

# A light touch mapping of the current research gaps and priorities in nutrition in emergencies

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### Key messages

In 2022, it was estimated that over 274 million people would require humanitarian assistance, the highest figure in decades. With such a high burden and scarce resources, it's essential that we can demonstrate long term impact and cost effectiveness of nutrition in emergencies programming. This would enable a better more evidence-based response that maximises impact for affected populations. This report aims to summarise key research gaps across infant and young child feeding in emergencies, nutrition information systems, wasting, management of small and nutritionally at-risk infants and their mothers, and cash and voucher assistance for nutrition outcomes to help better inform and encourage researchers, non-governmental organisations and donors involved in conducting nutrition in emergencies research.

### Key findings:

- While there has been an increase in nutrition in emergency research, important knowledge gaps remain both within each of the thematic areas as well as more generally with a lack of research on nutrition information systems and impact of cash and voucher assistance on children's and women/girls' nutritional status in emergency contexts being highlighted. This review also identified a need for more research on interventions to improve the identification and management of small/nutritionally at-risk infants and their mothers, prevention of wasting including through improving preconception nutrition, the need to further understand and identify children most at risk of adverse outcomes associated with wasting, management of breastmilk substitutes, re-lactation and complementary feeding.
- A critical challenge for nutrition in emergencies research is the lack of high-quality research, which has limited its ability to fully answer key questions and affect change in guidance and policy. At the same time, it's essential that research is designed to answer practical questions that exist on intervention design, feasibility and cost-effectiveness to support programme implementation.
- Overall, across thematic areas, further investment is needed to strengthen the quality and breadth of nutrition in emergency research. Consensus on the most important gaps need to be better articulated by practitioners and be more visible to researchers looking to conduct research in emergency settings.

## Background

The Global Nutrition Cluster Technical Alliance (GNC-Technical Alliance or the Alliance) is a global mechanism, established in 2017, which aims to provide predictable, timely and coordinated nutrition technical assistance to meet the nutrition needs of people affected by and at risk of emergencies. The Alliance's primary function is to provide technical advice; facilitate rapid, consensus-driven stop-gap guidance in the absence of established normative guidance; and provide specialised technical expertise [1].

The Global Thematic Working Groups (GTWGs),<sup>1</sup> provide a platform for developing timely consensus-driven stop-gap guidance in response to key technical gaps identified by the Alliance. Thematic areas covered by the GTWGs currently include child wasting prevention and treatment, Infant Feeding in Emergencies (IFE), Nutrition Information Systems (NIS), management of small and nutritionally at-risk infants under six months of age and their mothers (MAMI) and Cash and Voucher Assistance (CVA) for nutrition outcomes. The technical and knowledge gaps in each of these areas are partly due to a lack of nutrition research in emergency settings. This impedes practitioner-level understanding of appropriate evidence-based responses for different and changing contexts, which could improve the effectiveness of nutrition in emergency programming [2].

While there has been a sizable increase in studies looking at the efficacy and effectiveness of nutrition in emergency programming, large knowledge gaps remain [2]. The multiple forms of malnutrition present in emergency contexts are not distinct from other settings. However, the scale and urgency of required actions and the challenges faced by programmes is different [2]. Building the evidence base for effective nutrition in emergency interventions can be logistically and ethically challenging. Furthermore, where research has been conducted, there are often challenges around adequate data quality which impacts overall research findings and subsequent programmatic recommendations.

At the 2021 GNC annual meeting, this lack of nutrition research in emergency settings and its impact on practitioner-level responses was highlighted. During the meeting, attendees reflected on the possible role the GNC could have in highlighting these research needs more broadly. Subsequently, the activity to do a light touch research mapping was included in the GNC 2022-2025 strategy [3]. Given that this work was more technical in nature, the Alliance was asked to carry out this activity. Emergency Nutrition Network (ENN), in its oversight role of the GTWGs within the Alliance, undertook this exercise between August 2022 and January 2023.

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<sup>1</sup> Thematic areas were developed based on an initial mapping of technical needs, please see: Global Technical Assistance Mechanism for Nutrition (GTAM) (2019). Baseline Technical Needs Assessment Report 2019. [www.ennonline.net/resource/baselinetechicalneeds2019](http://www.ennonline.net/resource/baselinetechicalneeds2019)

## Objective

The aim of this report is to summarise the findings of the light touch research mapping exercise that aimed to highlight the key research gaps in Infant and Young Child Feeding in emergencies (IYCF-E), NIS, wasting, MAMI and CVA for nutrition outcomes to help better inform and encourage researchers, non-governmental organisations and donors involved in conducting nutrition in emergency research.

## Methods

This exercise was conducted in collaboration with the MAMI, IFE, NIS and CVA GTWGs.<sup>2</sup> It was not intended to be a systematic review of all literature. It rather builds upon existing work and draws upon the knowledge of the GTWGs regarding the research gaps and topics in their thematic areas.<sup>3</sup> The best approach for identifying key research gaps was determined in collaboration with each of the GTWG chairs and differed between each thematic area. This was due to several reasons, including that some thematic areas lend themselves more to research, while in other areas, key gaps are more operational. In addition, some thematic areas had existing research prioritisation exercises recently completed or ongoing at the time of this exercise. As a result, the process for identifying research gaps in each of the thematic areas included:

- **IYCF-E:** This exercise drew upon the findings of a 2016 research prioritisation exercise [4] and 2021 research stocktake (not yet publicly available). We mapped published peer-reviewed research conducted since January 2022 in the IYCF-E repository<sup>4</sup> against the 2016 research priorities. We then explored with IFE Core Group members what they felt were the current key research priorities, particularly any priorities that were not captured in the 2016 research prioritisation exercise.
- **MAMI:** An existing research prioritisation exercise conducted in 2015 [5] was used as the basis for this exercise. We implemented a relatively small-scale, non-systematic review of published peer-reviewed and grey literature to identify research conducted since 2015 against the identified research priorities.
- **NIS:** We identified research gaps through a relatively small-scale, non-systematic review of published peer-reviewed and grey literature. Then, utilising an online survey, the members of NIS GTWG ranked these questions in order of priority and identified any other areas they felt, from their experience, were current research priorities.

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<sup>2</sup> Due to a number of activities in the research space around wasting it was felt that capturing these ongoing activities and processes would be most useful.

<sup>3</sup> The GTWGs are groups of global level experts on the specific thematic areas, with a wealth of individual and agency level experience and expertise in nutrition in emergencies. Given this, it was felt that it was valuable to consult with members of the GTWGs to identify research gaps.

<sup>4</sup> The repository is compiled for the IFE Core Group by the Johns Hopkins Center for Humanitarian Health at Johns Hopkins Bloomberg School of Public Health, the Friedman School of Nutrition Science and Policy at Tufts University and the Gillings School of Global Public Health at the University of North Carolina at Chapel Hill. The repository aims to provide the reader with a snapshot of what is published with updates on a quarterly basis.  
<https://www.enonline.net/ife/iycferepository>

- **CVA for nutrition:** We conducted a relatively small-scale, non-systematic review of published peer-reviewed literature to identify possible research gaps drawing on previous work from the GTWG [6]. Then, utilising an online survey, the members of the CVA GTWG ranked these questions in order of priority and identified any other areas they felt, from their experience, were current research priorities.
- **Wasting:** There are several recent research prioritisation exercises on the prevention and treatment of wasting [7, 8] and ongoing efforts by World Health Organisation (WHO) and UNICEF to update and move forward this research agenda. For these reasons, we have chosen to simply summarise research gaps previously identified, articulate any published work that has begun to address these gaps and information publicly available on ongoing work to update and move forward the wasting research agenda.<sup>5</sup>

## Results

### Infant and Young Child Feeding in Emergencies (IYCF-E)

#### Research priorities

Infants and young children are particularly vulnerable and at risk of illness and death in emergency settings because of their specialised nutritional requirements, immature immune systems and dependency on caregivers [9]. In 2016, a research prioritisation exercise was conducted using the Child Health and Nutrition Research Initiative (CHNRI)<sup>6</sup> methodology to prioritise 40 research questions on IYCF-E identified through key informant interviews with experts in the topic area [4]. The research questions were scored by 27 people on the basis of their answerability, operational relevance, disease burden reduction and prevention, and originality. Ten questions were identified as research priorities (please see Table 1). Subsequently in 2022, a stocktake exercise involving an update of available peer-reviewed literature on the topic and 13 key informant interviews was conducted to identify the extent to which the top ten 2016 research priorities have been addressed.

**Table 1: Top ten topic areas identified through the IYCF-E research prioritisation (2016) and stocktake exercise (2022)**

Research questions (identified in 2016)	Priority level (identified in 2022) <sup>7</sup>
To what extent are cash transfers used to buy breastmilk substitutes?	Medium

<sup>5</sup> Information provided is based on publicly available information and thus this report does not capture the extensive work that is going on behind the scenes to move forward the wasting research agenda.

<sup>6</sup> The CHNRI methodology is systematic method for setting priorities in child health research.

<sup>7</sup> Priority level identified in the 2022 in a stock take involving a review of peer-reviewed literature and 13 key informant interviews.

What is the effectiveness and cost effectiveness of different complementary feeding interventions, alone and comparatively, for outcomes such as IYCF-E practises, nutritional status and morbidity? i.e., distribution of different food supplements, such as blended foods, ready to use foods, micronutrient powders; fresh foods; cash transfers; and voucher assistance in different contexts,	<b>High</b>
What is the long-term effect of IYCF-E interventions such as ‘baby tents’ after major natural disasters and IYCF-E component of CMAM programmes on IYCF practises of caretakers enrolled in the interventions, e.g., feeding colostrum, exclusive breastfeeding up to six months, dietary diversity for children more than six months?	<b>No longer a priority</b>
In contexts where pre-emergency breastfeeding rates are low and breastfeeding substitutes use is high, how should IYCF-E programmes be designed to ensure the protection, promotion and support of breastfeeding? What is the most effective mechanism for supplying breast milk substitutes (either in kind, through voucher assistance or cash transfer), and how can it be best managed?	<b>High</b>
How to design relactation interventions and how effective/cost effective are they in terms of impact on relactation rates?	<b>Medium</b>
How to provide effective psychosocial support to caregivers of infants and young children in different contexts, e.g., presence or absence of qualified staff, in terms of impact on IYCF-E practices?	<b>Medium</b>
How to determine the number of potential beneficiaries and coverage of IYCF-E programmes?	<b>No longer a priority</b>
When use of infant formula is necessary what are the pros and cons, e.g., safety, timeliness, and cost-effectiveness of distribution of ready to use infant formula compared to distribution of powdered infant formula plus kit for safer use of breastmilk substitutes, on nutritional status and morbidity?	<b>No longer a priority</b>
How to calculate, e.g., by mathematical modelling, the impact of specific IYCF-E programmes on outcomes such as nutritional status, morbidity and mortality?	<b>Medium</b>
How to effectively link and mainstream IYCF-E interventions with other sectors such as health, WASH, food security and child protection?	<b>Medium</b>

\*Infant and Young Child Feeding in Emergencies (IYCF-E); Infant and Young Child Feeding (IYCF); Water Hygiene and Sanitation (WASH); Community Based Management of Acute Malnutrition (CMAM).

### Published work to-date that has addressed priorities

Since the research prioritisation exercise in 2016, there has been multiple documented lessons learnt on the implementation of various infant and young child feeding (IYCF) interventions in emergency settings. However, there remains a lack of empirical evidence on their effectiveness and impact on IYCF indicators. Since January 2022, 37 peer-reviewed papers have been published that relate to IYCF-E. However, only seven (19%) of these studies contributed to answering research priorities previously identified in 2016 (see Appendix 1). Broadly, this

research has contributed to answering research priorities on complementary feeding, mainstreaming IYCF-E programming and providing psychosocial support to caregivers. The studies demonstrated that appropriate and safe complementary feeding can be maintained and even improved post-disaster [10, 11]. Studies also showcased the importance of emergency preparedness and psychosocial support in the protection, promotion and support of infant feeding during emergencies [12-14].

Since 2016, several evidence mapping exercises that have included IYCF-E research have been conducted [15-17]. While evidence is scarce, available research has primarily focused on social behaviour change programmes, cash transfers, and baby-friendly spaces. There has been an increase in available tools and guidance on IYCF-E resulting in participants in the 2022 stocktake identifying that the question on how to calculate coverage of IYCF-E programmes as no longer relevant. In addition, interviewees identified that the long-term impact of IYCF-E interventions is also not a priority. The interviewees expressed that it is more important to study the impact of these interventions in the acute or short-term as opposed to studying long-term impacts. Similarly, the question relating to the use of ready-to-use versus powdered infant formula was deprioritised as interviewees felt that learning was available and that ultimately this decision would be context specific.

### **Remaining gaps and ongoing research**

The research questions related to the effectiveness of complementary feeding interventions, and safe mechanisms of supplying breastmilk substitutes, were identified in the 2022 research stocktake as the top remaining research priorities. While interviewees felt that questions around complementary feeding had been partly answered, since it encompasses multiple interventions, they still identified a lack of evidence that compares interventions and linked IYCF-E outcomes. Similarly, interviewees felt that research concerning safe mechanisms of supplying breastmilk substitutes was only partly answered.

For questions related to relactation, interviewees noted that there remains a lack of evidence on the impact and effectiveness of such interventions. Interviewees also mentioned that more research in this area would help build confidence in using relactation in emergency settings. For research on effectively linking and mainstreaming IYCF-E interventions and the provision of psychosocial support, there is operational guidance on this topic; however, more evidence is needed on what interventions and platforms for delivery are most effective in different contexts.

The 2022 stocktake found that understanding of the extent to which cash transfers could be used to purchase breastmilk substitutes remains a priority, as this topic is not reflected in the evidence base for CVA. However, stakeholders interviewed raised concerns about whether the question as it currently stands would provide useful information. While it was the least mentioned priority, interviewees did find that modelling the impact of specific IYCF-E programmes was still important as it could provide vital information to inform advocacy efforts.



Management of small and nutritionally at-risk infants under six months of age and their mother's (MAMI)

Research priorities

Despite infants under six months of age being particularly vulnerable, the management of small and nutritionally at-risk infants under six months of age represents a critical care gap, as available evidence often does not address them directly [18]. A global collective of policymakers, practitioners and researchers (MAMI Global Network) is committed to generating evidence to improve policy and practice to strengthen their care across nutrition and health. In 2015, a research prioritisation exercise led by this group (as then, MAMI Special Interest Group) was conducted using the CHNRI methodology [5]. This was the first published research prioritisation exercise in this topic area. During this exercise, 64 experts scored 60 research questions on the basis of their answerability, likelihood of intervention efficacy, effectiveness, deliverability, sustainability, impact on disease burden, and impact on equity to identify the top research priorities for MAMI (see Table 2). This exercise did not focus on emergency settings specifically, but rather identified fundamental questions on how best to support small and nutritionally at-risk infants under six months of age and their mother's that are applicable to any context.

**Table 2: Top ten research questions identified through the MAMI research prioritisation exercise (2015)**

Research question
1. How should infant <6m with wasting* be defined?
2. What are/is the key opportunities/timing when infant wasting management can be incorporated with other healthcare programmes?
3. What are the priority components of a package of care for outpatient treatment of wasted infant?
4. Having detected wasting in the community, what is the efficacy of providing targeted skilled breastfeeding support to caregivers of stable infants?
5. How can existing tools be adapted and/or linked together to better identify and manage wasted infants <6m?
6. What are the most feasible tools and techniques for assessing treatment programme coverage for wasted infants <6m?
7. What is the feasibility, effectiveness, cost-effectiveness and impact of different approaches to promote early initiation and exclusivity of breastfeeding?
8. What are the main barriers to existing inpatient interventions for wasted infants <6m and how might they be best addressed?
9. What is the effectiveness, cost, and safety of an outpatient-focused treatment model for infants with wasting?
10. Which supervision tools and approaches are most effective towards improving the front-line case management of wasted infants <6m?

\* The term severe acute malnutrition was originally used during the CHNRI process but has been updated here to reflect recent views of the GTWG on this terminology.  
Under 6 months of age (<6m)

### **Published work to-date that has addressed priorities**

Recently, there has been increasing awareness and momentum to address the care of small and nutritionally at-risk infants under six months of age and their mothers, with significant developments in global policy (including WHO guidelines on wasting), practice (through pilot and small scale implementation of the MAMI Care Pathway Package,<sup>8</sup> an integrated adaptable resource to support implementation, developed by the MAMI Global Network) and research (secondary data analysis and increasingly, primary research). Research published on MAMI since 2015 identified by this exercise (not specific to but applicable to emergency settings) has primarily focused on three main topic areas (see Appendix 2):

#### ***1. How should infants under six months with wasting be defined?***

Most of the studies identified under this research question have examined which anthropometric measure is most effective at identifying infants at risk of death as well as the most optimal mid-upper-arm-circumference (MUAC) cut-off for this age group. Broadly these studies have found weight-for-age to be the best predictor of mortality, followed by a single-cut-off MUAC [19-25]. The most optimal MUAC cut-off for this age group appears to vary by context but is likely to be somewhere between 10.5 and 11.5cm [21-23, 26, 27]. Recognising the importance of non-anthropometric criteria for identifying at-risk infants, numerous studies have also analysed a broad range of risk factors for wasting in this age group (see Appendix 1). This exercise also identified one study that analysed whether measurements over time or a single anthropometric measurement is better at identifying low birth weight infants at risk of death. The study found that assessing weight gain since birth does not offer advantages over immediate anthropometry for discriminating mortality risk [28].

#### ***2. What are the priority components of a package of care for outpatient treatment of wasted infants under six months of age?***

Several studies have provided insights into what the priority components of a package of care for outpatient treatment of wasted infants under six months of age should be. These studies have examined breastfeeding support for wasted infants in an inpatient setting, kangaroo mother care (KMC), antimicrobial and micronutrient interventions and supplementary feeding (see Appendix 1). Several operational studies have captured learnings from implementing different versions of the MAMI Care Pathway. Studies in Ethiopia and Bangladesh [29] have shown early recovery of infants using the MAMI approach, and a multi-stakeholder analysis found that the MAMI Care Pathway is both needed and considered feasible to implement [30].

#### ***3. What is the feasibility, effectiveness, cost-effectiveness and impact of different approaches to promote the early initiation and exclusivity of breastfeeding?***

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<sup>8</sup> The MAMI Care Pathway is available at: <https://www.enonline.net/mamicarepathway>

Studies to date have examined the effect of implementing a variety of approaches to promote early and exclusive breastfeeding including: using multi-media products, training healthcare workers and traditional birth attendants, peer support, counselling, promotion, education, mass media and community campaigns, interventions targeting fathers, relaxation therapy or a combination of different approaches (see Appendix 1). Broadly these studies have found that key characteristics of successful interventions are that they are well structured, frequently delivered and involve key influencers in the community [31].

### **Remaining gaps and ongoing research**

Whilst there has been an increase in research focused on infants under six months of age since 2015, many key fundamental questions remain. Multiple stakeholders have identified the lack of a validated anthropometric screening method as a key barrier to programming in this age group [30]. While the current research base suggests that a combination of anthropometric and non-anthropometric indicators is likely to be most effective at identifying at-risk infants, the optimal combination of indicators for different contexts remains unknown. Based on the publicly available literature identified, more research is needed to understand how to effectively support at-risk mother-infant pairs once they have been identified, including how to leverage existing tools and programmes across nutrition and health systems. Ongoing research such as MAMI RISE, which will test the MAMI Care Pathway in a randomised control trial in two sites in Ethiopia, will contribute to the evidence base on the effectiveness of an outpatient-based treatment model for infants with growth faltering [32]. Still, more research is needed on how to adapt this approach in different contexts.

This exercise found no studies that answered the research questioned identified in 2015 on the efficacy of providing targeted skilled breastfeeding support to caregivers of stable infants when wasting has been detected in a community. However, many studies have identified the duration and exclusivity of breastfeeding as a risk factor for wasting in infants under six months of age. Whilst current guidelines for the management of at-risk infants and their mothers focus on feeding support, there is limited evidence for breastfeeding support for wasted infants in low and middle-income countries [33]; most research focuses on preventing growth faltering. Research on breastfeeding support packages has also generally focused on the effectiveness of interventions at improving breastfeeding practices, with large knowledge gaps remaining on the feasibility and cost-effectiveness of different approaches [34].

Several broader wasting prioritisation exercises have also identified the identification and management of small and nutritionally at-risk infants under six months of age and their mothers as a key research gap [7, 8]. Questions identified as priorities relate to: the impact and cost-effectiveness of interventions for managing at-risk mothers and infants less than six months of age; effective and safe strategies and protocols to support the scale-up of these interventions; the impact of poor growth during the first six months of life on the experience of wasting after six months of age; and how best to identify at-risk infants. Early identification and management of at-risk mother-infant dyads is critical to the prevention of wasting agenda as reflected in analyses by Mertens et al [35] and the MAMI Care Pathway approach. The nature of

the questions, for example, the how to identify, the impact and cost-effectiveness of managing at-risk infants and their mothers within existing systems of health and nutrition in different contexts, showcase the many practical and foundational questions that still exist about how best to support this vulnerable group.

Building on the work presented here, a more detailed MAMI research mapping exercise is near completion by the MAMI Global Network, led by ENN, to identify research underway and planned using contacts and networks of this active community of practice. The scope has been informed by consultation with WHO to help contribute to guideline development/update processes including potential for ‘living guidelines’ updates that react to emerging key research. This will inform next steps of the MAMI Global Network to strengthen harmonised and prioritised research that is designed to most usefully inform national and global decision-making for policy change and is operationally relevant in different contexts.

### Nutrition information systems (NIS)

#### Research priorities

NIS to inform nutrition in emergency programming is critical to identify needs and prioritise limited resources, show the effectiveness of responses or where responses may need to be improved or be modified. While progress has been made in strengthening NIS in emergencies, there is limited focus on how research from NIS are actually used to inform decision-making and improve responses. To our knowledge, there is no research prioritisation exercise in this area. To identify possible research priorities for NIS in emergencies, a non-systematic review was conducted (see questions identified in Appendix 3).<sup>9</sup> Members of the NIS GTWG then prioritised identified research questions and identified any other key research priorities not already captured. The top ten questions identified by the group are presented in Table 3.

**Table 3: Top ten research questions for NIS in emergencies ranked by GTWG members.**

Score*	Research question
4.7	How to design ‘good enough’ data collection systems where SMART surveys aren’t possible?
4.5	How to obtain accurate nutrition information in the absence of surveys such as SMART assessments, for example, during COVID-19?
4.2	How can mortality and malnutrition estimation be better contextualised across different contexts and countries?
4	How can we utilise innovations such as digital technologies to provide more accurate, timely and comprehensive nutrition data?
4	How can we use data on food systems to inform decisions that have an impact on nutrition in emergencies?

<sup>9</sup> Identified research gaps drew heavily on the diagnostic paper by Hailey P. et al: Hailey P, Dolan C, Shoham J, Leather C, Angood C, Sessions N. 2022. Nutrition information systems in fragile and conflict situations: A Diagnostic paper.

4	How can we improve coverage estimates of nutrition-specific and nutrition-sensitive interventions?
3.8	How can nutrition modelling tools be used to measure impact of interventions?
3.8	What methodology should be adopted when using data from the causes of malnutrition/ malnutrition determinants in burden calculations?
3.7	How can we improve publicly accessible integrated databases for nutrition?
3.7	What are the acute malnutrition thresholds for women and pregnant and lactating women (15-49 years of age)?

\* Survey participants were asked to rank research questions on a scale to 0 (not a priority) to 5 (the highest priority). The score shown is the average score.

Standardised Monitoring and Assessment of Relief and Transitions (SMART)

### Published work to-date that has addressed priorities

The NIS space has to date been made up of multiple NIS initiatives, activities, and stakeholders that operate locally, nationally and internationally. Recently efforts have focussed on strengthening and harmonising NIS in emergency settings to inform optimal programming and decision making. As part of such efforts, in 2021, UNICEF in partnership with the NIS GTWG, commissioned a diagnostic paper on the strengths and weaknesses of the current nutrition information ecosystem with a particular focus on NIS in fragile and conflict affected areas. This paper identified five issues across the data cycle process (see Box 1). While not research specific in nature, these issues highlight opportunities wherein research can be used to inform strategies to improve NIS.

#### Box 1: Issues across the data cycle process

1. The need to maximise coverage and availability of good enough estimates of nutrition status
2. Significantly improve the collection, collation, analysis and use of data on the determinants of nutritional status
3. Develop methods, tools, platforms and analytical frameworks to conduct more real time monitoring of changes in nutritional needs
4. Significantly increase the analytical capacity of NIS at national, regional and global level
5. Significantly improve the communication and dissemination capacity of NIS at all levels

As an immediate outcome of the diagnostic paper, a joint initiative between World Food Programme and UNICEF has been developed entitled 'Nutrition Vulnerability Assessment in Crises (NuVAC)', which aims to ensure predictable and reliable information on nutrition vulnerabilities in fragile and conflict affected areas for better and timelier decisions in humanitarian nutrition responses. Additionally, the Integrated Food Security Phase Classification (IPC) Acute Malnutrition Classification (AMN) has developed action plans to

strengthen elements of NIS.<sup>10</sup> UNICEF has developed guidance on strengthening NIS<sup>11</sup> although this is not limited to emergency contexts. Moreover, work continues in relation to exploring the strengthening of national level NIS and their analysis of data to enable effective design of multisector nutrition responses within the National Information Platforms for Nutrition (NiPN) initiative.

The NIS GTWG has already identified the need to address some of these gaps as articulated in their 2022 and 2023 workplan, which included activities such as (but not limited too), the development of guidance to assess nutrition programme data quality, the development of guidance for the collection of qualitative nutrition data for rapid assessments, mapping of existing data collection methodologies used in situations where there is no physical access and developing guidance and tools for such cases. Another initiative supported by the NIS GTWG is the Risk Monitoring Framework which identifies selected indicators to provide advance warning of potential nutrition deterioration. This framework is being implemented in Yemen, with hopes to scale up elsewhere. This initiative addresses questions around how to use data to inform more effective decision-making and is an example of collaboration between multiple United Nations agencies.

### **Remaining gaps and ongoing research**

As shown this review has found limited research to date on NIS in emergencies with more work focusing on the development of specific initiatives, tools and platforms. This reflects the need for more operational research and resources to enable guidance to be developed as opposed to more traditional forms of research for evidence generation.

NIS GTWG members prioritised through an online survey research questions for NIS in emergencies identified through a non-systematic review of the literature (see Table 3). However, despite efforts to obtain feedback, only six members completed the survey. Therefore, the research questions identified do not reflect the views of the whole group but rather a select group of individuals. Furthermore, these individuals are globally focused and thus these questions may not be priority questions for all contexts. There was high heterogeneity across respondents. The top two research questions were around how to obtain accurate nutrition information and the design of 'good enough' data collection systems where standard data collection mechanisms aren't possible. Inaccessibility to target populations is a common challenge in emergency settings, which was made more prominent during the COVID-19 pandemic when many countries suspended data collection and nutrition surveys. The pandemic highlighted our current dependency on repeated one-off surveys and the lack of robust routine data collection systems. Additional questions suggested by respondents as priority areas of research included:

1. Research on combined global acute malnutrition thresholds.
2. What is the best tool to identify acute malnutrition among pregnant and lactating women?

<sup>10</sup> Not yet publically available. More information can be found here: <https://www.ipcinfo.org/ipc-country-analysis/en/?maptype=77108>

<sup>11</sup> <https://data.unicef.org/resources/strengthening-nutrition-information-systems>

## Cash and Voucher Assistance (CVA) for nutrition outcomes

### Research priorities

Despite the increasing utilisation of CVA as a modality for humanitarian assistance, there has been limited investment in evidence generation from programmes using CVA for nutrition in emergencies [6]. This is partly due to the bulk of the evidence for CVA for nutrition being from development contexts. Furthermore, programmes that are implemented in emergency settings, often do not have specific nutrition objectives, leading to nutrition outcomes not being systematically measured [6]. Members of the GTWG on CVA for nutrition outcomes were asked to prioritise research questions identified in consultation with GTWG chairs, building on the “Evidence and guidance note on the use of cash and voucher assistance for nutrition outcomes in emergencies” (published in 2020) and other recent systematic reviews (see Appendix 4). The top ten questions identified by the group are presented in Table 4.

**Table 4: Top ten research questions for CVA for nutrition outcomes ranked by GTWG members.**

Score*	Research question
3.7	How does timing, frequency, duration, transfer amount, and choice of recipient of CVA impact on nutrition outcomes?
3.7	What is the comparative cost effectiveness of the different assistance modalities and the same modality with different intervention design (i.e., different transfer values, durations etc.) for preventing malnutrition?
3.7	What are the most promising combinations of cash, voucher and in-kind assistance to prevent malnutrition in different contexts? What are the impact pathways? What modalities are more adequate for the individual feeding component? Are there any differences when targeting young children or pregnant and lactating women and girls?
3.5	What are the differences in maternal and child nutrition status impact over the 1000 days when using soft conditionality (i.e., participants are expected to fulfil a certain condition, but in case of non-compliance, there is a follow-up and encouragement to fulfil the conditionality) vs hard conditionality (i.e., the assistance is tied to the fulfilment of a certain condition) vs no conditionality for participation in social behaviour change activities or attendance to priority health services?
3.5	What factors determine CVA recipient’s decision-making for use of the transfer and how does this decision influence maternal and child nutritional status?
3.4	Is there a risk in providing an incentive to caregivers to keep or make their children malnourished by providing household cash transfers to the caregivers of severely wasted children? If yes, what extent might this risk be context specific, for example based on social and cultural factors and can the risk be reduced through modality and design decisions? Is this risk any different to providing in-kind nutrition support as part of Community-based Management of Acute Malnutrition programming?

3.4	What is the impact of CVA on IYCF practices, particularly breastfeeding and to what extent is CVA used to buy breastmilk substitutes?
3.4	What are the specific impacts and pathways conferred by complementary interventions (single and combinations of interventions) to CVA and what are the contexts in which complementary interventions are required to prevent or reduce the risk of developing malnutrition?
3.3	What is the impact of CVA for nutrition outcomes on gender dynamics and decision-making power in the household?
3.3	What is the impact of CVA with or without social behaviour change activities on maternal and childcare practices, particularly on feeding practices and psychosocial care for children?
3.2	What is the impact of CVA on the different types of malnutrition i.e., stunting, wasting, micronutrient deficiencies overweight and obesity?

\* Survey participants were asked to rank research questions on a scale to 0 (not a priority) to 5 (the highest priority). The score shown is the average score.

Cash and voucher assistance (CVA); infant and young child feeding (IYCF)

### Published work to-date that has addressed priorities

Most of the evidence for CVA for nutrition outcomes is from development contexts and appears to be for the impact of CVA on household food expenditure, utilisation of health services, gender-based violence and women's empowerment (see Appendix 5). Broadly, it shows that there is potential for cash to positively impact on all these outcomes [36-52]. The evidence-base for the positive impact of CVA on maternal and child dietary diversity is growing but less robust than that of household dietary diversity, which appears to show a consistently positive impact [37, 41, 44, 53-61]. Evidence for CVA impact for women's dietary diversity appears to be far more limited than that of child dietary diversity.

There have been a growing number of studies in recent years examining the impact of CVA on child nutritional status, especially the impact on child wasting and stunting. Still, the evidence is sparse for emergency settings. Evidence mostly shows a positive impact for CVA on stunting [38, 55, 61], however, evidence on wasting is mixed but increasingly promising [53, 55, 61-64], and there is inconsistent evidence for CVAs impact on children's micronutrient status [6]. Compared to children's nutritional status, there is a dearth of evidence on the impact of CVA on the nutritional status of women and adolescent girls, with the available studies showing mixed effects on anthropometric outcomes [55-58, 61, 65]

### Remaining gaps and ongoing research

Overall, twenty-one members of the CVA for nutrition outcomes GTWG completed the survey to identify and prioritise research questions for CVA in emergencies. Therefore, the research questions identified do not reflect the views of the whole group but rather a select group of individuals. Furthermore, these individuals are globally focused and thus these questions may not be priority questions for all contexts. Despite this, there was a high level of homogeneity among respondents; this may have been due to the low response rate or the research questions in the survey being developed from the "Evidence and guidance note on the use of



cash and voucher assistance for nutrition outcomes in emergencies” carried out by the group in 2020.

Several of the top identified research questions focus on understanding the impact pathways between CVA and nutrition outcomes (see Table 4). The impact pathways between CVA and nutrition outcomes are complex and context-specific, and while research has been conducted in this area drawing meaningful insights from the existing literature base is often difficult due to the wide range of programme designs, objectives and indicators used. Several priority questions also related to the practical questions around programme design and cost-effectiveness. Key questions remain regarding which combination of modalities to use in different contexts, the use of conditionality, complementary and social behaviour change interventions, the choice of recipient and the timing, frequency, duration, and transfer amount required to achieve desired outcomes. Other questions suggested by respondents as priority areas of research included:

1. How much the market functionality (availability and affordability of nutritious foods) affects the impacts that CVA can have on nutrition outcomes?
2. How does CVA effect caregiver’s autonomy and financial inclusion?
3. What are the unintended consequences of CVA for individuals?
4. How does CVA effect caregiver’s access to resources, which in turns enables better care practices?
5. What are the impact pathways between CVA and increased dietary diversity at individual and household level?
6. What are the impact pathways between CVA and malnutrition treatment outcomes?
7. How can livelihood activities be used to complement and in the long-term as a substitute for CVA?
8. Which social behaviour change approaches and interventions have been effective in promoting CVA for nutrition outcomes?

## Wasting

### Research priorities

There have been several research prioritisation exercises on the prevention and treatment of wasting, which is one of the most significant contributors to child mortality [66]. In-mid 2017, CORTASAM<sup>12</sup> led the implementation of a global research prioritisation exercise for wasting treatment [67]. Over 300 individuals from 63 countries and 167 organisations participated in a survey to identify key research areas. Building on this exercise, CORTASAM identified seven topic areas with the highest potential impact towards the effective scale-up of wasting treatment by 2020 (see Appendix 6). In 2021, CORTASAM produced recommendations for further research under each of the seven topic areas identified in 2017 (see Appendix 6), which were made based on a landscape review of complete, ongoing and planned research [68].

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<sup>12</sup> The No Wasted Lives Coalition was formed in 2016 to accelerate the scale-up of effective prevention and treatment of acute malnutrition. The Council of Research & Technical Advice on Acute Malnutrition (CORTASAM) is an independent group of experts that provide technical guidance to No Wasted Lives.

The latest research prioritisation exercise on wasting treatment was conducted by 2021 [8]. The top ten research questions for wasting treatment were identified (see Table 5) using the CHNRI methodology. A total of 53 research areas, identified through a non-systematic review and in consultation with members of the No Wasted Lives Coalition, CORTASAM, and other regional and country-level stakeholders', were scored by 394 individuals. The questions were scored on impact, effectiveness, answerability and suitability.

Similarly in 2020, a research prioritisation exercise was conducted on the prevention of wasting using the CHNRI methodology (see Table 5) [7]. The exercise focused on research that could produce results in five years for children 0-59 months living in low and middle-income countries. The group took a broad view of wasting, considering the prevention of any degree of wasting and/or worsening in its severity. A total of 40 questions, identified through a review of available literature and consultation with a group of experts, were scored by 146 individuals. The questions were scored on answerability, efficiency, deliverability and whether the question fills a knowledge gap required to prevent wasting. Another key resource is the State of Acute Malnutrition Research Landscape, an interactive diagram that maps ongoing and recently completed research on wasting.<sup>13</sup>

Across the 2020 research prioritisation exercise on wasting prevention and 2021 exercise on wasting treatment, identified research questions fall into four main categories: Impact/effectiveness of interventions for the treatment and prevention of wasting; improving detection/targeting for prevention and treatment of wasting; the causal pathway for wasting; and integration of treatment and prevention of wasting into health systems (see Table 5).

**Table 5: Top research questions on wasting prevention and treatment identified in the 2020 and 2021 research prioritisation exercises respectively**

**1. Impact/effectiveness of interventions for the treatment and prevention of wasting**

What is the impact of interventions for managing at-risk mothers and infants less than six months of age in preventing wasting in infants under six months of age?

What are effective and safe strategies and protocols to support the scale-up of treatment of acute malnutrition in infants under six months of age?

What are effective and safe strategies and protocols to support the scale-up of treatment of acute malnutrition in infants under six months of age?

What are effective therapeutic feeding approaches for the management of severe acute malnutrition in children who are 6-59 months of age with diarrhoea?

What are the optimum entry and discharge criteria for treatment of acute malnutrition to ensure optimum outcomes?

What impact can effective wasting prevention interventions/approaches have on levels of stunting (and concurrent wasting and stunting) and vice versa?

<sup>13</sup> State of Acute Malnutrition Research Landscape is available at: <https://acutemalnutrition.org/en/research-landscape>

What is the impact IYCF in addition to the standard treatment of acute malnutrition and how do treatment programs impact individual and community IYCF practices?

Are there safe alternative formulations of RUTF for the treatment of uncomplicated severe acute malnutrition in children that use locally available ingredients and improve the cost-effectiveness of treatment?

What are effective interventions and operational models to reduce mortality risk after treatment?

## 2. Improving detection/targeting for prevention and treatment of wasting

What are effective and cost-effective approaches to target the highest risk infants and children 0–59 months (e.g. children with concurrent wasting and stunting, children under 24 months, etc.) for interventions (food or non-food) to prevent wasting?

What measures (anthropometric or non-anthropometric) or combinations of measures best identify individual infants and children (0–59 months) by age/sex at most risk of death/other adverse outcomes associated with wasting?

What measures (anthropometric or non-anthropometric) or combinations of measures best identify individual infants and children (6–59 months) by age/sex at most risk of death/other adverse outcomes associated with wasting?

What are the most effective tools to diagnose acute malnutrition by community members, including community health workers and caretakers?

How effective are tools for community-based detection and improving treatment-seeking behaviour across different geographies and contexts?

## 3. The causal pathway for wasting

What is the impact of growth failure during the first six months of life on experience of wasting after six months of age?

What are the causal factors of relapse after treatment of acute malnutrition and how can they be minimised?

What is the relationship between the nutrition and health of mothers and acute malnutrition in their children and how can interventions within and beyond the 1,000 day window reduce the risk of acute malnutrition?

What is the role of pre-pregnancy maternal factors (age, health status, nutritional deficits, psychological factors etc.) in determining risk of being born with a low birth weight, low weight-for-length, low MUAC, premature or small for gestational age?

How does being born prematurely and/or with foetal growth restriction impact on wasting at birth and throughout the first five years of life, by sex?

## 4. Integration of treatment and prevention of wasting into health system

How can existing interventions (e.g. growth monitoring, integrated management of childhood illness) better detect and support children (0–59 months) who are failing to thrive/faltering (i.e. those at-risk, not just those already below a z-score threshold)?

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What are effective and cost-effective approaches to integrating wasting prevention efforts into health systems (i.e. human resource capacity, financing, supplies and supply chain, etc)?

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Mid-upper-arm circumference (MUAC); infant and young child feeding (IYCF); ready to use therapeutic food (RUTF)

### **Published work to-date that has addressed priorities**

There has been a lot of research conducted on wasting. This section highlights some of the key work to date which has addressed identified research priorities but does not capture all relevant literature due to the light touch nature of this exercise. Several studies have contributed to answering the identified research questions on the prevention and treatment of wasting. Regarding what is the impact of growth faltering during the first six months of life on experience of wasting after six months of age, evidence from South Asia and sub-Saharan Africa has shown that being wasted during the first six months of life leads to an increased risk of subsequent wasting during later childhood [69, 70]. Research has also started to answer questions around the impact of in-utero growth restrictions and prematurity on wasting and the role of pre-pregnancy maternal factors on birth outcomes. Several research studies have demonstrated that child size and gestational age are strong risk factors for growth faltering in later infancy [35, 71-73]. Short maternal stature has also been shown to be a risk factor for low birth weight, preterm birth and small for gestational age [35, 74, 75].

Preconception nutrition interventions have been shown to improve foetal growth and reduce nutrition deficits in early infancy in South Asia [76]. During pregnancy, there is growing evidence that when given to undernourished women, balanced protein energy supplements can reduce wasting at birth [77-79]. There is also strong evidence that multiple micronutrient supplements can improve birth outcomes including weight [80]. For the impact of interventions on managing at-risk mothers and infants less than six months of age, there has been a growing number of studies, including operational research on the MAMI Care Pathway and a growing body of evidence on the criteria to identify at risk infants (see section on MAMI).

There has been a recent increase in research to test the called “simplified approaches”,<sup>14</sup> with differing results depending on the topic explored. These encompass expanded admission and discharge criteria to include moderate wasting, reduce frequency of follow-up visits, the use of MUAC and oedema only for admission and discharge, reduced dosage of ready-to-use therapeutic food (RUTF), the treatment of moderate and severe wasting with one product and the involvement of community health workers in wasting management to help streamline services, improve access to treatment for high risk moderate cases, and support continuity of care to discharge [81-84].

Our brief review also found several studies on relapse, alternative RUTF formulations and fluid management in severely wasted children. Two recent systematic reviews summarised the evidence on relapse and long-term outcomes after treatment for severe wasting [85, 86]. A systematic review evaluated 15 studies in alternative RUTF formulation and found that when

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<sup>14</sup> More information on simplified approaches available at: <https://www.simplifiedapproaches.org/>

comparing RUTFs with different formulations, the current evidence does not favour a particular formulation, except for relapse, which is reduced with standard RUTF. Recent reviews of fluid management in severely wasted children found that some studies suggest that global oral and IV rehydration guidelines may be inappropriate and potentially harmful [87].

### **Remaining gaps and ongoing research**

While there has been a lot of research on wasting (though less on wasting prevention), there are several key areas requiring further research as identified in recent prioritisation exercises (see Table 5) and highlighted in the CORTASAM 2021 landscape review (see Appendix 6). One key theme across the research prioritisation exercises is the need to understand the characteristics of children at highest risk of death or adverse outcomes associated with wasting in different contexts to aid early detection and treatment. Pooled data analysis to understand which anthropometric diagnostic criteria best discriminate higher from lower risk of death in children has been published in 2023 [88] and a pooled data analysis led by the WHO is also currently investigating what anthropometric and non-anthropometric criteria identifies highest risk children.

Across both wasting prevention and treatment the need for more research on the identification and management of small and nutritionally at-risk infants under six months of age was identified. More research is needed in this age group to improve child survival, avoid deterioration, and reduce the risk of wasting in later life. Research on the relationship between the nutrition/health of the mother and infant/child wasting is highlighted across research prioritisation exercises. Preconception nutrition remains a neglected area of both research and programming. In addition, in the Guidelines' review process undertaken by WHO in 2020-2022, a number of research gaps were identified based on the PICO (Population, Intervention, Comparison, Outcome) questions that were reviewed by the Guidelines Development Group (GDG) members (see Box 2).

### **Box 2: WHO Wasting Guidelines Development Process**

The WHO Wasting Guideline Development Process was started in 2020, and aims to provide guidance on the four following topic areas:

1. Poor growth and development in infants under six months of age
2. Severe wasting and oedema in children aged six months and older
3. Moderate wasting in children aged six months and older
4. Prevention of wasting

As a first step in the guideline development process scoping reviews were conducted in each of these topic areas, which informed the development of key research questions. Systematic reviews were then conducted, with evidence generated from these reviews informing guideline development as well as identifying key evidence gaps. Consultations to generate recommendations by the independent Guideline Development Group convened by WHO will take place through the first half of 2023. Guideline release is anticipated mid-2023. For more information on scheduling and process see:

<https://www.childwasting.org/normative-guidance>

The UNICEF-WHO Technical Advisory Group on wasting,<sup>15</sup> a multi-disciplinary group of healthcare workers, policymakers, programmers and researchers, has been established in 2022 to conduct various tasks including coordinating the wasting-related research agenda. Building on the research gaps identified in the guideline development process and existing research prioritisation exercises, this group aims to identify and prioritise formative and operational research and knowledge gaps on wasting prevention and treatment.

### **Discussion**

Nutrition in emergency research is critical to improve response preparedness and recovery, programme implementation and cost-effectiveness during emergencies. This report aims to summarise and highlight key research gaps in child wasting, IYCF-E, MAMI, NIS and CVA for nutrition. The focus on nutrition in emergency research has increased, with the 2022 ELRHA review [89] finding that the number of nutrition articles published in the past eight years is just under half the total number of articles included in the 2015 review, which spanned a 32-year period. However, knowledge gaps remain, with a lack in the number and quality of research studies available.

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<sup>15</sup> See more information at: <https://www.who.int/news-room/articles-detail/call-for-experts-who-unicef-technical-advisory-group-on-wasting>

This report finds in particular a sparsity of evidence for MAMI, NIS and CVA for nutrition outcomes in emergency contexts. The 2022 ELRHA review [89], identified CVA as a key priority area for nutrition in emergency research, given the rapidly increasing use of CVA in most humanitarian responses. In addition, the review identified the need for more research on interventions to improve breastfeeding, breastmilk substitutes, re-lactation, complementary feeding strategies, nutrition education, and grouped and multi-sectoral interventions. Wasting remains the most prominent topic for nutrition in emergency research, with this exercise also highlighting a lot of ongoing work on updating the wasting research agenda. The focus on wasting has been identified as a possible barrier to research in other thematic areas as well as an opportunity to explore synergies, such as those linked to stunting prevention, and to leverage ongoing initiatives.

A challenge for all research studies including those conducted in emergency settings is ensuring high-quality data. Conducting research in nutrition emergencies is challenging due to logistical obstacles, ethical barriers, challenges in data collection, a lack of funding and flexibility in funding that is available. This was highlighted in the recent ELHRA review wherein the majority of research papers analysed were observational, limiting their ability to affect change in guidance and policy. However, the review highlighted in many cases that improvements in reporting alongside the utilisation of standardised methodologies and definitions could make research more impactful in terms of both the utility of findings and the inclusion of information necessary for replicating successful interventions.

Another challenge for nutrition in emergency research is the level of quality that agencies and governments currently require to inform and shift guidance and programming and the dependence on systematic reviews for which there is increasing recognition of their limitations [90]. This issue is illustrated by the relatively strict criteria of inclusion for research that is needed by systematic reviews such as Cochrane and the subsequent updates to health and nutrition programme guidelines led by WHO. This means that, for example, WHO's ongoing guideline development process for the prevention and treatment of wasting cannot draw on important insights from the large body of observational and non-randomised studies published on wasting. Another consideration is that, shifting implementation during emergencies is often informed by the needs and available resources on the ground rather than optimal research. This has been seen in the implementation of some of the simplified approaches whereby some countries and non-governmental organisations are implementing such approaches despite the evidence base remaining fairly limited. The question is what level of evidence is 'good enough' to shift implementation remains across all thematic areas. Similarly, there remain opportunities for evidence generation to 'catch up' with programme implementation. This can be further facilitated by embedding operational research elements and strong monitoring, process and outcome measures to build evidence whilst 'doing'.

This report finds that the prioritisation of research gaps needs to be better articulated and more visible to researchers looking to conduct research in emergencies. At times research conducted does not speak to the priorities for research that have been identified. For example, this report found only 19% of peer-reviewed studies conducted in IFE in 2022 contributed to answering

research priorities previously identified. This may reflect the need for further advocacy and dissemination of identified research priorities and/or a re-visit or broadening of these research priorities. When identifying research priorities for emergency contexts a key consideration is what can't be answered through research in more stable contexts, and what type of research is needed to answer these questions. This report finds that for many topic areas, many practical questions remain regarding intervention design, cost-effectiveness and feasibility. Moving forward it will be critical to ensure that study designs enable data generation to answer such questions.

### Limitations

Whilst this exercise identifies many evidence gaps, it does not reflect an absolute gap. This exercise is not a systematic review of all literature, but rather a light touch mapping that builds upon a broad range of existing work and the knowledge of the GTWGs. It uses a variety of different methods, such as relatively small-scale non-systematic reviews and surveys, to identify research priorities across the thematic areas. The flexibility in methodology used to identify research priorities has allowed this exercise to adapt to the different levels of work on identifying research gaps and priorities in the thematic areas. The report draws upon publicly available resources, therefore research that is currently ongoing is not captured. This exercise looks at research priorities identified at a global level and does not account for country and regional drivers of research priorities and national evidence needs. This may account for some of the disparities seen between the research priorities identified and research conducted and captured in this report. Finally, this exercise does not investigate why research in emergencies has not taken place, an important next step to further contextualise the findings of this report.

### **Conclusion**

Given the scale of continued nutritional needs, a continued focus on research in emergency contexts is vital. We need to continue to build evidence of what works to maximise impact and to ensure resources are most effectively and efficiently delivered. In 2021 the Global Humanitarian Overview estimated that 274 million people would require humanitarian assistance in 2022. This number significantly increased from the 235 million people in the previous year, which was already the highest figure in decades. With such a high burden and scarce resources, it's essential that we can demonstrate the long-term impact and cost-effectiveness of nutrition in emergency programming and enable a better, more evidence-based response that maximises impact for affected populations. Across thematic areas, further investment is needed to strengthen the quality and breadth of nutrition in emergency research. Consensus on the most important gaps need to be better articulated by practitioners and be more visible to researchers looking to conduct research in emergency settings.



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## Appendix

[Appendix 1: Research compiled by compiled for the IFE Core Group by the Johns Hopkins Center for Humanitarian Health at Johns Hopkins Bloomberg School of Public Health, the Friedman School of Nutrition Science and Policy at Tufts University and the Gillings School of Global Public Health at the University of North Carolina at Chapel Hill mapped against the top ten research question identified in the 2015 CHNRI](#)

Date published	Journal article	Associated research priority
20-sep-22	Demirhan İI, Peksoy Kaya S, Sahin S, Kaplan S. Syrian refugee women’s breastfeeding behaviors and use of contraceptive methods: a qualitative study. <i>Women &amp; Health</i> . 2022:1-9.	NA
1-Sep-22	Cetthakrikul N, Kelly M, Baker P, Banwell C, Smith J. Effect of baby food marketing exposure on infant and young child feeding regimes in Bangkok, Thailand. <i>Int Breastfeed J</i> . 2022;17(1):64. Published 2022 Sep 1. doi:10.1186/s13 006-022-00503-7	NA
1-Sep-22	Doherty T, Engebretsen IMS, Tylleskär T, et al. Questioning the ethics of international research on formula milk supplementation in low-income African countries. <i>BMJ Glob Health</i> . 2022;7(5):e0091 81.	NA
30-Aug-22	Hodgins M, Ostojic K, Hu N, et al. Study protocol for a real-world evaluation of an integrated child and family health hub for migrant and refugee women. <i>BMJ Open</i> . 2022;12(8):e061 002. doi:10.1136/bmj open-2022061002	How to effectively link and mainstream IYCF-E interventions with other sectors such as health, WASH, food security and child protection?
		How to provide effective psychosocial support to caregivers of infants and young children in different contexts e.g., presence or absence of qualified staff?
26-Aug-22	Magnazi MB, Sartena G, Goldberg M, et al. Impact of the COVID-19 pandemic on breastfeeding in Israel: a cross- sectional, observational survey. <i>Int Breastfeed J</i> . 2022;17(1):61. Published 2022 Aug 26. doi:10.1186/s13 006-022-00505-5	NA
18_Aug-22	Evans J, Bansal A, Schoenaker DAJM, et al. Birth Outcomes, Health, and Health Care Needs of Childbearing Women following Wildfire Disasters: An Integrative, State-of-theScience Review. <i>Environ Health Perspect</i> . 2022;130(8):860 01. doi:10.1289/EHP10544	NA
11-Aug-22	Szczygiół P, Łukianowski B, Kościelska- Kasprzak K, et al. Antibodies in the breastmilk of COVID-19 recovered women. <i>BMC Pregnancy</i>	NA

	Childbirth. 2022;22(1):635. Published 2022 Aug 11. doi:10.1186/s12884-022-04945-z	
4-Aug-22	Becker GE, Ching C, Nguyen TT, Cashin J, Zambrano P, Mathisen R. Babies before business: protecting the integrity of health professionals from institutional conflict of interest. <i>BMJ Glob Health.</i> 2022;7(8):e009640. doi:10.1136/bmj_gh-2022-009640	NA
21-Jul-22	Gray H, Zakarija-Grković I, Cattaneo A, et al. Infant feeding policies and monitoring systems: A qualitative study of European countries. <i>Maternal &amp; Child Nutrition.</i> July 2022:1-12. doi:10.1111/mcn.13425	NA
18-Jul-22	Nakstad B, Filippi V, Lusambili A, et al. How Climate Change May Threaten Progress in Neonatal Health in the African Region. <i>Neonatology.</i> doi:10.1159/000525573	NA
28-Jun-22	Okinarum GY, Rochdiat W. Breastfeeding Experience During COVID-19 Pandemic in Indonesia: Strengthening and Weakening Elements. <i>Malays J Med Sci.</i> 2022;29(3):110121. doi:10.21315/mj_ms2022.29.3.11	NA
15-Jun-22	Giusti A, Marchetti F, Zambri F, Pro E, Brillo E, & Colaceci S (2022, June 15). Breastfeeding and humanitarian emergencies: The experiences of pregnant and lactating women during the earthquake in Abruzzo, Italy - <i>International Breastfeeding Journal.</i> BioMed Central. doi.org/10.1186/s13006-02200483-8	NA
31-May-22	Astuti A, Hayati H, Waluyanti FT, Wanda D. Local wisdom enriching complementary feeding practices during disaster situations in Indonesia. <i>Kesmas: Jurnal Kesehatan Masyarakat Nasional (National Public Health Journal).</i> 2022;17(2). <a href="https://journal.fkm.ui.ac.id/kesmas/article/view/5452">https://journal.fkm.ui.ac.id/kesmas/article/view/5452</a> . doi:10.21109/kesmas.v17i2.5452	The effectiveness and cost effectiveness of different complementary feeding interventions, per say and comparatively i.e., distribution of different food supplements, such as blended foods, ready to use foods, micronutrient powders; fresh foods; cash transfers; and voucher assistance in different contexts, on IYCF-E practises, nutritional status and morbidity?
26-May-22	DeYoung SE, Jackson V, Callands TA. Maternal stress and social support during Hurricane Florence [published online ahead of print, 2022 May 26]. <i>Health Care Women Int.</i> 2022;1-18. doi:10.1080/07399332.2022.2046750	NA
14-May-22	Daher S, Ziade F, Nasreddine L, Baroudi M, Naja F. Breastfeeding and complementary feeding in fragile settings: The case of Syrian refugees and their host communities in north Lebanon. <i>International</i>	NA

	breastfeeding journal. 2022;17(1):1-37. Dio:10.1186/s13006-022-00480-x	
15-Apr-22	Esan DT, Adegbilero-Iwari OE, Hussaini A, Adetunji AJ. Complementary feeding pattern and its determinants among mothers in selected primary health centers in the urban metropolis of Ekiti State, Nigeria. <i>Scientific reports</i> , 12(1), 6252. 2022. doi.org/10.1038/ s41598-02210308-7	NA
25-Mar-22	Irenso AA, Letta S, Chemedas AS, et al. Maternal Time Use Drives Suboptimal Complementary Feeding Practices in the El Niño Affected Eastern Ethiopia Community. <i>Int J Environ Res Public Health</i> . 2022;19(7):3937. Published 2022 Mar 25. doi:10.3390/ijerph19073937	NA
21-Mar-22	Becker GE, Zambrano P, Ching C, et al. Global evidence of persistent violations of the International Code of Marketing of Breast-milk Substitutes: A systematic scoping review. <i>Maternal &amp; Child Nutrition</i> . 2022. doi.org/10.1111/ mcn.13335	NA
16-Mar-22	Beyene T, Zosky G, Gibson P, McDonald V, Holliday E, Horvat J, Vertigan A, Van Buskirk J, Morgan G, Jegasothy A, Hanigan I, Murphy V, Jensen M. Environmental contaminants in breast milk during the 2019/2020 bushfire period. <i>Respirology</i> .2022;27(Suppl. 1):20– 87. Published 16 2022 March. doi/10.1111/res p.14216	NA
10-Mar-22	Campbell F, Booth A, Carroll C, Lee A, Relton C. Qualitative evidence syntheses of attitudes and preferences to inform guidelines on infant feeding in the context of Ebola Virus Disease (EVD) transmission risk. <i>PLOS Neglected Tropical Diseases</i> . 2022;16(3):e001 0080. doi.org/10.1371/ journal.pntd.0010080	NA
7-Mar-22	Tikvica Luetic A, Habek D, Spoljar P, et al. Mothers' anxiety to aggravated acute fear of earthquakes in the city of Zagreb in the Covid 19 pandemic. <i>PSYCHIATRIA</i>	How to provide effective psychosocial support to caregivers of infants and young children in different contexts, e.g., presence or absence of qualified staff?
28-Feb-2	Fahmida U, Hidayat AT, Oka AASI et al. Effectiveness of an Integrated Nutrition Rehabilitation on Growth and Development of Children under Five Post 2018 Earthquake in East Lombok, Indonesia. <i>Int J Environ Res Public Health</i> . 2022;19(5):2814.	The effectiveness and cost effectiveness of different complementary feeding interventions, per say and comparatively i.e., distribution of different food supplements, such as blended foods, ready to use foods, micronutrient powders; fresh foods; cash transfers; and voucher assistance in different contexts, on IYCF-E practises, nutritional status and morbidity?



		How to effectively link and mainstream IYCF-E interventions with other sectors such as health, WASH, food security and child protection?
23-Feb-22	Calderon C, Pedrogo Y, Huerta-Montañez G, et al. Pediatrician's Leadership Role: Evaluation of the Needs of Children and Mitigation After Disasters. <i>Pediatrics</i> February 2022; 149 (1 Meeting Abstracts February 2022): 23.	How to provide effective psychosocial support to caregivers of infants and young children in different contexts, e.g., presence or absence of qualified staff?
23-Feb-22	Piovanetti Y, Calderon C, Budet Z, et al. 2022. Breastfeeding, a Vital Response in Emergencies. <i>Pediatrics</i> .	How to effectively link and mainstream IYCF-E interventions with other sectors such as health, WASH, food security and child protection?
14-Feb-22	Yalçın SS, Erat Nergiz M, Elci ÖC, et al. Breastfeeding practice among Syrian refugees in Turkey. <i>Int Breastfeed J.</i> 2022;17(1):10. Published 2022 Feb 14. doi:10.1186/s13 006-022-00450-3	NA
6-Feb-22	Sabeeh HK, Ali SH, Al-Jawaldeh A. Iraq Is Moving Forward to Achieve Global Targets in Nutrition. <i>Children.</i> 2022;9(2):215. doi.org/10.3390/ children9020215	NA
1-Feb-22	Igwe D, Oshun P, Osuagwu C, Efunshile A, Oduyebo O. Prevalence and risk factors of acute gastroenteritis caused by Rotavirus among children in tertiary hospitals, southeastern Nigeria. <i>African Journal of Clinical and Experimental Microbiology.</i> 2022;23(1):8388. doi:10.4314/ajce m.v23i1.11	NA
1-Feb-22	Adeoya AA, Sasaki H, Fuda M, Okamoto T, Egawa S. Child Nutrition in Disaster: A Scoping Review. <i>The Tohoku Journal of Experimental Medicine.</i> 2022;256(2):103118. doi.org/10.1620/ tjem.256.103	NA
26-Jan-22	Tadele TT, Gebremedhin CC, Markos MU, & Fitsum EL. (2022). Stunting and associated factors among 623-month-old children in drought vulnerable kebeles of Demba Gofa district, southern Ethiopia. <i>BMC Nutrition,</i> 8 (1), 9. doi: 10.1186/s40795022-00501-2	NA
25-Jan-22	Nisbet C, Lestrat KE, Vatanparast H. Food Security Interventions among Refugees around the Globe: A Scoping Review. <i>Nutrient s.</i> 2022;14(3):522. Published 2022 Jan 25. doi:10.3390/nu1 4030522	How to effectively link and mainstream IYCF-E interventions with other sectors such as health, WASH, food security and child protection?
18-Jan-22	Nahalomo A, Iversen PO, Andreassen BA, et al. Malnutrition and Associated Risk Factors among	NA

	Children 6-59 Months Old in the Landslideprone Bududa District, Eastern Uganda: A Cohort Study. <i>Current Developments in Nutrition</i> . 2022; doi.org/10.1093/cdn/nzac005	
7-Jan-22	Farzana FD, Choudhury N, Haque MA, et al. Type of terrain and infant and young child feeding practices: cross-sectional study findings on children below 2 years of age from northern Bangladesh. <i>BMJ Open</i> . 2022;12(2):e056 593. Published 2022 Feb 8. doi:10.1136/bmj open-2021056593	NA
5-Jan-22	Mudiyanselage SR, Davis D, Kurz E, Atchan M. Infant and young child feeding during natural disasters: A systematic integrative literature review. <i>Women and Birth</i> . 2022;doi.org/10.1016/j.wombi.2021.12.006	NA
4-Jan-22	Iliyasu Z, Galadanci HS, Musa AH, et al. HIV self-testing and repeat testing in pregnancy and postpartum in Northern Nigeria. <i>Trop Med Int Health</i> . 2022;27(1):110119. doi:10.1111/tmi. 13705	NA
1-Jan-22	Gribble KD, Palmquist AEL. "We make a mistake with shoes [that's no problem] but... not with baby milk": Facilitators of good and poor practice in distribution of infant formula in the 2014-2016 refugee crisis in Europe. <i>Matern Child Nutr</i> . 2022;18(1):e132 82. doi:10.1111/mcn.13282	NA
1-Jan-22	Woldetsadik D, Llorent-Martínez EJ, Gebrezgabher S, et al. Okra ( <i>Abelmoschus esculentus</i> ) in a refugee context in East Africa: Kitchen gardening helps with mineral provision. <i>SN applied sciences</i> . 2022;4(1):1-19. doi.org/10.1007/s42452-02104898-6	NA
1-Jan-22	Kreif N, Mirelman A, Suhrcke M, Buitrago G, Moreno-Serra R. The impact of civil conflict on child health: Evidence from Colombia. <i>Economics &amp; Human Biology</i> . 2022;44:101074. doi.org/10.1016/j.ehb.2021.101074	NA

Appendix 2: Research on MAMI conducted since 2015 in relation to the top ten research question identified in the 2015 CHNRI

Top 10 research questions identified in 2015	Research conducted since 2015	
	Topic area	Reference
1. How should infant <6m with wasting* be defined?	Terminology	Emily Blake. Identification terminology for the Management of small and nutritionally At-risk Infants under 6 months and their Mothers (MAMI): A qualitative study. MSc project report. 2021. Available at: <a href="http://www.ennonline.net/identificationterminologyforthemangementofsmallandnutritionallyatriskinfantsmscprojectreport">www.ennonline.net/identificationterminologyforthemangementofsmallandnutritionallyatriskinfantsmscprojectreport</a>
	Risk factors for small and nutritionally at-risk infants <6m	Dadi, A.F. et al. Postnatal depression and its association with adverse infant health outcomes in low- and middle-income countries: a systematic review and meta-analysis. <i>BMC Pregnancy Childbirth</i> <b>20</b> , 416 (2020). <a href="https://doi.org/10.1186/s12884-020-03092-7">https://doi.org/10.1186/s12884-020-03092-7</a>
		Franck Garanet, Predicting Acute Malnutrition in Rural Twins Before Their Second Birthday: Cohort Study, <i>Current Developments in Nutrition</i> , Volume 4, Issue Supplement_2, June 2020, Page 1406, <a href="https://doi.org/10.1093/cdn/nzaa061_034">https://doi.org/10.1093/cdn/nzaa061_034</a>
		Mertens, A., et al., <i>Causes and consequences of child growth failure in low-and middle-income countries</i> . medRxiv, 2020.
		Kerac M, et al. Informing the management of acute malnutrition in infants aged under 6 months (MAMI): risk factor analysis using nationally-representative demographic & health survey secondary data. <i>PeerJ</i> . 2019 Apr 15;6:e5848. doi: 10.7717/peerj.5848. PMID: 31024756; PMCID: PMC6472469.
		Goldstein R.F, et al. Association of Gestational Weight Gain With Maternal and Infant Outcomes: A Systematic Review and Meta-analysis. <i>JAMA</i> . 2017 Jun 6;317(21):2207-2225. doi: 10.1001/jama.2017.3635. PMID: 28586887; PMCID: PMC5815056.
		Li X, et al. 2017. Association between ambient fine particulate matter and preterm birth or term low birth weight: An updated systematic review and meta-analysis. <i>Environ Pollut</i> . 2017 Aug;227:596-605. doi: 10.1016/j.envpol.2017.03.055. Epub 2017 Apr 28. PMID: 28457735.
		Surkan P.J, et al. Preventing infant and child morbidity and mortality due to maternal depression. <i>Best Pract Res Clin Obstet Gynaecol</i> . 2016 Oct;36:156-168. doi: 10.1016/j.bpobgyn.2016.05.007. Epub 2016 Jun 24. PMID: 27422745.
		Munirul Islam, et al. Severe malnutrition in infants aged <6 months—Outcomes and risk factors in Bangladesh: A prospective cohort study. <i>Matern Child Nutr</i> . 2019; 15:e12642. <a href="https://doi.org/10.1111/mcn.12642">https://doi.org/10.1111/mcn.12642</a>
		Jain N, et al. To study risk factor and clinical profile of severe malnutrition in children below 6 months of age. <i>European Journal of Molecular &amp; Clinical Medicine</i> , 2022; 9(3): 12174-12179.

	Anthropometric criteria	Hoehn C et al. Anthropometric Criteria for Identifying Infants Under 6 Months of Age at Risk of Morbidity and Mortality: A Systematic Review. <i>Clinical Medicine Insights: Pediatrics</i> ; 2021; 15. doi: <a href="https://doi.org/10.1177/11795565211049904">10.1177/11795565211049904</a>
	Anthropometric criteria: <i>Sequential vs singles measurement</i>	Mwangome M.K, et al. Growth monitoring and mortality risk in low birthweight infants: a birth cohort study in Burkina Faso [version 1; peer review: 2 approved with reservations]. <i>Gates Open Res</i> 2021, 5:82 ( <a href="https://doi.org/10.12688/gatesopenres.13231.1">https://doi.org/10.12688/gatesopenres.13231.1</a> )
	Anthropometric criteria: <i>WAZ vs WHZ vs MUAC</i>	<p>Chowdhury R, et al. Diagnostic measures for severe acute malnutrition in Indian infants under 6 months of age: a secondary data analysis. <i>BMC Pediatr</i>. 2021 Apr 1;21(1):158. doi: 10.1186/s12887-021-02629-9. PMID: 33794826; PMCID: PMC8017622.</p> <p>Grijalva-Eternod CS, et al. Malnutrition in Infants Aged under 6 Months Attending Community Health Centres: A Cross Sectional Survey. <i>Nutrients</i>. 2021 Jul 21;13(8):2489. doi: 10.3390/nu13082489. PMID: 34444646; PMCID: PMC8398549.</p> <p>Moore L, et al. Towards identifying malnutrition among infants under 6 months: a mixed-methods study of South-Sudanese refugees in Ethiopia. <i>Public Health Nutr</i>. 2021 Apr;24(6):1265-1274. doi: 10.1017/S1368980020004048. Epub 2020 Oct 16. PMID: 33059792.</p> <p>Mwangome M.K, et al. Anthropometry at birth and at age of routine vaccination to predict mortality in the first year of life: A birth cohort study in BukinaFaso. <i>PLoS One</i>. 2019 Mar 28;14(3):e0213523. doi: 10.1371/journal.pone.0213523. PMID: 30921335; PMCID: PMC6438502.</p> <p>Lelijveld N, et al. 2017. A review of methods to detect cases of severely malnourished infants less than 6 months for their admission into therapeutic care. 2017. Available at: <a href="https://www.enonline.net/mamicasedetectionreview">https://www.enonline.net/mamicasedetectionreview</a></p> <p>Mwangome M.K, et al. Diagnostic criteria for severe acute malnutrition among infants aged under 6 mo, <i>The American Journal of Clinical Nutrition</i>, Volume 105, Issue 6, June 2017, Pages 1415–1423, <a href="https://doi.org/10.3945/ajcn.116.149815">https://doi.org/10.3945/ajcn.116.149815</a></p>
	Anthropometric criteria: <i>MUAC cut-offs</i>	<p>Mwangome M, Ngari M, Bwahere P, Kabore P, McGrath M, Kerac M, et al. Anthropometry at birth and at age of routine vaccination to predict mortality in the first year of life: A birth cohort study in BukinaFaso. <i>PloS one</i>. 2019;14(3).</p> <p>Gupta A, Tielsch JM, Khatri SK, LeClerq SC, Mullany LC, Katz J. Ethnic and age differences in prediction of mortality by mid-upper arm circumference in children below 3 years of age in Nepal. <i>Public health nutrition</i>. 2018;21(12):2230-7.</p>

		Chand S, Shah D, Kumar P, Shenoi A, Kumar RK, Girish S, et al. Mid-upper arm circumference for detection of severe acute malnutrition in infants aged between one and six months. <i>Indian pediatrics</i> . 2015;52(6):528-32.
		Moore L, O'Mahony S, Shevlin M, Hyland P, Barthorp H, Vallières F. Towards identifying malnutrition among infants under 6 months: a mixed-methods study of South-Sudanese refugees in Ethiopia. <i>Public Health Nutrition</i> . 2020:1-27.
2. What are/is the key opportunities/timing when infant wasting management can be incorporated with other healthcare programmes?	Opportunities and barriers for implementing the MAMI Care Pathway approach	Michelle Alvare. Implementing policies & programmes for small and nutritionally at-risk infants u6m and their mothers, from a UNICEF perspective: a key informant qualitative study. 2021. Available at: <a href="http://www.ennonline.net/implementingpoliciesprogrammesformami-report">www.ennonline.net/implementingpoliciesprogrammesformami-report</a>
		Astrid Klomp. Opportunities and barriers in scale-up of Management of small and nutritionally At-risk Infants under six months and their Mothers (MAMI) in four humanitarian settings: a qualitative study. 2021. Available at: <a href="http://www.ennonline.net/opportunitiesandbarriersinscaleupofmami">www.ennonline.net/opportunitiesandbarriersinscaleupofmami</a>
		Immerzeel, T. D. v, et al. Implementing a Care Pathway for small and nutritionally at-risk infants under six months of age: A multi-country stakeholder consultation. <i>Maternal &amp; Child Nutrition</i> . 2021;e13455. <a href="https://doi.org/10.1111/mcn.13455">https://doi.org/10.1111/mcn.13455</a>
3. What are the priority components of a package of care for outpatient treatment of wasted infants <6m?	Breastfeeding support for small and nutritionally at-risk infants in inpatient setting	Mwangome, M, et al. Individualised breastfeeding support for acutely ill, malnourished infants under 6 months old. <i>Matern Child Nutr</i> . 2020; 16:e12868. <a href="https://doi.org/10.1111/mcn.12868">https://doi.org/10.1111/mcn.12868</a> .
		Kahindi, J. <i>et al</i> . Establishing exclusive breastfeeding among in-patient malnourished infants in a rural Kenyan hospital: mothers' experiences of a peer supporter intervention. <i>Int Breastfeed J</i> <b>15</b> , 40 (2020). <a href="https://doi.org/10.1186/s13006-020-00278-9">https://doi.org/10.1186/s13006-020-00278-9</a>
		Van Ryneveld, et al. Mothers' experiences of exclusive breastfeeding in a postdischarge home setting. <i>Matern Child Nutr</i> . 2020; 16:e13016. <a href="https://doi.org/10.1111/mcn.13016">https://doi.org/10.1111/mcn.13016</a>
		Chabeda S, et al. Infant malnutrition treatment in Kenya: Health worker and breastfeeding peer supporter experiences. <i>Matern Child Nutr</i> . 2021 Jul;17(3):e13148. doi: 10.1111/mcn.13148. Epub 2021 Feb 2. PMID: 33528108; PMCID: PMC8189199
		Rana, R.; McGrath, M.; Gupta, P.; Thakur, E.; Kerac, M. Feeding Interventions for Infants with Growth Failure in the First Six Months of Life: A Systematic Review. <i>Nutrients</i> <b>2020</b> , <i>12</i> , 2044. <a href="https://doi.org/10.3390/nu12072044">https://doi.org/10.3390/nu12072044</a>
	Antimicrobial and micronutrient interventions for small and nutritionally at-risk infants	Campion-Smith T.J, et al. Antimicrobial and micronutrient interventions for the management of infants under 6 months of age identified with severe malnutrition: a literature review. <i>PeerJ</i> . 2020 Sep 10;8:e9175. doi: 10.7717/peerj.9175. PMID: 32974089; PMCID: PMC7487149.

	Supplementary feeding for small and nutritionally at-risk infants	Woeltje, et al. Community-Based Management of Acute Malnutrition in Infants Under 6 Months of Age, <i>Current Developments in Nutrition</i> , Volume 4, Issue Supplement_2, June 2020, Page 1102, <a href="https://doi.org/10.1093/cdn/nzaa054_174">https://doi.org/10.1093/cdn/nzaa054_174</a>
	Kangaroo mother care for small and nutritionally at-risk infants (outpatient setting)	Mazumder S, et al. Effect of community-initiated kangaroo mother care on survival of infants with low birthweight: a randomised controlled trial. <i>The Lancet</i> . 2019: 394 (10210). <a href="https://doi.org/10.1016/S0140-6736(19)32223-8">https://doi.org/10.1016/S0140-6736(19)32223-8</a>
	Kangaroo mother care for small and nutritionally at-risk infants (inpatient setting)	<p>Rehman M.O.U, et al. Impact of intermittent kangaroo mother care on weight gain of neonate in nicu: Randomized control trial. <i>J Pak Med Assoc</i>. 2020 Jun;70(6):973-977. doi: 10.5455/JPMA.45123. PMID: 32810089</p> <p>Gonuguntla Y, et al. Effectiveness of kangaroo mother care in the management of twin low-birth-weight neonates: A non-randomized, open, controlled trial. <i>Iranian Journal of Neonatology</i>. 2018 Sep: 9(3).10.22038/IJN.2018.29036.1391</p> <p>Jayaraman D, et al. Randomized Controlled Trial on Effect of Intermittent Early Versus Late Kangaroo Mother Care on Human Milk Feeding in Low-Birth-Weight Neonates. <i>J Hum Lact</i>. 2017 Aug;33(3):533-539. doi: 10.1177/0890334416685072. Epub 2017 Feb 2. PMID: 28152330.</p> <p>Swarnkar K ,et al. Effect of kangaroo mother care on growth and morbidity pattern in low birth weight infants. <i>Int Journal of contemporary paediatrics</i>. 2016. 4. DOI: <a href="http://dx.doi.org/10.18203/2349-3291.ijcp20200583">http://dx.doi.org/10.18203/2349-3291.ijcp20200583</a></p> <p>Conde-Agudelo A, et al. Kangaroo mother care to reduce morbidity and mortality in low birthweight infants. <i>Cochrane Database of Systematic Reviews</i> 2016, Issue 8. Art. No.: CD002771. DOI: 10.1002/14651858.CD002771.pub4. Accessed 20 December 2022.</p> <p>Gavhane S, et al. 2016. Kangaroo mother care to reduce morbidity and mortality in low birthweight infants. <a href="https://doi.org/10.1002/14651858.CD002771.pub4">https://doi.org/10.1002/14651858.CD002771.pub4</a></p> <p>Lumbanraj,a et al. Influence of maternal factors on the successful outcome of kangaroo mother care in low birth-weight infants: A randomized controlled trial. <i>J Neonatal Perinatal Med</i>. 2016;9(4):385-392. doi: 10.3233/NPM-161628. PMID: 28009335.</p>

4. Having detected wasting in the community, what is the efficacy of providing targeted skilled breastfeeding support to caregivers of stable infants?		
5. How can existing tools be adapted and/or linked together to better identify and manage wasted infants <6m?	MAMI Care Pathway	Burrell A et al. GOAL's experiences of management of at-risk mothers and infants (MAMI) programming in Ethiopia. Field exchange; 2020. <a href="https://www.ennonline.net/fex/62/goalexperiencesofmanagement">https://www.ennonline.net/fex/62/goalexperiencesofmanagement</a>
	Breastfeeding assessment tools	Brugaletta C, et al. Breastfeeding assessment tools for at-risk and malnourished infants aged under 6 months old: a systematic review. F1000Res. 2020 Nov 10;9:1310. doi: 10.12688/f1000research.24516.2. PMID: 33628437; PMCID: PMC7898355.
	Training packages and patient management tools	Ramona Engle. Training packages and patient management tools for staff working with mothers and nutritionally at-risk Infants aged under 6 months: a qualitative Study. 2019. Available at: <a href="http://www.ennonline.net/englermamimscprojectreport">www.ennonline.net/englermamimscprojectreport</a>
6. What are the most feasible tools and techniques for assessing treatment programme coverage for wasted infants <6m?		
7. What is the feasibility, effectiveness, cost-effectiveness and impact of different approaches to promote early initiation and	Breastfeeding support packages (multiple interventions)	Rana R, et al. Effectiveness of Breastfeeding Support Packages in Low- and Middle-Income Countries for Infants under Six Months: A Systematic Review. <i>Nutrients</i> . 2021 Feb 20;13(2):681. doi: 10.3390/nu13020681. PMID: 33672692; PMCID: PMC7924359
		Gu, Y.; et al Effectiveness of a theory-based breastfeeding promotion intervention on exclusive breastfeeding in China: A randomised controlled trial. <i>Midwifery</i> 2016, 42, 93–99.
		Sinha, B.; Chowdhury, R.; Sankar, M.J.; Martines, J.; Taneja, S.; Mazumder, S. Interventions to improve breastfeeding outcomes: A systematic review and meta-analysis. <i>Acta Paediatr.</i> 2015, 104, 114–134.
		Moudi, A. et al. Comparing the effect of breastfeeding promotion interventions on exclusive breastfeeding: An experimental study. <i>Biomed. Res. Ther.</i> 2016, 3, 910–927

exclusivity of breastfeeding?		Menon, P et al. Impacts on breastfeeding practices of at-scale strategies that combine intensive interpersonal counseling, mass media, and community mobilisation: Results of cluster-randomised program evaluations in Bangladesh and Viet Nam. <i>PLoS Med.</i> 2016, <i>13</i> , 1–28.
	Peer-support	Mahdiah, et al. Effect of nutrition peer counseling and breastfeeding the improvement in exclusive breastfeeding and infant nutrition status in Sub Lubuk Pakam and Tanjung Morawa, Deli Serdang. <i>Indian J. Public Health Res. Dev.</i> 2018, <i>9</i> , 194–199.
		Shakya, P, et al. Effectiveness of community-based peer support for mothers to improve their breastfeeding practices: A systematic review and meta-analysis. <i>PLoS ONE</i> 2017, <i>12</i> , e0177434.
		Chepkirui D, et al. 2020. A scoping review of breastfeeding peer support models applied in hospital settings. <a href="https://doi.org/10.1186/s13006-020-00331-7">https://doi.org/10.1186/s13006-020-00331-7</a>
	Father focused interventions	Su, M. et al. Father's role in breastfeeding promotion: Lessons from a quasi-experimental trial in China. <i>Breastfeed Med.</i> 2016, <i>11</i> , 144–149.
		Bich, T.H, et al. Father's involvement and its effect on early breastfeeding practices in Viet Nam. <i>Matern Child Nutr.</i> 2016, <i>12</i> , 768–777.
	Training	Shamim, T, et al. In a rural area of Bangladesh, traditional birth attendant training improved early infant feeding practices: A pragmatic cluster randomised trial. <i>Matern. Child. Nutr.</i> 2017, <i>13</i> , e12237.
		Mukhopadhyay, D.K, et al. Can frontline workers be change agents for infant feeding and growth?—A community trial. <i>Al Ameen J. Med. Sci.</i> 2017, <i>10</i> , 71–77.
	Multi-media	Reinsma, K, et al. The development and evaluation of an audio program and discussion guide to promote exclusive breastfeeding in Cameroon, Central Africa. <i>Glob. Health Promot.</i> 2016, <i>23</i> , 14–26.
		Rana et al. Use of educational videos to improve maternal breastfeeding knowledge and practices in Ethiopia. Field exchange. 2021. <a href="https://www.ennonline.net/attachments/3920/FEX-65-Web_27May-21_88-91.pdf">https://www.ennonline.net/attachments/3920/FEX-65-Web_27May-21_88-91.pdf</a>
Breastfeeding counselling	Kimani-Murage, E.W, et al. Effectiveness of home-based nutritional counselling and support on exclusive breastfeeding in urban poor settings in Nairobi: A cluster randomised controlled trial. <i>Global Health</i> 2017, <i>13</i> , 90.	
Relaxation therapy	Shukri N.H.M, et al. 2017. The effectiveness of interventions using relaxation therapy to improve breastfeeding outcomes: A systematic review. <i>Maternal and Child Nutrition</i> . DOI: 10.1111/mcn.12563	
	Dib, S, et al. A Breastfeeding Relaxation Intervention Promotes Growth in Late Preterm and Early Term Infants: Results from a Randomized Controlled Trial. <i>Nutrients</i> 2022, <i>14</i> , 5041. <a href="https://doi.org/10.3390/nu14235041">https://doi.org/10.3390/nu14235041</a>	
8. What are the main barriers to existing inpatient interventions for wasted infants <6m		Kumar, P, et al. Managing at risk mothers and infants under six months in India – no time to waste. Field Exchange 63, October 2020. p38. <a href="http://www.ennonline.net/fex/63/mamiindia">www.ennonline.net/fex/63/mamiindia</a>
		Islam, M. M, et al. Severe malnutrition in infants aged <6 months—Outcomes and risk factors in Bangladesh: A prospective cohort study. <i>Maternal &amp; Child Nutrition</i> , 2019; <i>15</i> (1). <a href="https://doi.org/10.1111/mcn.12642">https://doi.org/10.1111/mcn.12642</a>



and how might they be best addressed?		Arafat Y, et al. Perceptions of Acute Malnutrition and Its Management in Infants Under 6 Months of Age: A Qualitative Study in Rural Bangladesh. <i>Clinical Medicine Insights: Pediatrics</i> . 2018;12. doi: <a href="https://doi.org/10.1177/1179556518771698">10.1177/1179556518771698</a>
		Grijalva-Eternod, C. S., Admission profile and discharge outcomes for infants aged less than 6 months admitted to inpatient therapeutic care in 10 countries. A secondary data analysis. <i>Maternal &amp; Child Nutrition</i> , 2017;13: e12345. doi: <a href="https://doi.org/10.1111/mcn.12345">10.1111/mcn.12345</a> .
9. What is the effectiveness, cost, and safety of an outpatient-focused treatment model for infants with wasting?	MAMI Care Pathway	<p>Burrell A et al. GOAL's experiences of management of at-risk mothers and infants (MAMI) programming in Ethiopia. Field exchange. 2020. <a href="https://www.enonline.net/fex/62/goalexperiencesofmanagement">https://www.enonline.net/fex/62/goalexperiencesofmanagement</a></p> <p>Butler S et al. C-MAMI tool evaluation: Learnings from Bangladesh and Ethiopia. Field exchange. 2018. <a href="https://www.enonline.net/fex/58/cmamitoolevaluation">https://www.enonline.net/fex/58/cmamitoolevaluation</a></p> <p>Kueter A.M et al. Piloting the C-MAMI approach in the Rohingya response in Bangladesh. Field exchange. 2018. <a href="https://www.enonline.net/fex/58/pilotcmamiapproachbangladesh">https://www.enonline.net/fex/58/pilotcmamiapproachbangladesh</a></p> <p>Immerzeel, T. D. v., et al. Implementing a Care Pathway for small and nutritionally at-risk infants under six months of age: A multi-country stakeholder consultation. <i>Maternal &amp; Child Nutrition</i>, 2023;e13455. <a href="https://doi.org/10.1111/mcn.13455">https://doi.org/10.1111/mcn.13455</a></p>
10. Which supervision tools and approaches are most effective towards improving the front-line case management of wasted infants <6m?		

\*The term severe acute malnutrition (SAM) was originally used during the CHNRI process but has been updated here to reflect recent views of the MAMI GTWG on this terminology.

Appendix 3: Research questions ranked by NIS GTWG members

<b>Research questions</b>
What are the best practices for setting up a NIS across the various sectors engaged with nutrition?
How can we better tailor nutrition assessments to the needs of users?
How can we utilise innovations such as digital technologies to provide more accurate, timely and comprehensive nutrition data?
How can NIS be developed around various indicators (i.e., infant and young child feeding in emergencies) in order to be able to inform early warning systems?
How to design 'good enough' data collection systems where SMART surveys aren't possible?
How can we use data on food systems to inform decisions that have an impact on nutrition in emergencies?
How can geospatial data be used to better inform malnutrition estimates?
Research to improve evidence on combined caseload estimates and use of mid-upper-arm circumference-for-age as an indicator.
Research to improve coverage estimates of nutrition-specific and nutrition-sensitive interventions.
What are the mechanisms that enable more frequent data collection and more data in general for program coverage indicators, including growth monitoring, breastfeeding counselling, and complementary feeding counselling?
How to obtain accurate nutrition information in the absence of surveys such as SMART assessments, for example, during COVID-19?
What are the most appropriate methods for dealing with missing and incompatible data?
What are the lessons learned on how to improve data quality and field practices when conducting nutrition assessments to inform data-quality improvement efforts.
How to account for poor quality anthropometric data (e.g., using median, larger sampling sizes etc)?
How to use data to enable the prioritization of limited resources for the most efficient, effective, equitable, and timely response possible?
How to overcome current analysis challenges such as the inability to identify hotspots, problems with projections, rigid methodologies, and the emphasis on outcomes not causes?
How can mortality and malnutrition estimation be better contextualized across different contexts and countries?
How can nutrition modelling tools be used to measure impact?
What methodology should be adopted when using data from the causes of malnutrition/ malnutrition determinants in burden calculations?
What strategies should be employed where full coverage of global acute malnutrition estimates are not possible, such as in inaccessible areas, variable access and/or due to resource limitations.
In different countries and contexts, what are the timing of fluctuations of global acute malnutrition as well as other measures of nutritional status?

What is the relationship between seasonal factors and levels of wasting, which could contribute to models for using contributory factor data in the analysis of the nutrition situation?
How to best calculate incidence conversion factors, what are the context-specific adjustments of the incidence conversion factor, and what contextual/ determinants information need to be considered to select the appropriate conversion factor?
How can we improve publicly accessible integrated databases for nutrition?
What are the acute malnutrition thresholds for women and pregnant and lactating women (15-49 years of age)?
Nutrition information system (NIS); Standardised Monitoring and Assessment of Relief and Transitions (SMART)

#### [Appendix 4: Research questions ranked by CVA GTWG members](#)

<b>Research questions</b>
Which CVA modality (unrestricted cash or restricted voucher) provided for transport costs to access treatment for wasting has better outcomes in terms of referral and completion of treatment uptake? Does providing the CVA at the point of referral or at the health centre improve outcomes?
Is there a risk in providing an incentive to caregivers to keep or make their children malnourished by providing household cash transfers to the caregivers of severely wasted children? If yes, what extent might this risk be context specific, for example based on social and cultural factors and can the risk be reduced through modality and design decisions? Is this risk any different to providing in-kind nutrition support as part of CMAM?
What is the impact of CVA on infant and young child feeding practices, particularly breastfeeding and to what extent is CVA used to buy breastmilk substitutes?
What are the most promising combinations of cash, voucher and in-kind assistance to prevent malnutrition in different contexts? What are the impact pathways? What modalities are more adequate for the individual feeding component? Are there any differences when targeting young children or pregnant and lactating women and girls?
What is the impact of CVA on the different types of malnutrition i.e., stunting, wasting, micronutrient deficiencies overweight and obesity?
What is the medium and long-term effectiveness of CVA for maternal and child nutrition outcomes?
What are the specific impacts and pathways conferred by complementary interventions (single and combinations of interventions) to CVA and what are the contexts in which complementary interventions are required to prevent or reduce the risk of developing malnutrition?
What are the differences in maternal and child nutrition status impact over the 1000 days when using soft conditionality (i.e., participants are expected to fulfil a certain condition, but in case of non-compliance, there is a follow-up and encouragement to fulfil the conditionality) vs hard conditionality (i.e., the assistance is tied to the fulfilment of a certain condition) vs no conditionality for participation in social behaviour change activities or attendance to priority health services?
How does timing, frequency, duration, transfer amount, and choice of recipient of CVA impact on nutrition outcomes?

Does programme design (i.e., different transfer values, duration etc) impact different types of malnutrition (e.g., stunting, wasting, overweight, obesity and micronutrient deficiencies), differently?
In different sets of circumstances using different program designs what are the most likely impact pathways for CVA, barriers and outcomes for maternal and child nutrition?
What is the comparative cost effectiveness of the different assistance modalities and the same modality with different intervention design (i.e., different transfer values, durations etc.) for preventing malnutrition?
What is the impact of CVA with or without social behaviour change activities on maternal and childcare practices, particularly on feeding practices and psychosocial care for children?
What is the impact of CVA for nutrition outcomes on gender dynamics and decision-making power in the household?
What factors determine CVA recipient's decision-making for use of the transfer and how does this decision influence maternal and child nutritional status?

Cash and voucher (CVA); Community-based management of acute malnutrition (CMAM)

[Appendix 5: Research on CVA for nutrition mapped against the enabling, underlying, immediate determinants for nutrition outcomes as depicted in the UNICEF framework](#)

<b>Enabling determinants</b>	
<i>Gender-based violence and women's empowerment</i>	Cross, A., Manell, T., and Megevand, M., 'Humanitarian cash transfer programming and gender-based violence outcomes: evidence and future research priorities,' 2018.
	Department for International Development (DFID). DFID Cash Transfers Evidence Paper. London: DFID; 2011.
	Leroy JL, Ruel M, Verhofstadt E. The impact of conditional cash transfer programmes on child nutrition: a review of evidence using a programme theory framework. Journal of Development Effectiveness. 2009;1(2):103-29.
	de Brauw A, Gilligan DO, Hoddinott J, Roy S. The impact of Bolsa Família on women's decision-making power. World Development. 2014;59:487-504
	Green EP, Blattman C, Jamison J, Annan J. Women's entrepreneurship and intimate partner violence: A cluster randomized trial of microenterprise assistance and partner participation in post-conflict Uganda (SSM-D-14-01580R1). Soc Sci Med. 2015;133:177-88.
	Merttens F, Hurrell A, Marzi M, Attah R, Farhat M, Kardan A, et al. Kenya hunger safety net programme monitoring and evaluation component impact evaluation final report: 2009 to 2012. Oxford: Oxford Policy Management; 2013
	Hidrobo M, Hoddinott J, Peterman A, Margolies A, Moreira V. Cash, food or vouchers? Evidence from a randomized experiment in northern Ecuador. Washington, DC: IFPRI; 2012.

<b>Underlying determinants</b>	
<i>Household food expenditure</i>	Department for International Development (DFID). DFID Cash Transfers Evidence Paper. London: DFID; 2011.
	Fenn B, Pietzsch S, Morel J, Ait-Aissa M, Calo M, Grootenhuis F, et al. Research on Food Assistance for Nutritional Impact (REFANI): Literature Review. New York: Action Against Hunger; 2015
	Bailey S, Hedlund K. The Impact of Cash Transfers on Nutrition in Emergency and Transitional Contexts – Review of Evidence. CaLP; 2012
	Bastaglie F, Hagen-Zanker J, Harman L, Barca V, Sturge G, Schmidt T, et al. Cash transfers: what does the evidence say? UK: Overseas Development Institute; 2016
	de Groot, Richard; Palermo, Tia; Handa, Sudhanshu; Peterman, Amber; Ragno, Luigi Peter (2015). Cash Transfers and Child Nutrition: What we know and what we need to know , <i>Innocenti Working Papers</i> , no. 2015-07, UNICEF Innocenti Research Centre, Florence
	Bailey, S., 'The Impact of Cash Transfers on Food Consumption in Humanitarian Settings: A review of evidence', 2013
	Manley, J., Gitter, S., and Slavchevska, V., 'How Effective are Cash Transfers at Improving Nutritional Status?' <i>World Development</i> , Volume 48, August 2013, p. 133-155, 2013.
	Doocy S, Tappis H. Cash-based approaches in humanitarian emergencies: A systematic review. International Initiative for Impact Evaluation; 2016
<i>Utilisation of health services and health outcomes</i>	Bastagli, F., et al., 'Cash transfers: what does the evidence say? A rigorous review of programme impact and of the role of design and implementation features', ODI, 2016.
	Leroy JL, Koch B, Roy S, Gilligan D, Ruel M. Social Assistance Programs and Birth Outcomes: A Systematic Review and Assessment of Nutrition and Health Pathways. <i>J Nutr.</i> 2021;151(12):3841-55.
	Bailey S, Hedlund K. The Impact of Cash Transfers on Nutrition in Emergency and Transitional Contexts – Review of Evidence. CaLP; 2012.
	Kusuma D, Cohen J, McConnell M, Berman P. Can cash transfers improve determinants of maternal mortality? Evidence from the household and community programs in Indonesia. <i>Soc Sci Med.</i> 2016;163:10-20
	Pega F, Liu SY, Walter S, Lhachimi SK. Unconditional cash transfers for assistance in humanitarian disasters: effect on use of health services and health outcomes in low- and middle-income countries. <i>Cochrane Database Syst Rev.</i> 2015(9):CD011247.
	Brody CM, Bellows N, Campbell M, Potts M. The impact of vouchers on the use and quality of health care in developing countries: a systematic review. <i>Glob Public Health.</i> 2013;8(4):363-88

<b>Immediate determinants</b>	
<i>Maternal and child dietary diversity</i>	Grijalva-Eternod CS, Jelle M, Haghparast-Bidgoli H, Colbourn T, Golden K, et al., 'A cash-based intervention and the risk of acute malnutrition in children aged 6–59 months living in internally displaced persons camps in Mogadishu, Somalia: A non-randomised cluster trial,' PLoS Med 15(10): e1002684, 2018.
	Kurdi, S., et al., 'Responding to Conflict: Does "Cash Plus" Work for Preventing Malnutrition? New Evidence from an Impact Evaluation of Yemen's Cash for Nutrition Program,' IFPRI POLICY BRIEF, 2019b.
	Cunha JM. Testing Paternalism: Cash versus In-Kind Transfers. American Economic Journal: Applied Economics. 2014;6(2):195-230
	Fenn B, Colbourn T, Dolan C, Pietzsch S, Sangrasi M, Shoham J. Impact evaluation of different cashbased intervention modalities on child and maternal nutritional status in Sindh Province, Pakistan, at 6 mo and at 1 y: A cluster randomised controlled trial. PLoS Med. 2017;14(5):e1002305.
	Fahey CA, Njau PF, Dow WH, Kapologwe NA, McCoy SI. Effects of short-term cash and food incentives on food insecurity and nutrition among HIV-infected adults in Tanzania. Aids. 2019;33(3):515-24.
	Harris-Fry HA, Paudel P, Harrisson T, Shrestha N, Jha S, Beard BJ, et al. Participatory Women's Groups with Cash Transfers Can Increase Dietary Diversity and Micronutrient Adequacy during Pregnancy, whereas Women's Groups with Food Transfers Can Increase Equity in Intrahousehold Energy Allocation. J Nutr. 2018;148(9):1472-83.
	Doocy S, Busingye M, Lyles E, Colantouni E, Aidam B, Ebulu G, et al. Cash-based assistance and the nutrition status of pregnant and lactating women in the Somalia food crisis: A comparison of two transfer modalities. PLoS One. 2020;15(4):e0230989.
	Olney DK, Gelli A, Kumar N, Alderman H, Go A, Raza A, et al. Nutrition-Sensitive Social Protection Programs within Food Systems. IFPRI; 2021
	Houngbe F, Tonguet-Papucci A, Nago E, Gauny J, Ait-Aïssa M, Huneau JF, et al. Effects of multiannual, seasonal unconditional cash transfers on food security and dietary diversity in rural Burkina Faso: the Moderate Acute Malnutrition Out (MAM'Out) clusterrandomized controlled trial. Public Health Nutr. 2019;22(6):1089-99.
	Grijalva-Eternod CS, Jelle M, Haghparast-Bidgoli H, Colbourn T, Golden K, King S, et al. A cash-based intervention and the risk of acute malnutrition in children aged 6-59 months living in internally displaced persons camps in Mogadishu, Somalia: A non-randomised cluster trial. PLoS Med. 2018;15(10):e1002684.
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	Bastaglie F, Hagen-Zanker J, Harman L, Barca V, Sturge G, Schmidt T, et al. Cash transfers: what does the evidence say? UK: Overseas Development Institute; 2016
	Doocy S, Tappis H. Cash-based approaches in humanitarian emergencies: A systematic review. International Initiative for Impact Evaluation; 2016
	Bailey S, Hedlund K. The Impact of Cash Transfers on Nutrition in Emergency and Transitional Contexts – Review of Evidence. CaLP; 2012
	Seal A, Dolan C, Trenouth L. REFANI: Synthesis Report. New York: Action Against Hunger; 2017.
<b>Nutrition outcomes</b>	
<i>Wasting</i>	Grijalva-Eternod CS, Jelle M, Haghparast-Bidgoli H, Colbourn T, Golden K, et al. (2018) A cash-based intervention and the risk of acute malnutrition in children aged 6–59 months living in internally displaced persons camps in Mogadishu, Somalia: A non-randomised cluster trial. <i>PLOS Medicine</i> 15(10): e1002684. <a href="https://doi.org/10.1371/journal.pmed.1002684">https://doi.org/10.1371/journal.pmed.1002684</a>
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[Appendix 6: Research priorities identified by CORTASAM in 2018 to achieve the scale up of wasting treatment by 2020 and recommendations for further research under each topic area](#)

Research priority area (2017)	Recommendation for further research (2020)
<b>Effective approaches to detect, diagnose, and treat wasting in the community.</b>	Strengthen the evidence on integration of community-based approaches to management of wasting beyond health facilities with other levels of health systems.
	Expand research on community-based approaches beyond health facilities for management of moderate wasting
	Explore tools and indicators for detection and diagnosis of wasting at community-level
	Differentiate between screening for wasting by community members (households/family) and diagnosis by community health workers
<b>Appropriate entry and discharge criteria for treatment of wasting to ensure optimum outcomes:</b> Building the evidence base on expanded MUAC thresholds for treatment to improve treatment outcomes for wasted children. Plus, research to explore different options to identify high-risk children not selected by MUAC<115mm and analysis on the impact on burden estimates and operational feasibility, including supply and supply chain.	Expand the evidence base for simplified approaches across contexts
	Tools and approaches for detecting and diagnosing children with wasting
<b>Optimum dosage of ready-to-use food (RUF) for treatment of wasting:</b> Investigating the safety, effectiveness, and cost-effectiveness of reduced dosage of RUF for treatment of wasting.	Expand evidence base for reduced RUF dosage schedules
	Long-term impact of reduced RUF dosage schedules
	Secondary outcomes of reduced RUF dosage schedules
	Reduced RUF dosage schedules and simplified approaches
<b>Effective treatment of diarrhoea in children with SAM:</b> Using evidence to streamline guidance and generating implementation research to understand how the operational application of guidelines can inform improved practice and better treatment outcomes.	Research on fluid management in severely wasted children
	Operational evidence and guidelines on rehydration in severely wasted children
	Focus on management of diarrhoea in wasted children rather than pathogenic causes
<b>Rates and causal factors of post-treatment relapse across contexts:</b> Understanding the burden of post-treatment relapse and, if found to be high, effective solutions to reduce relapse across contexts.	Develop a standardised definition of post-treatment relapse and a conceptual framework
	Frame issues around post-treatment relapse at an operational level

<p><b><i>Identification and management of at-risk mothers and of infants under six months of age</i></b></p>	<p>Evidence generation on tools and approaches to identify and manage at-risk infants under six months and mothers across contexts</p>
<p><b><i>Alternative formulations for ready-to-use foods for wasted children:</i></b> Continuation of the ongoing research to investigate the effectiveness, and cost-effectiveness, of formulas using alternative and local ingredient.</p>	<p>Differentiate between types of alternative formulations of RUTF</p> <p>Evaluate effects of emulsifiers in RUTF formulations</p> <p>Evaluate secondary outcomes and wider economic and health system implications of alternative RUTF formulations</p> <p>Alternative formulations of RUTF for the combined management of moderate and severe wasting</p> <p>Alternative vs. complementary formulations of RUTF</p>