSF	Nonrandomized pilot intervention study
10	2014-2016	Yemen-Kenya-South Sudan-Chad-Pakistan	ComPAS (Combined Protocol for Acute Malnutrition) _Stage 1	IRC	

	Dates	Country	Title of project	Organization	Design
11	2014-2016	Mali	Innovative approach of integrating and simplifying SAM and MAM management through CHWs	ACF	An observational, clinical prospective multi-centre cohort study
12	2015-2016	Pakistan	Innovative approach of integrating and simplifying SAM and MAM management through CHWs	ACF	A two-armed cluster randomised controlled trial (CRCT)
13	2015-2019	Burkina Faso	Modelling an Alternative Nutrition Protocol Generalizable for Outpatient (MANGO)	ACF	Randomized controlled, non-inferiority trial
14	2016	India	Community-based management of severe malnutrition in children under five in the Melghat tribal area, central India	MAHAN	A community-based prospective trial to treat SAM and SUW
15	2016-2017	Nigeria	Simplified approaches to treat acute malnutrition: Insights and reflections from MSF and lessons from experiences in NE Nigeria	MSF	Intervention (with no comparison)
16	2016-2018	Burkina Faso	The Optimising Treatment for acute Malnutrition (OptiMA)_Yako	ALIMA	Single-arm proof-of-concept trial
17	2017-2018	Somalia	ComPAS Somalia	IRC	Prospective cohort study
18	2017-2019	South Sudan-Kenya	ComPAS (Combined Protocol for Acute Malnutrition) _Stage 2	IRC and ACF	Multi-site, cluster randomized non-inferiority trial
19	2017-2019	Kenya	Innovative approach of integrating and simplifying SAM and MAM management through CHWs	SCI-ACF-IRC-UNICEF	A two-arm, parallel groups, Cluster Randomized Controlled Trial
20	2017-2019	Niger	Increased coverage of management of severe acute malnutrition through the support of community health workers	ACF	Observational study
21	2017-2019	Mauritania	Increased coverage of management of severe acute malnutrition through the support of community health workers	ACF	Observational study
22	2018	Somalia	Simplified approach for the management of AM in Somalia	UNICEF	Intervention (with no comparison)
23	2018-2020	Mali	ComPAS Mali	IRC	Pilot trial
24	2018-2020	Sierra Leone	Hi-MAM Study	Project Peanut Butter, Washington University	Randomised cluster-control trial
25	2019	Nigeria	Simplified approach for the management of AM in Rann, Borno State	UNICEF	Intervention (with no comparison)
26	2019-2020	Burkina Faso	The Optimising treatment for acute Malnutrition (OptiMA)_Barsalogho	ALIMA	Operational pilot
27	2019-2020	Chad	Simplified Protocol for the Management of Acute Malnutrition in Chad	UNICEF-WFP-IRC	Operational research
28	2019-2020	DRC	OptiMA DRC_RCT	ALIMA	Non inferiority clinical trial (RCT)
29	2019-2020	Mali	The Optimising treatment for acute Malnutrition (OptiMA)_Bamako	ALIMA	Pilot trial with external comparator

	Dates	Country	Title of project	Organization	Design
30	2019-2020	Niger	The Optimising treatment for acute Malnutrition (OptiMA)_Mirriah_Etude "OptiMA vie reelle"	ALIMA	Proof of concept pilot with a comparison arm
31	2020	DRC	DRC MoH, Nutrition Cluster and Tech RTT-Testing a package of simplified approaches	DRC MoH,	To be determined
32	2020-2021	CAR	Efficiency and feasibility of a simplified protocol for the management of acute malnutrition in children 6-59 months in CAR: prefectures of Ouaka and Kémo in CAR	UNICEF-WFP	Operational research
33	2020-2021	Mali, Niger	Efficiency, cost-effectiveness and coverage of severe acute malnutrition treatment delivered by community health workers through the modified protocol in emergency contexts in Mali and Niger	ACF	Randomised cluster-control trial
34	2020-2021	Senegal	Scaling-up decentralization of AM management without complications by CHWs in Matam region	ACF, MoH	To be determined
35	2020-2021	Mauritania	-	ACF	To be determined
36	2020-2022	Niger	RCT Niger_OptiMA & ComPAS	ALIMA	Non inferiority clinical trial with 3 arms

ACF, **ALIMA**, **IRC** and **UNICEF** are the four main organizations that have contributed to the available evidence on simplified approaches.

- Evidence from **ACF** comes mainly from West and Central Africa (Mali, Senegal, the Niger, Mauritania, Burkina Faso). The main simplified approach tested was treatment delivered at the community level by CHWs to improve coverage in the Niger, Mauritania, Mali, and soon in Senegal. The first published results were about the studies in Mali (2014) and Pakistan (2016). ACF then developed additional pilot studies in Niger and Mauritania (2017-2019). Based on promising results,[8] this approach is being scaled-up in Mauritania (Guidimakha), Niger (Maradi (Mayahi), Tahoua (Bouza and Madaoua) and Mali (Kayes). A modified dosage (ComPAS dosage, see below) has recently been integrated with this approach in order to test it in emergency contexts (e.g., Gao in Mali[9], N'Guimi in the Niger and Néma in Mauritania). A modified dosage was first documented and tested by ACF in Myanmar in 2009.[10] ACF has also collaborated with IRC to trial a modified dosage under to ComPAS project (detailed further below).
- Evidence from **ALIMA** comes from West and Central Africa (Burkina Faso, the Niger, Mali and Democratic Republic of Congo) and is built upon OptiMA projects, mainly testing the effectiveness of a simplified protocol including a modified dosage and screening at the household level (Family-MUAC) for earlier detection of acute malnutrition. One Randomised Control Trial is planned in the Niger (comparing effectiveness of ComPAS dosage, OptiMA dosage and standard protocol) and a recently completed in the Democratic Republic of Congo (ongoing analysis about effectiveness of the dosage compared to the standard protocol). In 2020, for the first time, ALIMA is implementing[11]

8 Alvarez Morán et al, 2018 (2); López-Ejeda et al, 2020 ; López-Ejeda et al, 2018 ; Alvarez Morán et al, 2018 (1)

9 http://www.isrctn.com/ISRCTN3039323

10 James PT, et al, 2015

11 "First time"means that it was the first time that the NGO is including this simplification (treatment delivered by CHW)

treatment delivered by CHWs in Burkina Faso (Barsalogho), based on the simplified national protocol for the treatment of acute malnutrition (recommending a ComPAS-like dosage with a transition period between red and yellow MUAC criteria). In 2019–2020), ALIMA is also piloting an OptiMA project in an urban context in Mali (Bamako), which currently represents the only studies in an urban setting. Results from OptiMA Yako (Burkina Faso) and OptiMA Mirriah (the Niger) are published or have been shared with partners.

- Evidence from **IRC** mainly concerns Eastern and Southern Africa (Kenya, South Sudan and Somalia) and includes the development and testing of a modified dosage, the 'ComPAS dosage', the first phase of which started in 2014 and was based on a retrospective multi-country analysis (in Chad, Kenya, Pakistan, South Sudan, and Yemen). This simplified dosage was first tested in Kenya and South Sudan in collaboration with ACF during phase 2 of the ComPAS project (2016– 2018). Except for the project in Somalia, IRC simplified protocols are all based on a MUAC-only admission. The most recent projects are carried out in West Africa, with Mali and Chad, including both a MUAC-only admission and a Family-MUAC approach. In Mali, under this protocol, treatment is also delivered by CHWs.
- **MSF** is a pioneer in implementing a number of the simplified approaches in the West and Central Africa region, starting soon after the release of the CMAM protocol in 2007. MSF has mainly implemented the treatment of both SAM and moderate acute malnutrition (MAM) with the same product (in the Niger in 2007,[12] Burkina Faso in 2010, Mali in 2012,[13] and South Sudan in 2015[14]) and recommending the use of a MUAC-sliding scale to adapt MUAC thresholds for admission to the context and its related constraints. MSF also documented a simplified frequency of visits (i.e., monthly visits) during a large-scale simplification in an emergency context in Nigeria in 2016,[15] and published peer reviewed evidence regarding the effectiveness of this simplification in the Niger.[16] These experiences are well documented in terms of implementation and feasibility, but fewer data are available on other effectiveness outcomes (for programmes that used the same product and/or MUAC-only admission).
- **Project Peanut Butter** is one of the first organizations to trial simplified approaches. Project Peanut Butter is a non-governmental organization involved in producing RUTF locally (in Malawi, Sierra Leone, and Ghana), and has recently been testing an alternative oat-based RUTF formulation in Sierra Leone.[17] Project Peanut Butter published a decisive study showing that the integrated management of global acute malnutrition in children (via a single food product – RUTF – to treat both MAM and SAM) is an acceptable alternative to standard management and provides greater community coverage.[18] This study paved the way for other studies examining simplified approaches to treatment in the region.
- **UNICEF** is working with the World Health Organization (WHO) and partners to build the evidence base for simplifying and optimizing wasting treatment interventions. The

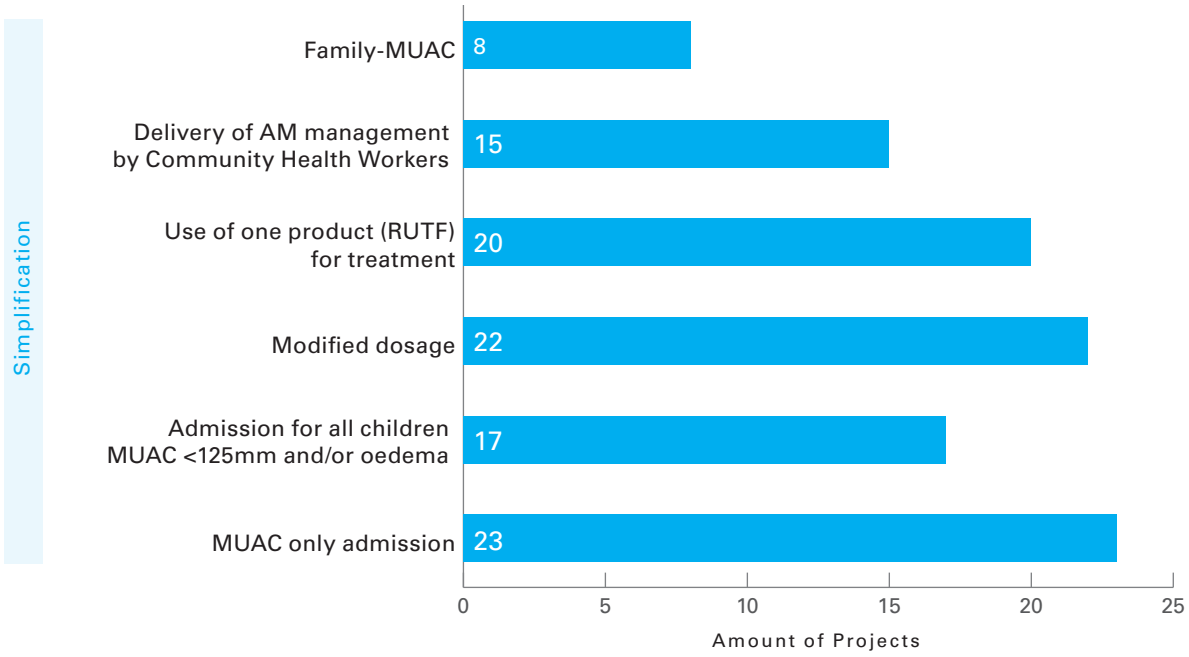
12 Defourny et al, 2007
13 Phelan et al, 2015
14 Grellety et al, 2015
15 Hanson et al, 2019
16 Isanaka et al, 2017
17 Hendrixson et al, 2020
18 Maust et al, 2015

UNICEF West and Central Africa Regional Office (WCARO) is supporting the testing of modifications to certain components of simplified protocols across nine countries in the region, while the UNICEF Eastern and Southern Africa Regional Office (ESARO) has also generated evidence (in Ethiopia, Kenya and Somalia). UNICEF and partners have been testing and implementing several different simplifications and combinations of simplifications: effectiveness and feasibility of the ComPAS dosage (in Nigeria, ongoing in the Central African Republic, and recently completed in Chad), MUAC-only admission (in West and Central Africa and Eastern and Southern Africa), Family-MUAC and a modified dosage, with IRC and the World Food Programme (WFP) (in Central African Republic and Chad), the delivery of treatment by CHWs (in Ethiopia and Kenya) and the integrated management of acute malnutrition/use of a single product in all these countries except Somalia (where a simplified dosage is only used for MAM) and Ethiopia (where the simplified dosage is only used for SAM).

B. Overview of simplified approaches projects

The **Graph 2** presents an overview of the adaptations included in simplified approaches to treatment. Three of the projects were excluded at this stage as final details of the intervention design had not yet been concluded at the time of the review, bringing the total to 33 individual projects.

Graph 2. Adaptations included in simplified approaches to treatment (from 33 unique projects included in this review)



MUAC-ONLY ADMISSION

MUAC-only admission is the most commonly used adaptation: 23 out of 33 of the reviewed projects include MUAC-only admission (see **Graph 2**). MUAC-only admission uses MUAC as the single anthropometric criteria, but also admits children based on oedema.

MUAC-only admission is also the "oldest" simplification tested, especially in emergency contexts:

- From 2007 to the present, MSF has operated MUAC and oedema only-based CMAM programming in several challenging emergency contexts, with MUAC thresholds for admission varying from <115mm to <125mm and differing prescribed lengths of stay according to contextual factors, prevailing mortality, presence of other nutrition actors, access constraints, and available resources.[19] In addition:
  - » All ALIMA trials use a MUAC-only approach.
  - » Most IRC trials (South Sudan, Kenya, Mali) have adopted a MUAC-only approach, apart from the study in Somalia in 2017–2018 (where admission criteria were based on MUAC and weight-for-height z-score (WHZ)).
  - » **UNICEF** programmes in Central African Republic, Chad, Ethiopia, Kenya, Nigeria and Somalia include MUAC-only admissions criteria.
  - » ACF is currently testing the addition of MUAC-only admission/treatment/discharge and a modified dosage for treatment delivered by CHWs in Gao, Mali (2019–2021), the Niger (2019–2020) and soon, in Neima, Mauritania.

ADMISSION FOR ALL CHILDREN BASED ON MUAC <125MM AND/OR OEDEMA AND DISCHARGE CRITERIA BASED ON MUAC >125MM

- Admission criteria for all children based on MUAC <125mm are included in **51%** of listed simplified approaches projects
- Discharge criteria based on MUAC >125mm is included in **57%** of these same protocols.

Projects using MUAC <125mm as an admission criterion generally implies using a similar discharge criterion based on MUAC >125mm. The percentage difference between protocols using admission criteria for all children with MUAC <125mm (51%) and protocols using discharge criteria based on MUAC>125mm (57%) can be explained by the fact that two protocols are using different admission/discharge criteria thresholds: 1 protocol is only admitting children with SAM (based on MUAC <115mm) and using discharge criteria based on MUAC >125mm, while the other one is only admitting children with MAM, based on MUAC >11.4cm and <12.5cm and using discharge criteria based on MUAC >125mm.

MODIFIED/REDUCED DOSAGE OR REDUCED DOSAGE OVER COURSE OF RECOVERY

A '**modified'** dosage is different from the standard RUTF dosage. It is a dosage tested to **optimize** the treatment of acute malnutrition by moving towards more **effective** and **cost-effective treatment** with a **reduced amount of RUTF**, which is usually associated with expanded admission criteria for an earlier detection of wasting.

In the standard protocol, RUTF is given according to body weight throughout treatment until discharge. Within the simplified approaches, RUTF dosage and its calculation vary according to the implementer.

19 Hanson et al, 2019

Reducing Dosage

A modified dosage is used in **66%** (22/33) of all the projects included in this review. Most of these modified dosages are gradually **reduced over the course of a child's recovery**, based on MUAC status and weight (OptiMA) or Child's MUAC only (ComPAS). This was seen in 18 of the 22 projects that included a modified dosage.

Calculating dosage

59% (13/22) of these projects calculated dosage based on MUAC status only; **32%** (7/22) calculate dosage based on MUAC and weight; and **9%** (2/22) calculate dosage based on weight only.

Five types of modified dosage have been tested and documented over the last five years (*see Annex 1*) but only two of them have been tested in different contexts and optimized according to achieved outcomes (OptiMA):

- **OptiMA dosage (ALIMA)** where dosage is calculated according to MUAC status and weight
- **ComPAS dosage (IRC)** where dosage corresponds to a fixed amount of RUTF according to MUAC status only (two sachets per child, per day/1000kcal for MUAC <115mm and one sachet per child per day/550kcal for 120 ≤ MUAC <125 mm)
- **MANGO dosage (ACF)** which has been tested in Myanmar and Burkina Faso

The **ComPAS dosage** is currently the most used/tested modified dosage, likely due to the simplified calculation of dosage based only on MUAC status. For full table with dosage by project please see Annex 1.

USE OF A SINGLE PRODUCT FOR TREATMENT

The use of one product (RUTF) to treat both MAM and SAM was utilized in **61%** of the projects included in this review. Other simplified approaches projects that do not use the same product for treatment for both MAM and SAM generally use the standard protocol for both categories or include treatment for one category of child only (such as children with MAM in the Hi-MAM study in Sierra Leone and children with SAM in Niger, where treatment with a reduced schedule of RUTF was provided by MSF in 2014).

TREATMENT AND MANAGEMENT OF ACUTE MALNUTRITION BY COMMUNITY HEALTH WORKERS

Treatment of acute malnutrition by CHWs is included in **45%** of the simplified approaches projects. Given that this was one of the first simplifications tested during the first phase of simplified approaches, evidence on this approach is quite robust with crucial results related to effectiveness of treatment.

- **60% of these protocols are MUAC-only,** whilst the rest are based on standard admission criteria (MUAC <115 mm or bilateral pitting oedema or WHZ<–3 Z-score), and one protocol used the old National Centre for Health Statistics reference (2009, Malawi). These MUAC-only projects are usually implemented or tested in emergency areas; ACF in Gao (Northern Mali), N'Guigmi (the Niger, Lake Chad region) and in Neima (Mauritania,

at the border with Mali); ALIMA in Barsalogho (Northern Burkina Faso); UNICEF in Rann (Northern Nigeria); IRC in Nata (Mali); and Malaria Consortium in South Sudan.

- Screening at community level (Family-MUAC approach), is another simplification that has been added to the delivery of treatment at community level. This approach is ongoing in Barsalogho (ALIMA) and has been tested in Nara (IRC, Mali) in 2018–2020, as well as in Niger and Mauritania (ACF). The combined use of these two simplifications is therefore quite new.

SCREENING AT THE COMMUNITY LEVEL (THE FAMILY-MUAC APPROACH)

Screening for acute malnutrition at the household level has been tested and implemented since 2011, with ALIMA pioneering this approach in the Niger.[20] There is some peer reviewed evidence and a lot of operational findings showing the capacity of mothers to detect malnutrition.[22-21] The evidence on its effectiveness remains promising and should be supported through more effective monitoring and evaluation mechanisms, including indicators of effectiveness.[22]

The Family-MUAC simplification was included in only **24%** of the studies in this review as it only includes projects that focused on treatment; however, Family MUAC is already widely implemented in several countries across the globe. Projects that integrated Family MUAC into treatment programs, were all **MUAC-only** and **all used an expanded admission criteria** with a **discharge criterion based on MUAC >125mm** and all tested **a simplified dosage:** all the OptiMA studies (ALIMA), ComPAS (IRC) in Mali, UNICEF in Central African Republic, and WFP in Chad and CAR and IRC in Chad using the ComPAS dosage.

REDUCED VISITS TO HEALTH FACILITY DURING TREATMENT

The frequency of visits was mentioned in 27 out of the 33 projects included in this review. Only 4 projects (out of 27) are reducing visits to health facility during treatment and moving mainly from weekly to biweekly visits for all children: UNICEF-WFP in Central African Republic, UNICEF in Nigeria and Project Peanut Butter in Sierra Leone. The fourth project included the reduction of the RUTF ration and moving to a monthly ration but keeping weekly visits to monitor children during this simplification of the RUTF schedule.[23]

C. Outcomes: effectiveness and gaps (nutritional outcomes)

Simplified approaches are designed to improve coverage and reduce the costs of caring for children with uncomplicated wasting, while maintaining quality of care. As there is no single set of simplifications, but rather a series of different approaches adapted and adopted according to the opportunities and challenges in each context, it may be difficult to assess the effectiveness of simplified approaches without classifying projects and results. Evidence therefore remains limited given the wide range of simplifications and their different potential combinations.

20 Blackwell et al, 2015

21 Alé et al, 2016 ; Daures et al,2020

22 UNICEF WCARO, Rapid review of the Family-MUAC approach, August 2020

23 Isanaka et al, 2017

1. Nutritional outcomes (recovery, non-response, defaulting, death) for protocols including a modified dosage

These projects usually include different sets of other simplifications, mainly: MUAC-only admission (17/22), expanded admission criteria (15/22) and using the same product for treatment of children with MAM and SAM (15/22). Eight projects include Family-MUAC and four include the delivery of treatment at community level. Nutritional outcomes associated with these five main modified dosages are presented below, in Table 2 & 3.

Table 2. Modified dosage and nutritional outcomes from Research Trials

Research Projects	DOSAGE	RECOVERY (>75%)			DECEASED (<10%)			DEFAULTED (<15%)			NON-RESPONDERS		
		MUAC 115 or oedema	MUAC 115–119	MUAC 120–124	MUAC 115 or oedema	MUAC 115–119	MUAC 120–124	MUAC 115 or oedema	MUAC 115–119	MUAC 120–124	MUAC 115 or oedema	MUAC 115–119	MUAC 120–124
OptiMA Yako_ Burkina Faso	OptiMA Dosage	70.4%	84.1%	91.4%	1.5%	0.6%	0.1%	9.3%	5.5%	3.2%	10.6%	4.3%	1.2%
OptiMA_ Mirriah_Study «OptiMA vie reelle»_Niger	OptiMA Dosage	57.6%	87.1%	92.6%	1.0%	1.5%	0%	6.9%	4.8%	3.1%	34.1%	6.6%	3.7%
ComPAS_South Sudan-Kenya	ComPAS Dosage	41.6% vs 37.8%	86.4% vs 85.1%		1.8% vs 1.8%			-	-	-	21.9% vs 24.7% (non-inferiority to standard protocol.)		
ACF_Myanmar	Standard protocol (SAM) for children >65cm, 1 sachet/ child/day MAM)	90.2%[2]			0%			2%			0.9%		
ACF_MANGO_ Burkina Faso	MANGO dosage for SAM children	52.7% vs 55.4%[3] (using Sphere calculation standard: 68% vs 72%; non-inferiority to standard protocol for all indicators)			0.3% vs 0.3%			12.2 vs 8.5%			12.7 vs 12.5 %		
Project Peanut Butter_Sierra Leone	Project Peanut Buter Dosage	83% (not specified by MUAC category)			3.8% (same)			8.2% (same)			5.3% (same)		

1 -3 Children with SAM defined by MUAC <115mm or WHZ <-3
2 Children with SAM defined by MUAC <110 mm or WHZ <–3

Table 3. Modified dosage and nutritional outcomes from Operational Implementation

OPERATIONAL IMPLEMENTATION		RECOVERY		DECEASED		DEFAULTED		NON-RESPONDERS	
MUAC 115 or edema		MUAC 115-124	MUAC 115 or edema	MUAC 115-124	MUAC 115 or edema	MUAC 115-124	MUAC 115 or edema	MUAC 115-124	
ComPAS_ Mali	ComPAS Dosage	94%	98%	0%	0%	6%	2%	0.08%	0%
ComPAS_ Somalia	ComPAS Dosage	98%[1]	(SAM only)	0%	-	1%	-	0%	-
UNICEF_ Nigeria	ComPAS Dosage	90%	95.9%	0.30%	0.20%	6%	2.50%	3.70%	1.4%

These tables show that nutritional outcomes for protocols including a modified dosage are usually less satisfactory for children admitted with MUAC under 115. Results for children with MAM are always far above Sphere standards. When looking at the results from operational implementation however, results for these children appear acceptable.

Recent results from ComPAS in Kenya and South Sudan showed non-compliant results with Sphere standards, but these results are not inferior to the standard protocol. High rates of non-response[24] have been registered for this project, but these numbers are still non-inferior to standard protocol, which can mean that these high rates of non-response are not due to the dosage/protocol.

Regarding projects with a modified dosage targeting all children (ComPAS, OptiMA), although the overall strategy is very satisfying for children with MUAC 115–124mm, children with SAM have low rates of recovery **(OptiMA Yako, OptiMA Mirriah, ComPAS South Sudan-Kenya).**

What are the characteristics of children with the lowest recovery rates?

Low recovery rates were identified in the Niger and Burkina Faso for children admitted with MUAC <115mm or oedema (57.6% in Mirriah and 70.4% in Yako). These rates can be explained by **high non-response rates** (34.1% in Mirriah and 10.6% in Yako) and high defaulter rates (6.9% in Mirriah and 9.3% in Yako and). Non-responders share the following characteristics:

- **Children who are severely wasted (WHZ<-3Z) and those with MUAC <115 mm** have the highest non-response rates (40% in Mirriah; 12.5% in Yako) and the lowest recovery rates (51.6% in Mirriah and 64.3% in Yako).
- The highest mortality rate was observed in Yako (1.7%) for severely wasted children with MUAC <115 mm.
- **Most non-respondents are stunted**: 92.1% of non-responding children with SAM (MUAC <115 mm) are stunted (Height for age <-2Z) in Mirriah while stunting in Yako is highly prevalent among severely wasted children and those with MUAC <115 mm (57.9%).

In Kenya and South Sudan (ComPAS protocol), low recovery rates for children admitted with MUAC <115mm or oedema is a similar issue as only **41.6%** of children in this category

24 Non-response = 10 weeks after inclusion for MUAC 115mm and 12 weeks for MUAC 115-124mm

recovered. Among children with SAM or MAM, there is a high rate of defaulting (33.8% for SAM; 21.3% for MAM)

Are non-response rates/low recovery rates related to the use of a modified dosage?

Regarding the ComPAS study in Kenya and South Sudan, it is important to mention that the low recovery rates for children admitted with MUAC< 115 mm **are non-inferior to standard protocol** (41.6% combined/simplified protocol *vs* 37.8% standard protocol). This means that low recovery rates observed with the two protocols may not be explained by the different protocols/dosage but by other factors affecting the recovery of children with SAM (MUAC <115 mm), regardless of the treatment used.[25]

Regarding the OptiMA's studies, it seems that children with MUAC <115mm and severe wasting (WHZ<-3Z) are more likely to be non-responders. In this study, there was no comparison with the standard protocol, but authors (Daures et al, 2020) mentioned that previous studies described a correlation between shorter length and treatment non-response rate.[26-27] This indicates that non-response may be related to factors other than the use of a simplified protocol/dosage and suggests "that severely wasted and stunted children may require other interventions over a longer time period to improve growth trajectory."[28] On the contrary, the two variables that explain most of the recovery of children in this study in Yako were: children whose mothers were alive and children living within 10 km of the health centre.[28]

While recovery for children with MUAC <115 mm is challenging, ALIMA noted that of the non-responders in this category in Mirriah, Niger, most exited with a WHZ>-2 and/or +10 mm MUAC gain. If these criteria had been used the rather than MUAC >125mm, recovery rates would have gone from 57.6% to 85% for children admitted at MUAC <115 mm.[29]

In Mirriah, Niger, ALIMA conducted a follow up case control study among non-responders and those who achieved recovery and found that in younger children (6-9 months), the severity of malnutrition at admission, especially severe stunting, and hospitalization during treatment were factors associated with non-response. Five to eight months after discharge, 58% of non-responders were still malnourished and 32% of the control group (i.e. those who had recovered) had a MUAC <125 mm. Additional research is needed on non-responders in order to understand predictive factors as well as the mid- and longer-term outcomes of children who do not meet the criteria for recovery during a course of malnutrition treatment.

Lastly, while comparing the outcome of these simplified protocols with other MUAC-based programmes that do not include a modified dosage, lower recovery rates for children with SAM have also been observed, ranging from 57.4%[30] to 63%[31] in India to 63.4% in Malawi.[32]

25 Bailey et al, 2020.

26 Binns et al, 2015

27 Khara et al, 2018

28 Daures, et al, 2020

29 ALIMA. Rapport d'activité de l'Etude OptiMA vie réelle, Mars 2020, District de Mirriah, Région de Zinder, Niger, 22 juillet 2019 au 21 janvier 2020

30 Burza et al, 2015

31 Vibhavari et al, 2016

32 Binns et al, 2016

Daures et al state that this range of reported recovery rates under Sphere standards with and without RUTF dose reduction suggests that recovery for this category is challenging.[28]

2. Nutritional outcomes (recovery, non-response, defaulting, death) for MUAC-only based admission

Among the 33 projects reviewed, 23 (70%) were MUAC-only projects. These projects are not only MUAC-based but also include other simplifications, such as expanded admission criteria (8) and/or use of the same product (7) and/or a modified dosage (7) and/or offering delivery of treatment for acute malnutrition by CHWs (6) and/or implementing screening at the household level with a Family-MUAC component (3).

Among these 23 simplified approaches projects, 11 documented results in terms of nutritional outcomes (see Table 4).

Table 4. MUAC-only based simplified approaches including nutritional outcomes (n=11)

	RECOVERY (>75%)			DECEASED (<10%)			DEFAULTED (<15%)			NON-RESPONDERS		
	MUAC 115 or oedema (or MUAC 110mm[1])	MUAC 115–119	MUAC 120–124	MUAC 115 or edema[1]	MUAC 115–119	MUAC 120–124	MUAC 115 or edema[1]	MUAC 115–119	MUAC 120–124	MUAC 115 or oedema[1]	MUAC 115–119	MUAC 120–124
The optimizing treatment for acute MAlnutrition (OptiMA)_Yako_Burkina Faso	70.4%	84.1%	91.4%	1.5%	0.6%	0.1%	9.3%	5.5%	3.2%	10.6%	4.3%	1.2%
The optimizing treatment for acute MAlnutrition (OptiMA)_Mirriah_Etude «OptiMA vie reelle»_ Niger	57.6%	87.1%	92.6%	1.0%	1.5%	0%	6.9%	4.8%	3.1%	34.1%	6.6%	3.7%
Project Peanut Butter_ Sierra Leone	83% (not specified by MUAC category)			3.8% (same)			8.2% (same)			5.3% (same)		
ComPAS Mali	94%	98%		0%	0%		6%	2%		0.08%	0%	
ComPAS (Combined protocol for acute malnutrition) _Stage 2_South Sudan-Kenya	41.6% vs 37.8%	86.4% vs 85.1%		1.8% vs 1.8%			-	-	-	21.9% vs 24.7%		
Simplified approach for the management of acute malnutrition in Rann, Borno State_ Nigeria	90%	95.9%		0.30%	0.20%		6%	2.50%		3.70%	1.40%	
Use of RUTF based on community case management model_ Angola	93.8%	96.70%		1%	0.20%		4.8%	2.90%		0.30%	0.20%	
Community case management of severe acute malnutrition in southern Bangladesh	91.60% [1]	SAM only		0.10%	-	-	7.50%	-		0.60%	-	-
CMAM in Ethiopia	82.10%[2]	SAM only		0.70%	-	-	5.0%			-	-	-
Integrating severe acute malnutrition into the management of childhood diseases at community level in South Sudan	89%	SAM only		1.0%	-	-	6.0%	-		-	-	-
Simplified approaches to treat acute malnutrition: Insights and reflections from MSF and lessons from projects in north east Nigeria	No data shared but the paper states that programme outcomes remained within MSF thresholds and Sphere minimum standards throughout their use in 2016 and 2017.											

1-2 Children with SAM defined by MUAC <110 mm

The little evidence available shows that these MUAC-based approaches have satisfactory nutritional outcomes for children overall. However, recovery outcomes are less acceptable for children admitted with MUAC <115mm or oedema.

Recent published results (2020) from OptiMA in the Niger and Burkina Faso and from ComPAS in Kenya and South Sudan show that recovery does not meet Sphere standards for severely malnourished children. While Sphere standards were not met for these children in Kenya and South Sudan, the simplified approach did not result in worse recovery rates than the standard protocol (41.6% versus 37.8% respectively). The outcomes of both protocols fall far behind the optimal rate of recovery of 75%. Other standard programme indicators (death rate and defaulted rate) are aligned with Sphere standards (respectively <10%and <15%), even if the defaulted rate is a bit higher for children with SAM. Death rates are low at under 1.5% for all categories of children, except for the Project Peanut Butter in Sierra Leone, which had a death rate of 3.8%.

3. Nutritional outcomes (recovery, non-response, defaulting, death) for protocols including delivery of treatment for acute malnutrition at community level (CHW approach)

A review of operational projects (2005–2018) in delivering SAM treatment through community health platforms shows that nutritional outcomes, including recovery and defaulter rates, can be improved compared with standard CMAM programmes.[33] This review also found that the CHW model had a positive impact on treatment coverage and improved the cost-effectiveness of the approach, reducing time and money needed for the treatment at the household level.

This current review focuses on nutritional outcomes related to this approach from 2009 to 2020.

Of the 33 projects review, 15 (45%) included the delivery of treatment for acute malnutrition at the community level (Table 5).

33 López-Ejeda et al, 2019

Table 5. Nutritional outcomes associated with CHW approaches

SIMPLIFIED APPROACHES	RECOVERY (>75%)		DECEASED (<10%)		DEFAULTED (<15%)		NON-RESPONDERS	
	Children with SAM (MUAC-based or standard admission criteria)	Children with MAM (MUAC-based or standard admission criteria)	Children with SAM (MUAC-based or standard admission criteria)	Children with MAM (MUAC-based or standard admission criteria)	Children with SAM (MUAC-based or standard admission criteria)	Children with MAM (MUAC-based or standard admission criteria)	Children with SAM (MUAC-based or standard admission criteria)	Children with MAM (MUAC-based or standard admission criteria)
OptiMA_Barsalogho_Burkina Faso_ALIMA	Ongoing		Ongoing		Ongoing		Ongoing	
Effectiveness, cost-effectiveness and coverage of SAM treatment delivered by CHWs using a modified protocol in emergency contexts in Mali (Gao) and the Niger (N'Guigmi).	Ongoing		Ongoing		Ongoing		Ongoing	
ComPAS Mali_Nara_IRC	94%[1]	98%	0%	0%	6%	2%	0.08%	0%
Simplified approach for the management of acute malnutrition in Rann, Borno State_UNICEF	90%*[2]	95.9%	0.30%	0.20%	6%	2.50%	3.70%	1.40%
Innovative approach of integrating and simplifying SAM and MAM management through CHWs_Mali_Kayes_ACF	79.2%[3]	-	0.2%	-	6.3%	-		-
Innovative approach of integrating and simplifying SAM and MAM management through CHWs_Pakistan_ACF	76.0%[4]	-	0.2% vs 0.5%	-	3.8% vs 2.5%	-	20% vs 14%	-
Increased coverage of management of severe acute malnutrition through the support of CHWs in the Niger_ACF	77.4% vs 71.9%[5] (to be confirmed with final results)		1.7% vs 2.2%	-	7.6% vs 10.2%	-	7.6% vs 5.7%	-
Increased coverage of management of severe acute malnutrition through the support of CHWs in Mauritanie_ACF	76.5% vs 82.3%.[6] (to be confirmed with final results)		0% vs 0%	-	3.6% vs 3.8%	-	0% vs 0%	-
Use of RUTF based on a community case management model_Angola_World Vision	93.8%[7]	96.70%	1%	0.20%	4.8%	2.90%	0.30%	0.20%
Community case management of severe acute malnutrition in southern Bangladesh_SCI	91.90%[8]	-	0.10%	-	7.50%	-	0.60%	-
CMAM in Ethiopia_UNICEF	82.10%[9]	-	0.70%	-	5.0%	-	-	-
Community-based management of severe malnutrition in children under five in the Melghat tribal area, central India_MAHAN	63.0%[10]	-	2.0%	-	-	-	-	-
The use of home-based therapy with RUTF to treat malnutrition in a rural area during a food crisis_Malawi_Wash.Univ.	93.70%[11]	-	0.90%	-	3.6%	-	-	-
Integrating severe acute malnutrition into the management of childhood diseases at community level in South Sudan_Malaria Consortium	89%[12]	-	1.0%	-	6.0%	-	-	-
Innovative approach of integrating and simplifying SAM and MAM management through CHWs_Consortium_Kenya	No results		No results		No results		No results	

* In Nigeria, CHWs only treated children with MAM with a ComPAS dosage, whereas children with SAM were treated at the health centre level, while also receiving a modified dosage (ComPAS).

1-2-7-12 Children with SAM defined by MUAC-115mm

3-4-5-6 Children with SAM defined by MUAC <115 mm; Bilateral oedema or WHZ <–3 Z-score

8-9 Children with SAM defined by MUAC <110 mm

10 SAM defined by WHZ or WAZ < –3 Z-score

[11] WHZ with ancient reference

Table 5 shows **very satisfactory results for the approach in terms of nutritional outcomes for children with SAM** (defined by MUAC <115 mm or oedema or defined by MUAC <115 mm or WHZ < –3 Z-score or bilateral pitting oedema). Aside from the study conducted in India,[34] recovery rates were all above Sphere standards and frequently exceeded 90% cure rates for children with SAM.

When admission criteria are expanded for children with MAM (ComPAS in Mali, UNICEF in Nigeria and World Vision in Angola), recovery exceeds 95%.

How can these good recovery rates be explained?

Compared with the nutritional outcomes of other simplified protocols, **recovery rates for children with SAM treated by CHWs are better and defaulter rates are low**. This may be because with community level care, caregivers do not have to go to the health centres, far away from their villages. Therefore, this approach tends to overcome the main barrier of access to SAM treatment.[35] Indeed, proximity to treatment has previously been identified as a factor influencing recovery.[40-36] Some coverage outcomes also suggest that using CHWs to treat SAM can lead to improved access to treatment.[37]

Moreover, as stated in the first review of this approach (Lopez-Ejeda et al, 2019): most of these interventions have reported 'early detection' (enrollment of children with MUAC and/or weight-for-height just below the admission criteria) and a potential reduction in complications and mortality. The general health of children at admission (and the presence of comorbidities: diarrhoea, anaemia, chronic conditions) have been proven to influence the recovery process.[38-39-40]

There are high non-response rates and low recovery rates observed for children with SAM admitted with MUAC <115mm in simplified protocols that do not include a CHW approach. Considering that non-response is probably linked to other contextual factors (such as comorbidities) and that defaulter rates can be impacted by distance to health centres, the difference observed in recovery rates could be explained by proximity (see above). It may also be influenced by the fact that CHWs are treating both acute malnutrition and the most common diseases affecting children in the community, meaning that the treatment of these other diseases may positively affect recovery from SAM and decrease non-response rates.

These same factors could also explain the difference observed in recovery rates for children with SAM between ComPAS in Mali (including a CHW approach and a 94% recovery rate among children with SAM) and other protocols that include a modified dosage (but no CHW approach and low recovery rates). Evidence is still too limited to draw conclusions, but this hypothesis can orient future combinations of simplifications to be tested.

34 Vibhavari et al, 2016
35 Rogers et al, 2015
36 Massa et al, 2016.; Kabalo et al, 2017
37 Charle-Cuellar et al, 2019 ; Álvarez Morán et al. (2018a); López-Ejeda et al, 2019.
38 Teshome et al, 2019
39 Asres, et al, 2018
40 Yazew et al, 2019

V. Discussion

The evidence base on simplified approaches is quite substantial and mainly consists of research protocols, peer reviewed research, and Emergency Nutrition Network articles. Evidence on simplified approaches has been growing, especially over the last five years and the West and Central Africa region has been increasingly at the centre of testing and implementing different sets of simplifications.

The evidence is promising for some simplifications alone (CHW approach, Family-MUAC, MUAC programming) or combined (OptiMA and ComPAS protocol including a modified dosage and/or management of acute malnutrition at the community level). And yet, the evidence related to the combination of different simplifications is quite recent (especially for protocols combining a modified dosage or Family-MUAC approach to other simplifications) meaning that the evidence is heterogeneous and includes gaps given that a context-specific approach is promoted. Furthermore, each implementer has their own approach, testing different combinations of simplifications according to the context of nutrition services in the country, national policies/guidelines, and their own research agenda. While it is challenging to provide a general overview of the effectiveness of simplified approaches, the evidence available nevertheless provides important programming insights. This is because:

- **Simplified approaches** are increasingly combining simplifications as protocols become more complex. This improves the overall effectiveness and cost-effectiveness of a nutrition response by aggregating the (recently) known added value identified for each simplification (*for instance: evidence has showed that Family-MUAC can improve early detection, and that CHWs can improve coverage and decrease defaulting)*. This can make it difficult to assess the effectiveness of simplified approaches as there are various combinations that have been tested in different contexts.
- **Simplified approaches** are responding to context-specific barriers identified in countries. This means they can present different outcomes depending on the barriers in the specific contexts where they have been implemented.

Simplified approaches need to be country specific. It is important to continue supporting country-based evidence generation and advocate for a combination of simplifications. This evidence needs to include current research and operational gaps identified at the regional and country level.

A. MUAC-ONLY ADMISSION

MUAC-only admission is the most utilized simplification as 64% of the studies in this review include this component in their simplified treatment protocol. Most of the studies used simplified MUAC-only admission and discharge criteria. MUAC-only admission is also the 'oldest' simplification tested. Studies using MUAC <125mm as an admission criterion for all children generally implies using a similar discharge criterion based on MUAC >125mm.

An outstanding question is about the optimal entry and discharge criteria for treatment of acute malnutrition to ensure the best possible treatment outcomes. A study in India

simulating nine different discharge criteria in a CMAM cohort,[41] found variation in cured rates (compared with discharge based on same criteria as admission, including WHZ+MUAC if both present at admission). This suggests that the discharge criteria selected may have implications for relapse, but also that there is a need to provide a least consistency between discharge and admission criteria.

MUAC and WHZ measurements do not always identify the same children as having SAM and produce different prevalence estimates (Leidman et al, 2019).[42] As we still need to better understand the mechanism behind the discrepancy between MUAC and WHZ (Briend, 2016[43]), this has generated a broad (and static) debate, as illustrated by the recent article by Grellety & Golden (BMC Nutr. 2016).[44] This debate also focuses on the relevance of prioritizing MUAC (over WHZ) to effectively reduce malnutrition-related deaths. Some authors are convinced by the better sensitivity of MUAC to identify children at high risk of mortality (Briend et al, 2016; Ale et al, 2016[45]) and/or to use MUAC as both an admission and discharge criterion (Goosens et al, 2012[46]; Isanaka et al, 2019[47]).

There is a growing body of evidence that MUAC is safe and effective as the sole anthropometric criterion (along with oedema) used to identify, manage and discharge children requiring treatment for SAM,[29-30] even if further research is needed. It has been demonstrated that MUAC can be an equivalent or better predictor of mortality than WHZ <-3[48-49] or WHZ <-3 combined with MUAC, with an inherent age bias that targets younger children who are at highest risk of death.[50]

B. MODIFIED DOSAGE

Most simplified approaches with treatment are including a modified dosage, which is generally reduced over the course of recovery of children. Calculation of dosage varies according to implementers' dosage table. Most of these dosages are based on MUAC status only (59%) whereas others are based on MUAC and weight (32%) or weight only (9%). Two main types of modified dosage have been tested/implemented in different contexts over the five last years (emergency contexts/urban contexts/rural contexts) on the African continent and mainly in West and Central Africa (OptiMA and ComPAS).

Because of low recovery among children admitted with MUAC <115 mm, further study and comparisons are needed:

- to assess whether increasing the dosage of RUTF would improve recovery rates and non-response for this category.

41 Guesdon et al, 2019.
42 Leidman,et al, 2019
43 Briend et al, 2016
44 Grellety et al, 2016
45 Alé et al, 2016
46 Goossens et al, 2012
47 Isanaka et al, 2019
48 Myatt et al, 2005
49 Briend et al, 2012
50 Phelan et al, 2015

- to verify whether the standard protocol performs better or not for this same category of children, in different contexts. Context-specific adaptations are the key to the effectiveness of simplified approaches.

To address outstanding research questions, ALIMA is currently undertaking several projects to:

- Compare the strategy to current national protocols in an area with high prevalence of oedema: a randomized control trial in DRC.[51-52]
- Determine whether short RUTF dosage reductions (for instance, 150 kcal/kg/d) have a non-inferior result to the current dosage (175-200 kcal/kg/j) for children with MUAC <115 mm or oedema.
- Compare the effectiveness of the two main dosages, either based on weight and MUAC status (OptiMA) or MUAC status only (CompAS), in an area with a high prevalence of stunting and wasting: a randomized control trial in the Niger.46
- Better understand non-response, the failure to reach a MUAC ≥125 in less than 10–12 weeks: a follow-up of non-responders in Mirriah (the Niger) and their future 3–6 months after discharge.29
- Test this simplified protocol/dosage in an urban setting: such as the pilot trial with external comparator in Mali.

And lastly, as stated by ALIMA, **nutrition programmes are very dependent on the context; therefore, it is important to conduct more observational studies in different contexts**. The effectiveness of simplified approaches may vary widely according to context.

C. MANAGEMENT OF ACUTE MALNUTRITION BY COMMUNITY HEALTH WORKERS

The management of acute malnutrition by CHWs was included in 45% of the studies included in this review. Most of these studies that included treatment for malnutrition at the community level are MUAC-only based (60%) and do not use expanded admission criteria, but include SAM only, either based on MUAC (3/15) or standard admission criteria (6/15).

These studies that integrated treatment by CHWS and MUAC-only were usually in emergency areas. Over the past three years, some implementers have added and tested a modified dosage to this approach, which also mainly concerns the same emergency areas. The evidence around this approach is rapidly growing and consistent, showing promising and satisfactory results for all categories of children. However, some gaps or steps forward have been identified.

- As with all simplifications, the model should be explored in other contexts, given that context (nutritional situation, humanitarian situation, prevalence of comorbidities, barriers to access, etc.) seems to have a deep impact (as potential bias factors) on how children respond to treatment.

51 Clinical Trials Registry (2018) ClinicalTrials.gov Identifier: NCT03751475. Optimizing Acute Malnutrition Management in Children Aged 6 to 59 Months in Democratic Republic of Congo (OptiMA-DRC).

52 Phelan et al, 2019

- Time allocation studies **comparing** the performance of health facilities and CHWs are required to assess whether adding treatment in the package of interventions delivered by CHWs negatively affects the quality of care in the other preventive and curative services delivered.
- Further studies assessing the **long-term health and nutrition status** of children are needed to identify the potential impact of the CHW approach on relapse and mortality rates over time for children who recovered.
- Continue building the evidence on the sustainability of achieving similar results **at scale**.
- Continue assessing the impact of CHW-delivered treatment on **non-response**, **relapse** and the characteristics of **defaulters**.
- Consider coupling **Family-MUAC with management of acute malnutrition** for a better combined effectiveness of the two simplifications. One of the main challenges identified with the Family-MUAC approach is the distance to health centres, which can affect caregivers' decisions about whether to seek treatment, even though their capacity to effectively screen for malnutrition has been widely demonstrated. [53]-56-57 Coupling screening at the household level and treatment at the community level could therefore ensure an earlier detection and treatment of acute malnutrition and improve both coverage and treatment outcomes.
- Assess the effectiveness of modified dosage when combined with a close proximity of follow-up and with the integrated management of childhood diseases (CHW approach).

D. SCREENING ACUTE MALNUTRITION AT THE COMMUNITY LEVEL

Screening for acute malnutrition at community level was only included in 24% (8/33) of projects reviewed. Yet, this approach is already widely implemented or scaled up in several countries in Africa to improve the coverage of screening. Simplified approaches for treatment that include a Family-MUAC approach are all MUAC-only based, all use expanded admission criteria with a discharge criterion based on MUAC >125mm, and all test a simplified dosage.

This simplification can be added to the delivery of treatment at the community level (CHW approach). This combination is ongoing in Barsalogho (ALIMA, Burkina Faso) and has been tested in Nara (IRC, Mali) quite recently, between 2018 and 2020.

E. CONCLUDING REMARKS

It is recommended that simplifications be combined and adapted to the context (including identifying barriers and understanding the humanitarian and nutritional situation) to improve the overall effectiveness of nutrition services. Given that the nutritional outcomes of the various simplified approaches may vary according to the context and its preexisting challenges (e.g., high prevalence of stunting, distance to health centres), it is important to test and adapt simplifications and their combinations within different settings.

53 UNICEF WCARO, Review of Family-MUAC, August 2020
56 Alé et la, 2016
57 Blackwell et al, 2015

The good results obtained using CHW models in different contexts regarding nutritional outcomes (MUAC <115mm only or based on standard admission criteria) and the unsatisfactory results obtained for children with SAM using other simplified protocols suggest the need for further research on the combination of the CHW model with a modified dosage. Given that non-response may be related to factors other than the use of a simplified protocol/dosage, further research will help determine whether this combination could decrease non-response and defaulter rates and improve recovery rates for children with SAM (MUAC <115mm), which are important challenges to simplified treatment for these children.

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Annex 1. Simplified approaches to treatment including a modified dosage (n=22)

Projects with a modified dosage (n=22)	For MUAC < 115mm (or for children with SAM defined by standard admission criteria)	115 ≤ MUAC ≤ 120 mm	120 ≤ MUAC < 125 mm
The Optimizing Treatment for acute Malnutrition (OptiMA)_Yako_ Burkina Faso	175 kcal/kg per day	125 kcal/kg per d	75 kcal/kg per d
The Optimizing treatment for acute Malnutrition (OptiMA)_Mirriah_ Etude «OptiMA vie reelle»_Niger	150 kcal/kg/j	110 kcal/kg/j	75 kcal/kg/j
The Optimizing treatment for acute Malnutrition (OptiMA)_ Barsalogho_Burkina Faso	2 sachets per child per day (1,000 kcal)	1 sachet per child per day (500 kcal) after 2 week transition from red to yellow MUAC	
The Optimizing treatment for acute Malnutrition (OptiMA)_Bamako_ Mali	150 kcal/kg/j	110 kcal/kg/j	75 kcal/kg/j
RCT_Niger_OptiMA & ComPAS	**Treatment Arm 1.** 175 kcal/kg per d	**Treatment Arm 1.** 125 kcal/kg per d	**Treatment Arm 1.** 75 kcal/kg per d
	Treatment Arm 2. 2 sachets per child per day (ComPAS dosage)	**Treatment Arm 2.** 1 sachet per child per day (ComPAS dosage)	
OptiMA DRC_RCT	175 kcal/kg per d	125 kcal/kg per d	75 kcal/kg per d
Project Peanut Butter_Sierra Leone	175 kcal/kg per d	75 kcal/kg/per d	
ComPAS Mali	2 sachets per child per day (1,000 kcal)	1 sachet per child per day (500 kcal)	
ComPAS Somalia	2 sachets per child per day (1,000 kcal)	1 sachet per child per day (500 kcal)	
ComPAS (Combined Protocol for Acute Malnutrition)_Stage 1 (design dosage table)	2 sachets per child per day (1,000 kcal)	1 sachet per child per day (500 kcal)	
ComPAS (Combined Protocol for Acute Malnutrition)_Stage 2_South Sudan and Kenya	2 sachets per child per day (1,000 kcal)	1 sachet per child per day (500 kcal)	
Modelling an Alternative Nutrition Protocol Generalizable for Outpatient (MANGO)_Burkina Faso	For children with SAM: Standard RUTF dosage is given during weeks 1–2. RUTF dosage is reduced on week 3 to discharge following a dosage table based on weight (reduced dosage depends on weight and can be decreased from 13% to 53%)		
Hi-MAM Study_Sierra Leone	No SAM	1 sachet per child per day (525 kcal)	
Simplified approach for the management of acute malnutrition in Rann, Borno State_Nigeria	2 sachets per child per day (1000 kcal)	1 sachet per child per day (500 kcal)	
Simplified approach for the management of acute malnutrition in Somalia	Standard protocol	1 sachet per child per day (500 kcal)	
Effectiveness, cost-effectiveness and coverage of SAM treatment delivered by CHWs using a modified protocol in emergency contexts in Mali (Gao) and the Niger (N'Guigmi).	2 sachets per child per day (1000 kcal)*	1 sachet per child per day (500 kcal)	

Low-dose RUTF protocol and improved service delivery lead to good programme outcomes in the treatment of uncomplicated SAM: a programme report from Myanmar_ACF	Stage 1: Standard RUTF dosage until MUAC ≥ 110 mm and a WHZ ≥ –3	Stage 2: When MUAC ≥ 110 mm and a WHZ ≥ –3, 1 sachet/day
Simplified approaches to treat acute malnutrition: Insights and reflections from MSF and lessons from experiences in north-east Nigeria	RUTF for all children with acute malnutrition (dosing based on SAM or MAM according to age-specific MUAC cut-offs)	
Outpatient treatment of SAM: response to treatment with a reduced schedule of therapeutic food distribution_Niger	(56 sachets/4 wk for those weighing <8 kg and 84 sachets/4 week for those weighing ≥8 kg)	
Management of MAM with RUTF in the Niger	RUTF (1,000 kcal/day) for all outpatients	
Effectiveness and feasibility of a simplified protocol for the management of acute malnutrition (moderate and severe) in children aged 6–59 months in Ouaka and Kémo Central African Republic	2 sachets per child per day (1000 kcal)	1 sachet per child per day (500 kcal)
Simplified protocol for the management of acute malnutrition in Chad	2 sachets per child per day (1000 kcal)	1 sachet per child per day (500 kcal)

* Children under 5 kg , 1 sachet (to respect CMAM protocol of the country)