MULTISECTORAL PREVENTION OF UNDERNUTRITION FOR FOOD INSECURE CONTEXTS:

an evidence synthesis

elrha

Contents

Jump to contents

Jump to contents

ACRONYMS

ACRONYMS

Jump to contents

ALNAP	Active Learning Network for Accountability and Performance
ANC	Antenatal care
ASFs	Animal-Source Foods
BEP	Balanced energy protein
BMGF	Bill and Melinda Gates Foundation
BMI	Body mass index
BSFP	Blanket Supplementary Feeding Program
C4N	Capacity for Nutrition
CCT	Conditional cash transfer
Child DD	Child Dietary Diversity
CHW	Community health worker
CMAM	Community-based Management of Acute Malnutrition
CSB	Corn-Soya Blend
CVA	Cash and voucher assistance
DG ECHO	Directorate-General for European Civil Protection and Humanitarian Aid Operations
DHS	Demographic and Health Survey
EED	Environmental enteric dysfunction
ENN	Emergency Nutrition Network
FAO	Food and Agriculture Organization
FBF	Fortified blended food
FCDO	Foreign, Commonwealth and Development Office
FCS	Fragile and Conflict-affected States
FFV	Fresh food voucher
FIM	Food, Income and Markets
GNC	Global Nutrition Cluster
GWG	Gestational weight gain
HAZ	Height-for-age z-score
Hb	Haemoglobin
HFA	Height-for-age
HHDD	Household Dietary Diversity
iCCM	Integrated community case management
IFA	Iron-folic acid
IFPRI	International Food Policy Research Institute
IMCI	Integrated management of childhood illness
IPD	Individual Participant Data
IYCF	Infant and Young Child Feeding
LAZ	Length-for-age z-score
LBW	Low birth weight
LLMIC	Low- and Lower-Middle-Income Countries
LMIC	Low- and Middle-Income Countries
LNS	Lipid-based nutrient supplement
MAM	Moderate acute malnutrition

ACRONYMS

Jump to contents

MAMI	Management of Nutritionally At-risk Mothers and Infants
MDD-W	Minimum Dietary Diversity – Women
MERIAM	Modelling Early Risk Indicators to Anticipate Malnutrition
MeSH	Medical Subject Headings
MMS	Multiple micronutrient supplementation
MND	Micronutrient deficiency
MNP	Multiple micronutrient powder
MQ-LNS	Medium quantity lipid-based nutrient supplements
MUAC	Mid-upper arm circumference
NIS	Nutrition Information Systems
NRS	Nutrition Registry Systems
NSS	Nutrition Surveillance Systems
NTD	Neural tube defect
NuVAC	Nutrition Vulnerability Assessment in Crisis
PB	Preterm Births
PBW	Pregnant and breastfeeding women
PBWG	Pregnant and breastfeeding women and girls
PICO	Population, Intervention, Comparison, Outcome
PLA	Participatory learning and action
RBC	Red blood cell
RCT	Randomized controlled trial
RUSF	Ready-to-Use Supplementary Food
SAM	Severe Acute Malnutrition
SAP	Social assistance program
SBC	Social behaviour change
SC	Standard cash
SFF	Specially formulated food
SGA	Small for gestational age
SQ-LNS	Small-quantity lipid-based nutrient supplements
UCT	Unconditional cash transfer
UNICEF	United Nations Children's Fund
USAID	United States Agency for International Development
WASH	Water, sanitation and hygiene
WAZ	Weight-for-age z-score
WELI	Women's Empowerment in Livestock Index
WFH	Weight-for-height
WFL	Weight-for-length
WFP	World Food Programme
WHO	World Health Organization
WIFAS	Weekly iron folic acid supplementation
WSB+	Wheat soya blend plus

Jump to contents

FOREWORD

FOREWORD

In 2023, the Global Report on Food Crises estimated that nearly 282 million people went without essential food and nutrition that year - 24 million more people than the previous year. This trend is likely to increase due to drivers including acute and protracted conflicts, impacts of the climate crisis and global economic challenges.

Some populations are more vulnerable to the effects of these crises than others. Changes in livelihoods, incomes and food access have worsened the health and nutritional status of women and adolescent girls in countries most affected by food insecurity. Children are particularly likely to suffer acute undernutrition with potentially long-term consequences for their physical and cognitive development. It is essential that humanitarian and research communities work together to identify solutions to prevent households and communities from falling into crisis and to avoid the long-term impacts of poor nutrition.

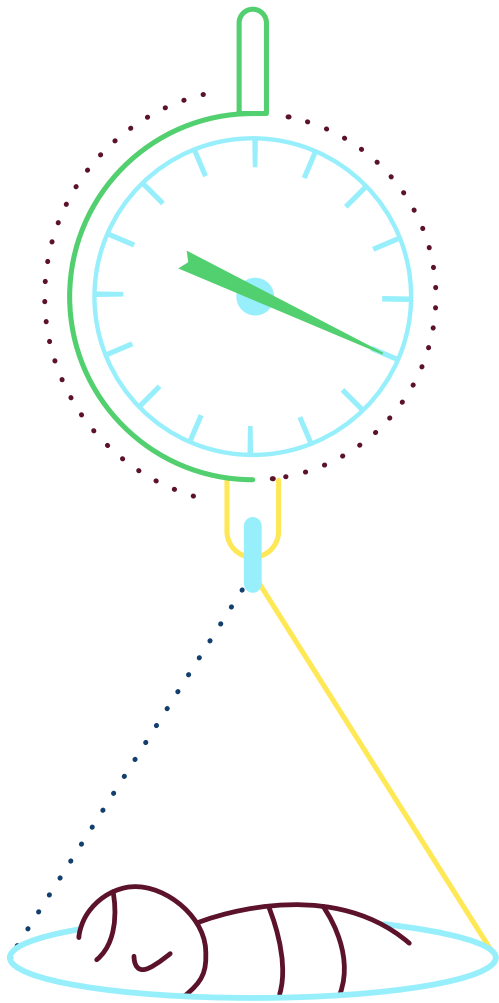
In 2022, expert consultations convened by Elrha's Research for Health in Humanitarian Crises Programme (R2HC), identified that a clear gap in evidence-based practice was the lack of operational and technical guidance on interventions that can be implemented in food insecure contexts to prevent undernutrition in children under the age of 5, and pregnant and breastfeeding women. Given the limited funding available in crises, resources tend to be targeted to the treatment of undernutrition, rather than the prevention of it.

To respond to this, we launched a multi-year research initiative to develop such guidance, and then test its implementation in different settings, to build the evidence base needed to change policy and practice in prevention of undernutrition in food insecure contexts. This work will be ongoing until 2030.

This evidence synthesis, the first output from this new research initiative, is a comprehensive multi-sectoral analysis of "what works" to prevent undernutrition in our target groups. The NutritionWorks research team conducted a comprehensive literature review and consulted with a wide range of humanitarian stakeholders to create this synthesis, to inform the development of the operational and technical guidance.

We are committed to building the evidence base to reduce undernutrition in vulnerable populations, and we look forward to collaborating with humanitarian practitioners, researchers, UN agencies and funders as we work together to achieve Sustainable Development Goal #2: Zero Hunger.

Anne Harmer,
Head of R2HC Programme, Elrha



Jump to contents

ACKNOWLEDGEMENTS

ACKNOWLEDGEMENTS

Jump to contents

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About Elrha

We are a global organisation that finds solutions to complex humanitarian problems through research and innovation. We are an established actor in the humanitarian community, working in partnership with humanitarian organisations, researchers, innovators, and the private sector to tackle some of the most difficult challenges facing people all over the world. Through our globally recognised programmes, we have supported more than 200 world-class research studies and innovation projects, championing new ideas and different approaches to evidence what works in humanitarian response.

R2HC aims to improve health outcomes for people affected by humanitarian crises by strengthening the evidence base for public health interventions. Our globally-recognised research programme focuses on maximising the potential for public health research to bring about positive change and transform the effectiveness of humanitarian response.

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The project team would like to acknowledge and thank all stakeholders and contacts who helped identify relevant published and grey literature, including country experience of prevention programming, for this review. The full list of organisations contacted can be found in Annex 1.

The views expressed in this paper are those of the authors and are not necessarily those of Elrha or Elrha's donors.

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Jump to contents

SUMMARY

EXECUTIVE SUMMARY

Jump to contents

Introduction

According to the 2023 edition of the Global Report on Food Crises, there are currently 258 million people across 58 countries and territories facing acute food insecurity at crisis or worse levels (IPC/CH Phase 3-5). Women and children are particularly vulnerable to undernutrition in these contexts and whilst we have long known 'what' is needed to keep women and children healthy, there remain many unknowns about 'how' we ensure this in evidence-based operational packages of measures for the prevention of undernutrition in food insecure/humanitarian settings.

This research project aims to develop and test packages of multi-sectoral preventive interventions designed to prevent undernutrition in humanitarian contexts of increasing food insecurity.

The project objectives are:

To conduct an evidence review to synthesise the literature for the prevention of undernutrition for children less than five years, adolescent girls and pregnant and breastfeeding women (PBWGs) in food insecure/humanitarian settings.

To define multisectoral preventive package(s) for children and PBWGs that is/are evidence-based, practical and responsive to need across different humanitarian policy and programming contexts.

This report presents findings of the evidence review and aims to map the evidence base for single, bi- and multi-sectoral interventions that aim to prevent undernutrition (wasting, stunting and micronutrient deficiency) in humanitarian contexts (ie, food insecure contexts or at high risk of food insecurity).

Methods

The review drew on both the academic and grey literature. We prioritised building upon existing systematic and narrative reviews, through a 'review of reviews' approach that also incorporated any individual study or evaluation that was noteworthy, added specific learning of value and/or that was not included in any of the reviews.

Key stakeholders and contacts known to be actively working on the prevention of undernutrition and food insecurity in humanitarian contexts were contacted early in the review process to support identification of relevant key published and grey literature, including country experience of prevention programming. A rapid literature search using online libraries supplemented the literature sourced through existing reviews and stakeholder networks.

Both the search strategy and the eligibility criteria were guided by the Population, Intervention, Comparison, Outcome (PICO) framework to delineate the questions of focus for the review and to define inclusion and exclusion criteria.

Summary of findings

Findings of the review are organised by intervention type, starting with nutrition sensitive interventions relating to community and household assistance: food, cash and vouchers, social protection, agriculture/livestock production and WASH and health services. Targeted nutrition support for women and children through nutrition-specific interventions are then addressed, including the evidence linked to the value of addressing women's empowerment and maternal mental health. The final section examines the evidence available for multisectoral packages of support. The value of social behaviour change communication (SBC) is addressed under each of the intervention areas because it is rarely delivered as a standalone intervention.

EXECUTIVE SUMMARY

Community and household-level assistance

Food, cash/voucher and social protection: There is a substantial evidence base on the impact of cash and voucher assistance (CVA) on nutrition outcomes, sourced mainly from stable contexts; and a growing body of evidence emerging from humanitarian settings. Evidence for impact of CVA on child dietary diversity, household food security and uptake of health and nutrition services is good, whilst the evidence base on impact of CVA on wasting and stunting is mixed. There is some evidence that cash combined with food transfers has greater impact than cash alone on preventing stunting and wasting, particularly in crisis settings. In-kind food assistance can support good impacts for women's and children's dietary intakes, stunting and anaemia, and also possibly birth outcomes such as LBW (although evidence is weaker), especially when combined with other interventions (eg, cash and supplement/food transfer, cash and SBC). Evidence indicates that interventions are most effective when targeted directly to women and children. The duration of food, cash/voucher and social protection interventions and timeline, to measurement of nutrition status outcomes assessed, varies widely across studies. Many target women and children during the first 1,000 days and record nutrition outcomes at around the 6-12 months age group in children. However measured changes in diet diversity and household food security outcomes have been observed within much shorter timeframes and some studies examining impacts of CVA/food transfers implemented in crisis settings have seen improvements in nutrition status of children within six months. There is some limited evidence for an impact of CVA on care behaviours.

Agriculture/livestock production and income generation: Available evidence for home agricultural production shows a significant impact on women's and children's dietary diversity and some limited impact on child nutrition status. Nutrition-sensitive agriculture interventions may be more likely to impact child wasting if they increase production of micronutrient-rich foods along with foods high in energy or protein. Livestock-based interventions that help to maintain livestock health and access to milk, have been shown to decrease the risk of wasting, stunting and underweight among children and could help to address seasonal spikes in acute malnutrition in drylands Africa. Home food production with a nutrition SBC component is more effective than an agriculture intervention alone. The pathway through which home food production may have an impact is not clear, although evidence on production for consumption is most dominant. However, the duration of agricultural intervention required to achieve nutrition impacts may be a constraint in contexts where the need to stabilise a deteriorating food security situation is urgent. Evidence on the impact of income generation projects on nutrition outcomes, particularly in humanitarian contexts, is currently very limited.

Health services: Access to antenatal care (ANC) services, including iron-folic acid (IFA) or multiple micronutrient supplements (MMS) in pregnancy as part of ANC (see targeted assistance below), is directly associated with improved birth outcomes and longer-term reductions in child mortality and undernutrition. Whilst prevention of childhood infection, particularly to reduce the occurrence of diarrhoea and measles, is accepted as an essential component of the prevention of malnutrition, there is limited evidence available for the impacts of these interventions on improved growth outcomes explicitly.

WASH services: Current evidence is insufficient to demonstrate a consistent preventive effect of WASH interventions against stunting or wasting in children. Several RCTs and observational studies have found no impacts of household water treatment, latrines or hygiene practices on reducing wasting prevalence. Systematic reviews have found a small number of low-quality trials reporting reductions in stunting from WASH interventions and more promising results where WASH interventions have been included in packages of support. However, other nutrition sensitive WASH studies have shown improvements in WASH and health practices and there is general consensus that WASH interventions piloted in nutrition studies may not have been adequately robust to generate results. The historical significance of WASH in disease control, the strong conceptual basis for WASH and research findings that suggest that high levels of WASH service coverage are needed to improve nutrition and health outcomes, all point to the need for more effective joint programming, as well as linked research.

EXECUTIVE SUMMARY

Targeted assistance

Complementary feeding and nutrition supplementation for children: Supporting healthy diets for young children in fragile and humanitarian settings has long been a challenge. There is now strong evidence to suggest that the use of SQ-LNS among at-risk children (under two years of age), provided for at least three months, can reduce the prevalence of stunting, wasting and underweight. Early data also suggests some of the positive effects on linear growth are still evident among children 9-11 years of age. However, household food security status, compliance (possibly linked to sharing at an individual level), duration of supplementation and coverage are important modifiers. Studies in food-insecure settings that provide specialised foods to young children, such as SQ-LNS, appear to be more likely to show an impact, and more likely to show larger impacts, on one or more wasting outcomes, compared with fortified complementary foods or household or child-specific staple foods. Design of complementary feeding interventions, including the supplements and foods used, should be guided by issues linked to context, availability, feasibility and cultural acceptability. Growth outcomes are likely to be better when two or more interventions are provided together and in populations with worse nutrition status and at baseline. Most of the evidence in this area comes from settings that could be described as food-insecure and humanitarian. Caregiver education/counselling provided as a standalone intervention can improve food consumption, knowledge and dietary practices, but only in food-secure settings and where households have sufficient resources and access to healthy diets. Caregiver education/counselling on IYCF has limited impact on child anthropometry in any setting as a standalone intervention but has been shown to improve the impact on nutrition outcomes when provided with other nutrition support through complementary feeding and other interventions.

Micronutrient supplementation interventions alone demonstrate good impacts on micronutrient deficiency, such as anaemia, but not on stunting and wasting. However, communities with the highest burden of stunting and wasting also have the highest burden of iron and other micronutrient deficiency so programming should be designed to address undernutrition in all its forms.

Nutrition supplementation and breastfeeding support for pregnant and breastfeeding women: There is increasing evidence that balanced energy protein (BEP) supplementation of pregnant women and girls is beneficial for improving infant outcomes, reducing the rates of stillbirth, low birth weight (LBW) and small for gestational age (SGA) and increasing mean birth weight. Although fewer studies have focused on outcomes for women/girls themselves, studies are increasingly showing positive outcomes of BEP supplementation on maternal anaemia and gestational weight gain (GWG). The use of different nutrient compositions and formulations of BEP and different ration sizes across trials and programmes has complicated the consolidation of evidence to inform implementation guidance on BEP supplementation.

Supplementation with IFA is associated with a reduced risk of iron deficiency and anaemia in pregnant women. There is also strong evidence that MMS containing IFA leads to improved outcomes over IFA alone in terms of reduction of LBW, SGA births, preterm births and stillbirths. The benefits are even greater among anaemic and underweight pregnant women, those who initiate supplementation earlier, and those with higher adherence. To date, much MMS programming has been small-scale and more experience with implementing MMS interventions is called for, particularly in humanitarian contexts.

Weekly IFA supplementation (WIFAS) has been shown to be efficacious in increasing haemoglobin concentrations and reducing anaemia among anaemic adolescent girls in targeted interventions, especially through school platforms where nutrition education can support compliance.

Maternal mental health and women's empowerment: Evidence shows women's empowerment interventions, such as nutrition education, entrepreneurship training, livelihood programmes that increase spousal communication, financial decision-making and healthcare decision-making, can reduce likelihood of child wasting. Empowerment allows women greater control over resources to provide nutritious food and make healthcare decisions benefitting child nutrition. However, the relationship is complex, as increased autonomy may reduce care time, or social support trade-offs can emerge. Further research is needed to delineate the specific impacts of maternal mental health interventions, especially in the context

Jump to contents

of standalone approaches. The multifaceted nature of maternal mental health, coupled with its integration into broader intervention packages, underscores the need for targeted investigations to optimise outcomes for both maternal mental health and child nutritional well-being. Further research is needed in humanitarian and fragile settings affected by conflict.

Multisectoral packages of support

There is growing evidence to suggest that a combination of interventions from different sectors is more effective at preventing wasting than separately implemented interventions. This is particularly true of the combination of CVAs, food supplementation and/or agricultural/food production and health, and of the addition of nutrition SBC to any of these interventions/intervention packages. Furthermore, addressing women's empowerment as part of multisectoral interventions is also increasingly shown to improve nutrition impacts. Concurrent provision of these combined interventions during critical periods such as preconception, pregnancy, and early childhood, while incorporating sustainability in monitoring and evaluation designs, is also recommended. There is emerging evidence that indicates effects on wasting operate through improvements in child diet and reductions in morbidity in some contexts.

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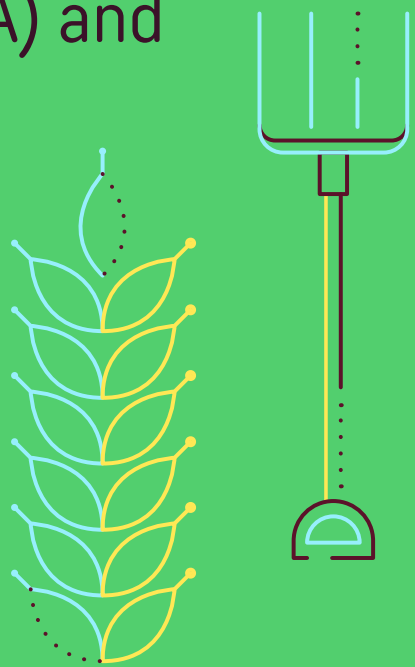
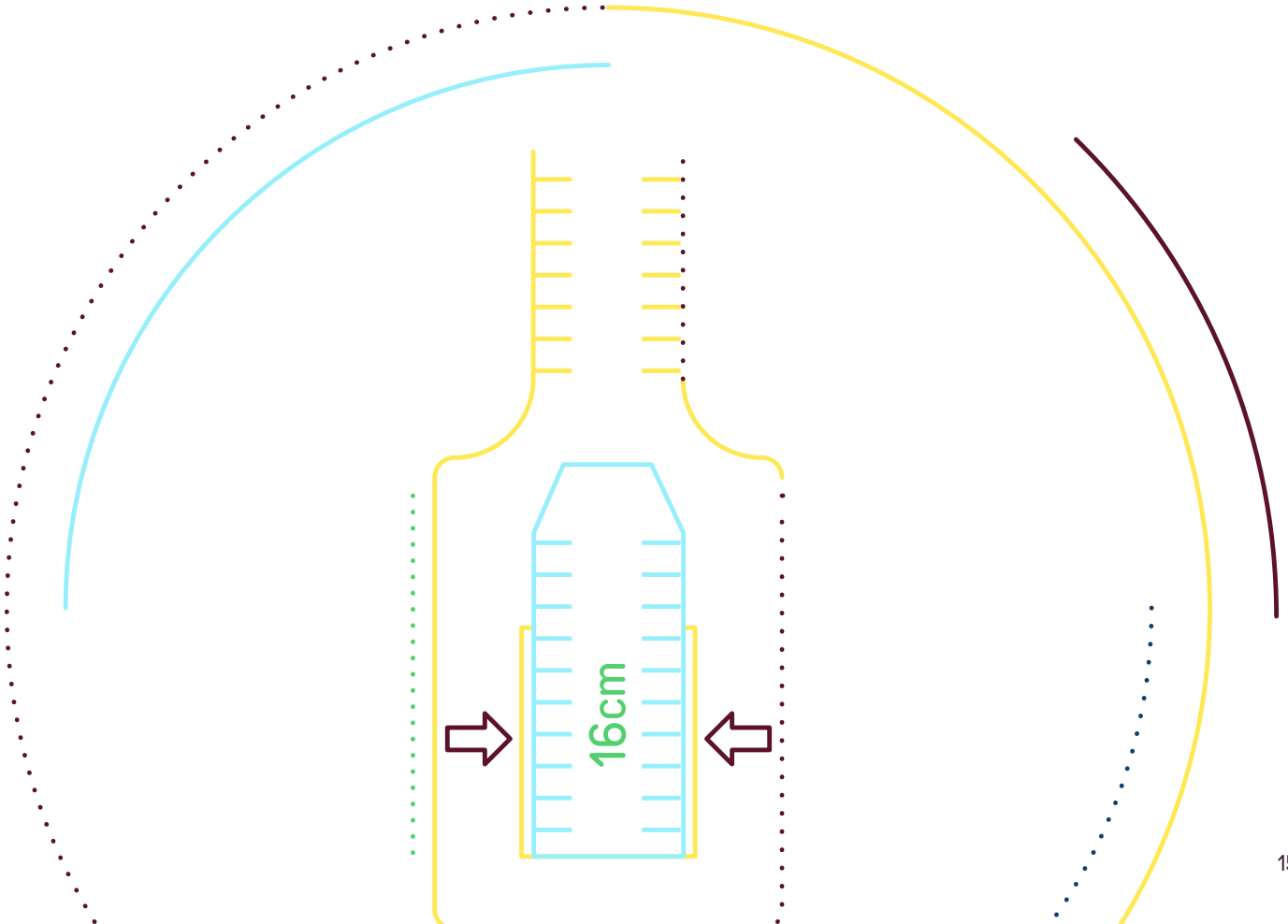


EXECUTIVE SUMMARY

Conclusion and next steps

In general, when looking at the state of evidence on the prevention of undernutrition with multi-sectoral interventions (provided as single interventions or in packages of support), this review found a growing body of evidence in nearly all of the intervention areas investigated, and high-quality evidence in some areas. It is important to note however that in many areas, evidence is drawn from studies implemented outside acute humanitarian contexts (although most evidence does come from populations in LMICs that suffer food insecurity), and this should be considered when applying findings from this review to development of guidance. The duration of intervention needed to see preventive impacts depends on the outcomes studied and the intervention type. This is also an important consideration for the prevention of undernutrition across different food-insecure/humanitarian contexts eg, immediate acute crisis versus long-term protracted.

Whilst some areas are under-evidenced, we conclude that this shouldn't necessarily exclude them from any guidance development process at this stage, especially if they form part of an essential package we have long known to be important for maternal and child health (see Figure 1) and if they come out strongly as important during the consultations that will support next steps. Work linked to these next steps should discuss caveats to acknowledge that more evidence in some areas would help to strengthen understanding of the most effective and cost-effective combinations of interventions needed to prevent undernutrition in different contexts. The future testing and evaluation of any guidance developed (that is planned for the next phase of work under this Elrha project) could help to provide some of the additional evidence needed.



1. INTRODUCTION

INTRODUCTION

According to the 2023 edition of the Global Report on Food Crises (WFP, 2023), there are currently 258 million people across 58 countries and territories facing acute food insecurity at crisis or worse levels (IPC/CH Phase 3-5), up from 193 million people in 53 countries and territories in 2021, with children under-five accounting for at least 30 million. These children are particularly vulnerable to all forms of undernutrition – wasting, stunting and micronutrient deficiency – all of which increase mortality and impede development. Only 1-in-3 of children with severe wasting receives treatment (UNICEF, 2022). Women too are particularly vulnerable to undernutrition in food-insecure and fragile contexts. Poorer regions have a disproportionate share of adolescent girls and women with underweight and anaemia; South Asia and sub-Saharan Africa are home to two in three women with underweight and three in five adolescent girls and women with anaemia globally (UNICEF, 2023b). Not only does this have devastating consequences for women but also for their children – increasing risks of stillbirths, newborn death, low birthweight and multiple forms of undernutrition through childhood (UNICEF, 2023b).

Given all the above, the reduction of the incidence and prevalence of all forms of undernutrition, particularly among women and children, through accelerated efforts to prevent new cases, is paramount. We have long known what women and children need to stay healthy and free from malnutrition ie, access to nutritious food, healthcare that treats and prevents infection, a healthy WASH environment and maternal and infant health, care and feeding practices that support health and nutrition (Bhutta et al, 2013). Yet, 'how' we ensure these needs are met at scale, particularly in fragile settings, remains a challenge. This was underlined by a recent consultative process led by Elrha's Research for Health in Humanitarian Crises (R2HC) programme which identified that there is no agreed, evidence-based operational package of interventions for the prevention of undernutrition being implemented in food insecure/humanitarian settings.

In response, this research project aims to develop and test packages of multi-sectoral preventive interventions designed to prevent undernutrition in humanitarian contexts of increasing food insecurity.

Jump to contents

The project objectives are:

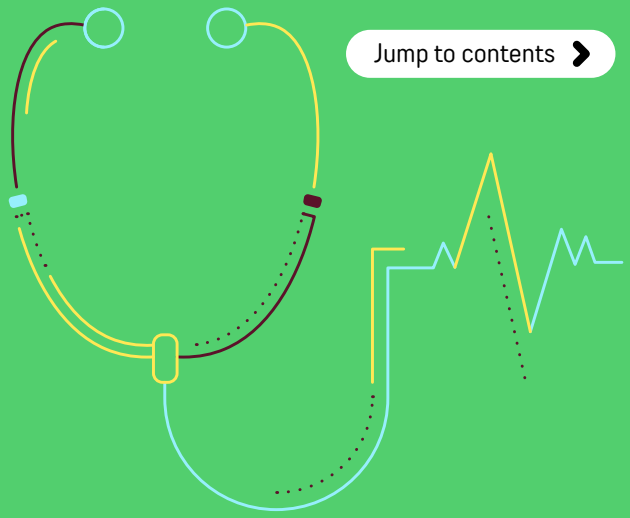
To conduct an evidence review to synthesise the literature for the prevention of undernutrition for children less than five years, adolescent girls and PBWGs in food-insecure/humanitarian settings.

To define multisectoral preventive package(s) for children and PBWGs that is/are evidence-based, practical and responsive to need across different humanitarian policy and programming contexts.

INTRODUCTION

This report presents findings of the evidence review and aims to map the evidence base for single, bi- and multi-sectoral interventions that aim to prevent undernutrition (wasting, stunting and micronutrient deficiency) in humanitarian contexts (ie, contexts of food insecurity or at high risk of food insecurity), synthesize the state of knowledge, and highlight knowledge gaps that need further research. It has built on a large body of existing work that has recently drawn together a lot of the evidence around the prevention of wasting including a 2018 evidence synthesis published by the United Kingdom's Foreign, Commonwealth and Development Office's Maximising the Quality of Scaling Up Nutrition Plus (MQSUN+) project (Emergency Nutrition Network [ENN], 2018); a 2021 technical brief published by ENN (Sadler, Sessions, N. and Khara, T., 2021); the United Nations Agencies Global Action Plan (GAP) on Child Wasting and linked action plans at country level (ENN, 2021); WHO's recent guideline development process on wasting prevention and treatment that includes the development of systematic reviews (WHO, 2023b); a 2023 evidence review commissioned by WFP, on the prevention of wasting with interventions that address food related needs (ENN, 2023); and UNICEF's approach to the prevention, early detection and treatment of child wasting outlined in documents such as 'No Time to Waste' (UNICEF, 2022) as well as a UNICEF guidance update for PBWGs in humanitarian contexts.

Jump to contents



1.1 Objectives of the review

The objectives of this evidence review are to: Summarise the evidence base for interventions that could support the prevention of undernutrition among children under five, adolescent girls and PBWGs in humanitarian/food-insecure contexts[1]. Sub areas of investigation will include:

- Considerations (the role and effects) linked to seasonality in preventing undernutrition.
- The role of SBC in preventing undernutrition as part of an intervention package.
- The value of approaches that deliver 'packages' of interventions[2] that address more than one pathway or driver of undernutrition (versus standalone)
- Understanding of factors on intervention impact pathways that can limit or improve impacts on nutrition outcomes. These include factors such as gender equality, women's empowerment and SBC
- Understanding of the key issues around operational factors that can limit or improve impacts on nutrition outcomes. These include factors such as intervention coverage, ration size, feasibility, acceptability, choice of delivery platform and existing capacity and programmes.
- Highlight knowledge gaps that need further research and the implications of these for the design of multi-sectoral preventive package(s) for children and PBWGs.

1 Recognising that some evidence from 'development' settings may provide important learning for humanitarian settings.

2 For this review we will define 'package' of interventions as two or more interventions delivered together that address more than one pathway or driver of undernutrition in the same population (multi-sector). Two or more interventions delivered together that address the same pathway or driver of undernutrition (eg, the addition of SBC) will be discussed under relevant intervention areas.

Jump to contents

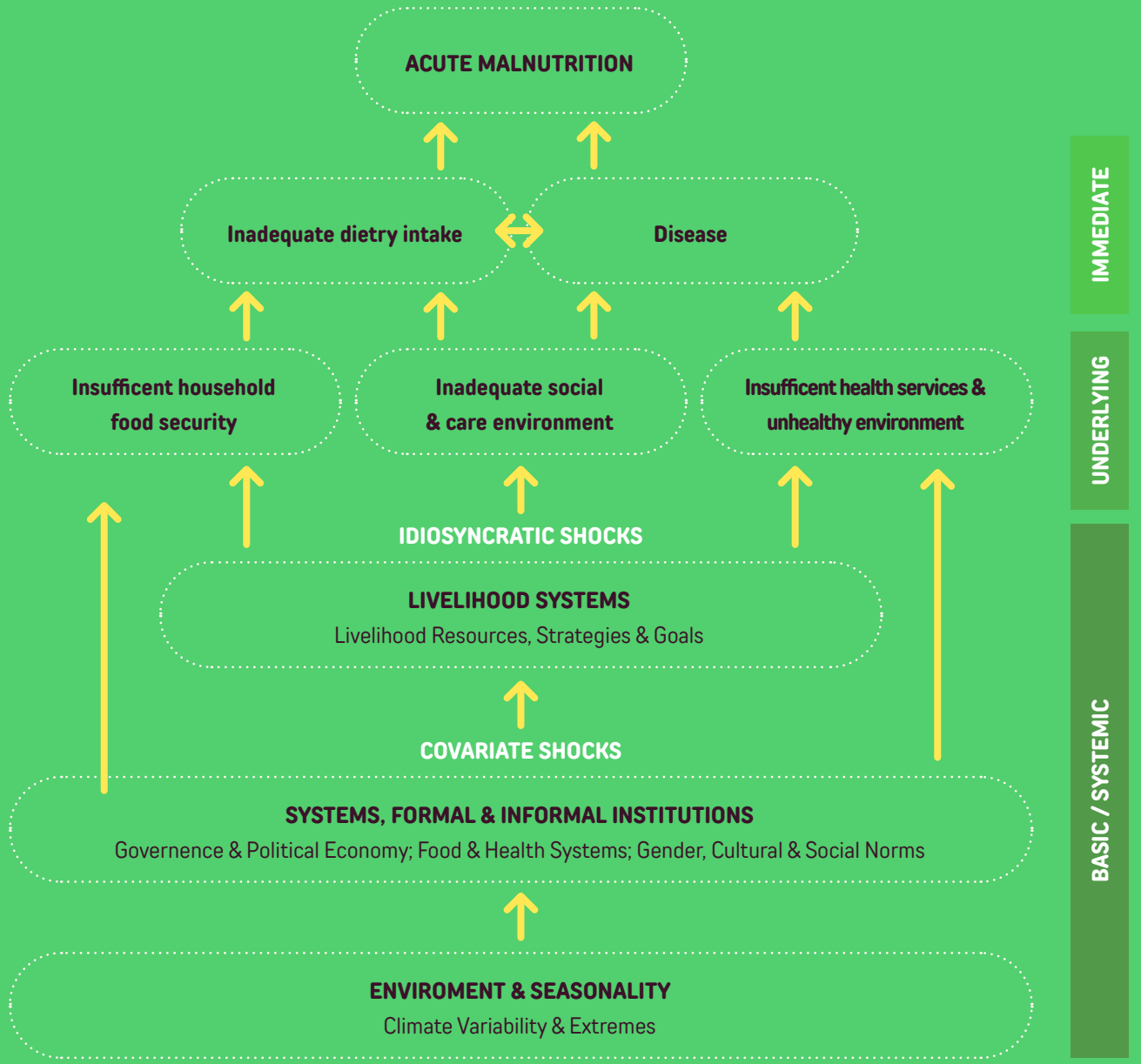
2. METHODS

METHODS

In order to maximise relevance of review findings for the prevention of undernutrition in humanitarian contexts (ie, contexts of food insecurity or at high risk of food insecurity), the review drew on causal models of undernutrition adapted for food-insecure contexts such as The Feinstein International Center's recent update of the UNICEF Framework (Young, H., 2020) (Figure 1), to highlight key factors such as seasonality as important considerations for undernutrition in these contexts. These conceptual models were used to guide the sectors and interventions of most relevance to be covered by this evidence review.

Jump to contents

Figure 1: Nutrition in Africa's Drylands



Source: Feinstein International Centre, Tufts University, 2020

METHODS

2.1 Eligibility Criteria

Table 1 below summarises the criteria that were used to select studies for inclusion in the review.

Category	Inclusion Criteria (for each category any of below)	Exclusion Criteria
Types of studies	Experimental studies eg, RCTs, quasi-experimental Observational studies eg, cohort, cross-sectional, case-control Systematic reviews Meta-analyses Narrative reviews Evaluations	
Intervention/exposure	Household assistance programmes that include measurement of at least one of the outcomes of interest Any targeted intervention in children (<5 years), adolescent girls or PBWGs that include measurement of at least one of the outcomes of interest	Interventions that do not include measurement of at least one of the outcomes of interest
Outcome: Wasting incidence/ prevalence, stunting prevalence, MND prevalence, infant birth outcomes, dietary diversity	WFH <-2 z-scores; WFL <-2 z-scores; HFA <-2 z-scores MUAC < 12.5cm Fe and Vit A deficiency LBW MDD-W/HHDD/Child DD	
Date of publication	2013-current[3]	Pre-2013
Publication status	Articles that have been peer reviewed Articles/reports that have not been peer reviewed but are considered relevant and of good quality[4]	Articles/reports that have not been peer reviewed and not deemed good quality
Language of publication	Articles published in English and Frenc	Articles published in languages other than English and French
Country	LMICs (as per world bank classification of 2022)	
Study participants	Human participants including women and children	Non-human participants (eg, animal or in-vitro models)

3 A ten-year limit has been chosen to fit resources and time available for this scoping review. There may be some older work of relevance, but reviews included in the timeframe will likely cover much of this. In addition, we can ask some key stakeholders (with knowledge of this) which work (pre 2013) is most valuable here.

4 'Good quality' defined broadly as using a known study or evaluation design, conclusions that are based on results and that discuss the role of bias or gaps in data in relation to findings.

METHODS

2.2 Information sources

The review drew on both the academic and grey literature. We prioritised building upon existing systematic and narrative reviews, through a 'review of reviews' approach that also incorporated any individual study or evaluation that was noteworthy, added specific learning of value and/or that was not included in any of the reviews.

Key stakeholders and contacts known to be actively working on the prevention of undernutrition and food insecurity in humanitarian contexts were contacted early in the review process to support identification of relevant key published and grey literature, including country experience of prevention programming. The full list of organisations contacted can be found in Annex 1.

A rapid literature search using the online libraries of Google Scholar[5], PubMed, WHO, FAO, WFP, UNICEF, ENN, International Food Policy Research Institute (IFPRI), USAID's Nutrition Resource Hub, Bill and Melinda Gates Foundation (BMGF, ALNAP, Evidence Aid, Research for Development (R4D), FCDO Development Tracker and the GNC/food security cluster/ WASH cluster resource banks supplemented the literature sourced through existing reviews and stakeholder networks.

We also drew on literature and learning generated in the areas of social protection, stunting prevention, cash for health, and from Nutrition Advisory Services for the EU (Capacity for Nutrition, C4N[6]), USAID and World Bank publications.
We used a snowball approach, reviewing the citations of the articles identified in our online search, to find any relevant newer articles within our search timeframe. Both the search strategy and the eligibility criteria were guided by the Population, Intervention, Comparison, Outcome (PICO) framework to delineate the questions of focus for the review and to define inclusion and exclusion criteria. The PICO is presented in Annex 2 along with details of the search strategy.

2.3 Search Strategy

The search used indexing terms, including MeSH terms, keywords, and free text words (see Annex 2).

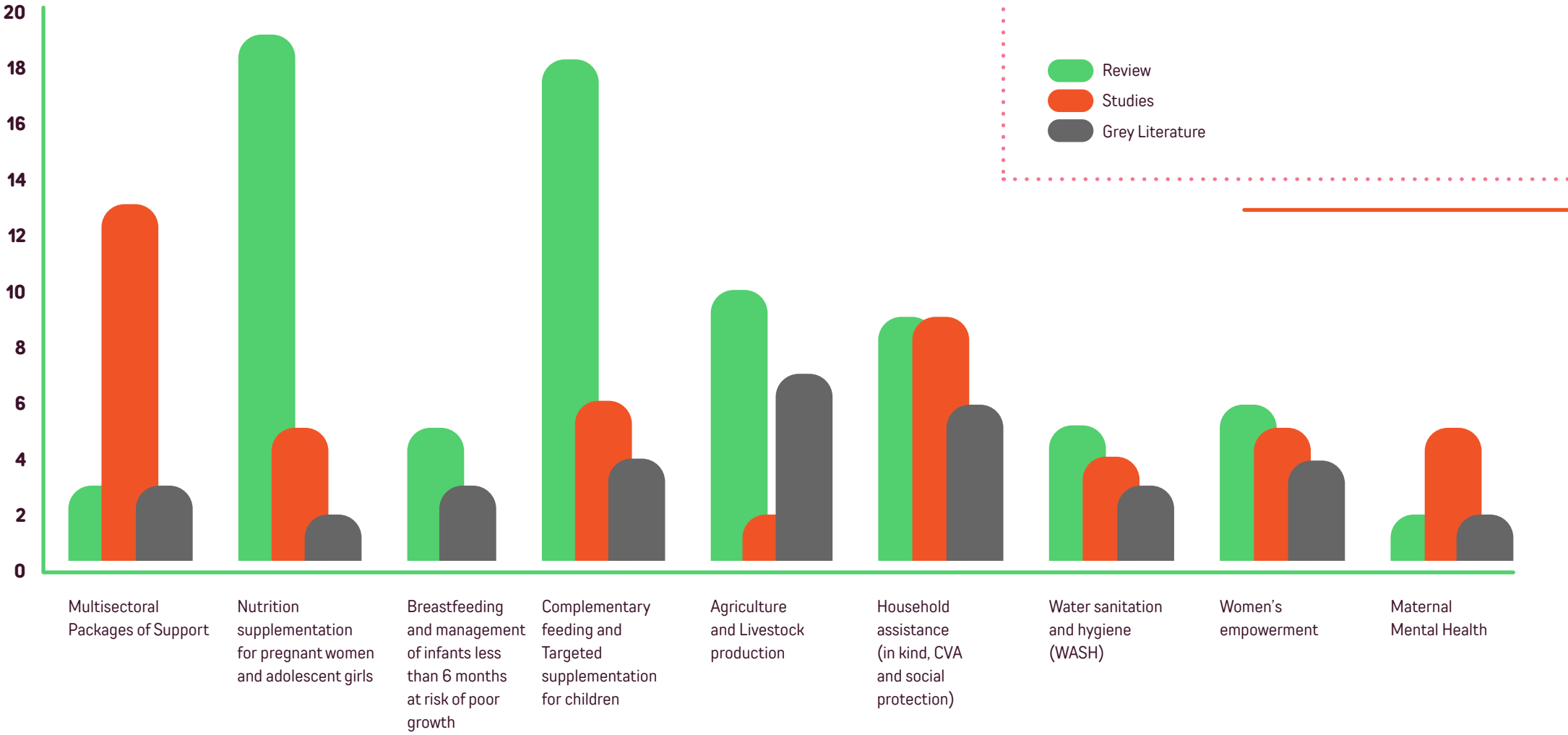
A review of the first ten pages of each online library was deemed sufficient to maximise relevance and reduce repetition. A total of 80 pages in both PubMed and Google Scholar were therefore reviewed, which was around 800 articles excluding the grey literature. Following screening of titles and abstracts and the exclusion of irrelevant papers and duplicates, we ended up with circa 300 papers plus an additional 90 references from our contact with stakeholders and grey literature search. During the data extraction process the full text was examined in more detail, allowing for further exclusion of some papers, including studies that were well-covered by systematic review papers. We ended up with 164 papers (including those that provided evidence for the synthesis as well as more general background papers) to cite in the review. Figure 2 below presents the key literature cited for evidence by type of study and intervention area. Some of the review articles were used as evidence for more than one intervention area and therefore the sum of the totals shown in the figure is more than the total number of references used as evidence across interventions areas.

5 Google Scholar is now the biggest academic database and search engine (8) and has been shown to have similar recall to PubMed for both overall search results (71% vs 69%) and full-text results (43% vs 51%) (9). Importantly it has also been shown to return the most complete search results that covers a breadth of literature including that found in the grey literature. Accessing this literature is considered important for this review.

6 Note that two team members – Rebecca Brown and Tamsin Walters – are consultant experts within C4N.

METHODS

Figure 2: Key Literature cited by type of paper



METHODS

2.4 Study Selection

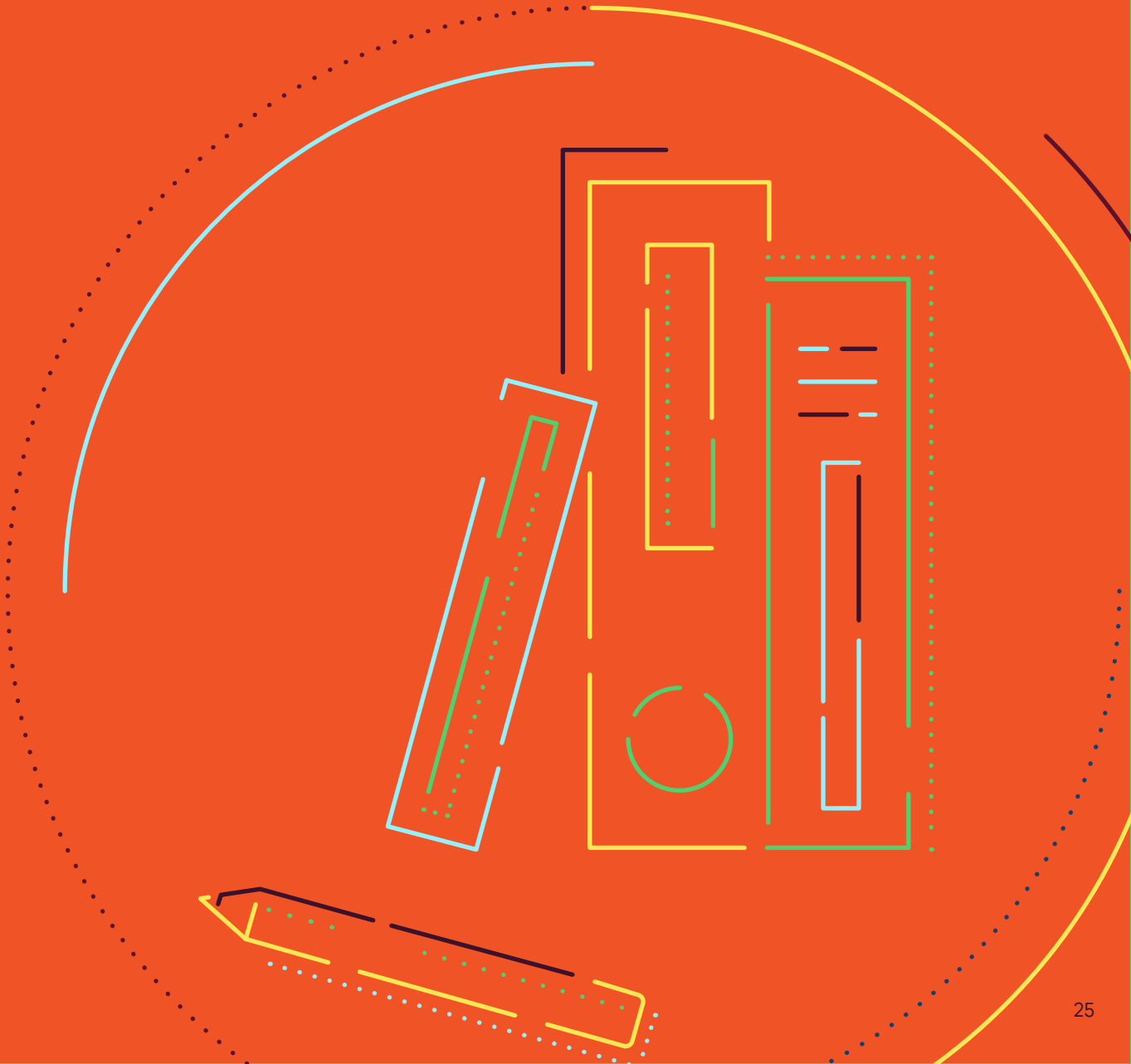
References were managed using Zotero. Screening of titles and abstracts identified was performed by a single reviewer (RA). All the search results (ie, titles and abstracts) were assessed based on the inclusion and exclusion criteria to eliminate irrelevant/duplicate studies by two reviewers independently (RA and KS). This was followed by a full-text screening conducted according to the same inclusion/exclusion criteria to determine studies that meet the criteria and to flag studies that are well covered by systematic review papers. Articles were excluded if the study did not match our search criteria in terms of population, intervention or outcomes. Any uncertainty regarding the criteria was resolved between the two reviewers.

2.5 Data Management and Extraction

Zotero software was used to file and organise literature retrieved. To support analysis and compilation of data extracted from the literature we used a standardized data extraction sheet incorporating a numerical summary and qualitative thematic analysis organised by themed 'tags' used in the literature database. The data was extracted and entered into the extraction form that was produced for this purpose. We pilot tested the sheet using five randomly selected studies to assess replicability and applicability. The data extracted included specific details including the title, authors, year of publication, year of intervention, country (and context), study characteristics, intervention (including type, timing, duration), outcomes assessed, and main findings. Operational factors, ie, those linked to intervention design, delivery etc, were also included in the table where available. Where a reviewer was uncertain over the quality of any of the studies extracted, the second reviewer was consulted for a second opinion.

Jump to contents

3.RESULTS



RESULTS

Findings of the review are organised by intervention type, starting with nutrition sensitive interventions relating to community and household assistance: food, cash and vouchers, social protection, agriculture/livestock production and WASH and health services. Targeted nutrition support for women and children through nutrition-specific interventions are then addressed, including the evidence linked to the value of addressing women's empowerment and maternal mental health. The final section examines the evidence available for multisectoral packages of support. The value of SBC is addressed under each of the intervention areas because it is rarely delivered as a standalone intervention.

3.1 Community and household level assistance

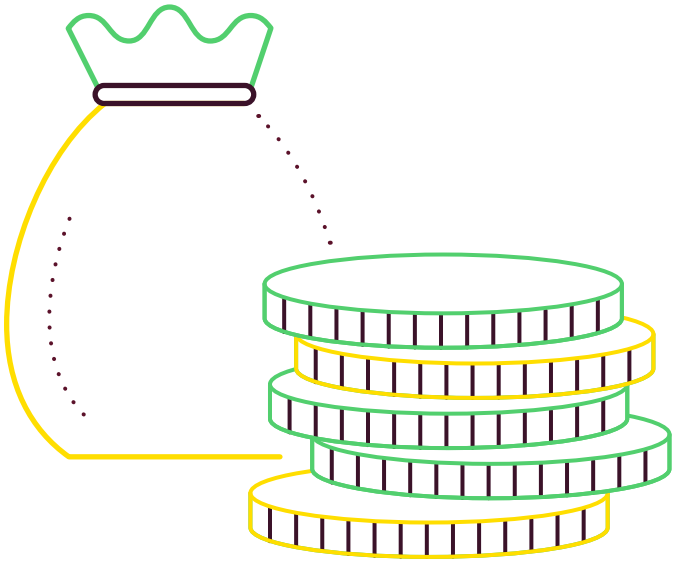
Household-level assistance programmes, such as those aimed at increasing home food production (eg, kitchen gardens) or those aimed at protecting assets and livelihoods, such as general food assistance programmes (eg, CVAs and in-kind assistance), are often targeted at crisis-affected and vulnerable households and individuals to address food needs. However, these programmes on their own may not be enough to prevent wasting, either because the causes of wasting are not linked only to food insecurity at the household level and/or because these programmes do not tackle food insecurity sufficiently; ie, they do not address important barriers, such as the causes of food insecurity, as well as intra-household dynamics and sharing, inequalities in decision-making, lack of cooking facilities, lack of knowledge on food storage and safety, and competing non-food expenses (eg, on health) (ENN, 2023).

While the main objectives of household-level assistance often focus on addressing household food insecurity and are not primarily designed to address malnutrition at the individual level, there can be spill-over effects onto nutrition outcomes. This review of the evidence specifically examines the impact of household-level assistance programmes that have a nutrition objective, on the nutrition outcomes of women and children.

31.1. General food, cash voucher assistance and social protection

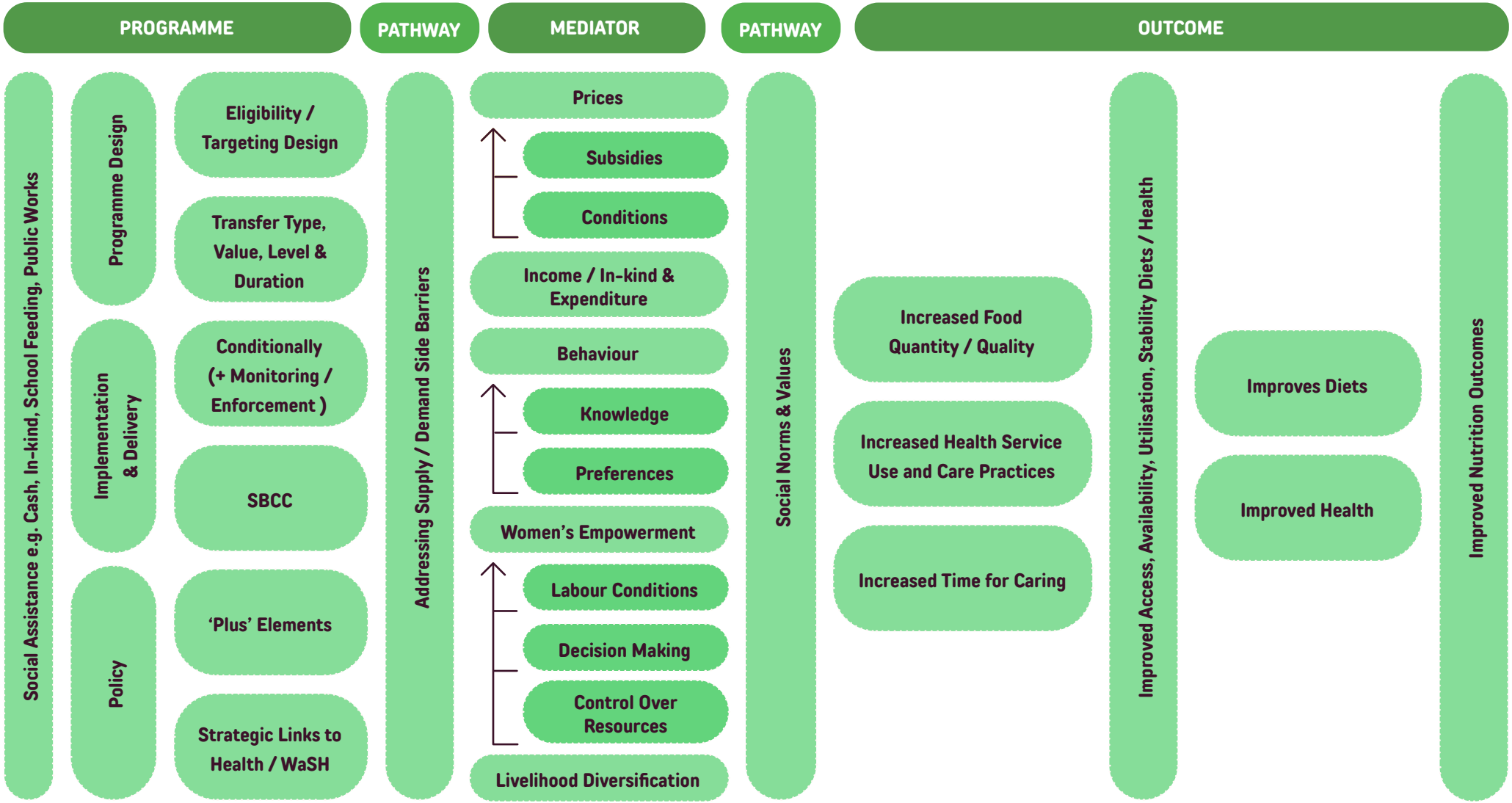
Introduction and impact pathway

Most types of humanitarian household assistance interventions (including in-kind food and cash and vouchers) can effectively improve basic needs outcomes, such as food security, food expenditure, and coping strategies (WFP and the World Bank, 2022). Social assistance interventions such as CVA can have an impact on nutrition outcomes through household incomes and expenditure, behaviours, women's empowerment (eg, increasing control over resources and decision making) and diversification of livelihoods. In turn, these impacts can increase access to and uptake of health and nutrition services, improve household food security and have positive impacts on the diversity and quality of women and children's diets in some contexts. This can lead to improvements in the nutrition status of women and children under five years of age, as measured by anthropometric status (TASC, 2021).



RESULTS

Figure 3: Indicative pathways from social assistance to nutrition



Source: TASC 2021, adapted from Alderman 2015

Evidence summary

Child wasting and stunting

An ENN (2023) review observed limited evidence of an impact of CVAs on child wasting, despite their popularity as a food assistance approach in humanitarian settings. Four reviews indicated a (small) positive impact of CVAs on wasting (Little et al, 2021; Olney et al, 2021; Manley, Alderman and Gentilini, 2022; van Daalen et al, 2022) (van Daalen Conditional Cash Transfer (CCT) only), although questions were raised around the viability of pooling results of such heterogeneous studies which showed mixed results from different types of CVA modalities.

One review found a lack of impact of unconditional cash transfers (UCT) on acute malnutrition in humanitarian settings (van Daalen et al, 2022). Another review (UNICEF, 2020a) identified the provision of CVA together with specialised nutrition foods as 'a promising strategy' for preventing malnutrition, whilst Olney (Olney et al, 2022) found that the provision of in-kind transfers (with fortified foods) was more effective than CVAs alone in terms of their impact on children's weight-to-length Z-score (WLZ)/weight-to-height Z-score (WHZ). However, USAID's Advancing Nutrition Desk Review (USAID Advancing Nutrition, 2023c), which focused principally on development settings, suggested that cash alone is as effective as 'cash plus' programmes (cash with nutrition behaviour change communication or food transfer) at reducing the odds of wasting (but acknowledged the findings of Little et al (2021) in crisis situations). Some of the reviews included in the ENN (2023) review also looked at impacts on stunting: Olney et al (2021) found that agriculture asset, cash and in-kind transfer programmes had positive impacts on increasing height-for-age Z-score (HAZ) (33-45% of study arms), with impacts of in-kind programmes limited to the first 1,000 days, while Manley (Manley, Alderman and Gentilini, 2022) observed small improvements in linear growth among young children as a result of cash transfers, and Little et al (2021) suggests that cash combined with food transfers has greater impact than cash alone on preventing stunting and wasting. Another review (Durao et al, 2020) highlights that UCTs and food vouchers potentially have an impact on reducing stunting, whereas CCTs do not appear to have any impact on either stunting or wasting.

Olney et al (2022) recommends that where CVA programmes aim to reduce malnutrition, they should consider targeting women and/or young children, including both household and individual transfers of fortified foods/supplement and/or behaviour change communication.

Although findings of individual studies considering the impact of different CVA modalities on wasting and stunting are mostly synthesised within the reviews listed above, this review has identified some additional findings of interest with relation to the impact of Social Assistance Programmes (SAPs)/CVAs. The Tubaramure programme in Burundi (Leroy, Olney, et al, 2021) found a significant protective effect of food rations on wasting, although this was limited to children from the poorest households, with the largest effect observed in children 6–12 months of age. An impact evaluation of the Cash for Nutrition Programme in Yemen (IFPRI, 2019), which targeted mothers during the first 1,000 days, providing cash plus nutritional training, also observed improved nutritional status in the poorest third of households. Kurdi et al (Kurdi, 2021) observed statistically significant impacts on HAZ of the same programme, and recommended the increased use of cash transfers for supporting child nutrition in protracted crisis contexts. In a study on the synergetic effect of cash transfers and child-sensitive social protection programmes (targeting poorest and most marginalised households with young children) in Nepal, Renzaho et al (Renzaho et al, 2017) observed a reduction in the prevalence of stunting, wasting and underweight among children under five, with greater intervention impact on stunting (and wasting) for boys than girls, although no impact was observed among younger children (under 24 months), resulting in a recommendation to embed cash payments for households into IYCF initiatives to improve outcomes among younger children.

Kerac (Kerac and Seal, 2014) found the risk of malnutrition to be greater in single intervention groups versus combination-intervention groups, whether the single intervention was cash or supplementary food for children, whilst the evaluation of the NICHE programme in Kenya (Guyatt, H et al, 2020) found no measurable impact on any anthropometric indicator of cash/supplements/family food rations in any combination. The NICHE programme did however see a significant positive impact on some immediate and underlying determinants of undernutrition, including minimal acceptable diet, treatment of drinking water, use of household handwashing facility, optimal complementary feeding; early initiation of breastfeeding; and exclusive breastfeeding. Fenn (Fenn et al, 2015) emphasises the importance of knowledge of risk factors for malnutrition in a particular setting, for the effective design of appropriate

cash transfer interventions, in order to safeguard the living standards of the most at-risk households. Hoddinott (Hoddinott et al, 2020) found that household receipt of an electronic voucher instead of a food ration in Bangladesh was associated with improvements in linear growth of children between 6 and 23 months. In rural Togo one study (Briaux et al, 2020) observed a protective effect of UCTs targeting the first 1,000 days of a child's life, noting the combined contribution of simultaneous positive effects on various immediate, underlying and basic causes of malnutrition.

Micronutrient deficiency

Olney et al (2021) found some limited evidence of cash transfer interventions having impacts on increasing women's nutritional status including BMI and haemoglobin concentration (Hb), although a slightly later review (Olney et al, 2022) observed that in-kind transfers (with fortified foods) were more likely to significantly increase women's and children's Hb and decrease anaemia prevalence than cash transfers. Fenn (Fenn et al, 2017) observed a negative impact of Fresh Food Vouchers (FFV) and standard cash (SC) on Hb concentration and an increase in anaemia in FFV recipients (mothers were twice as likely to be anaemic) in an impact evaluation of different cash-based intervention modalities on child and maternal nutritional status in Sindh Province, Pakistan. This effect could be due to the potentially restrictive nature of the FFVs.

A review by TASC (2021) found that food assistance programmes (including in kind distribution and CVA) were not consistently effective in reducing anaemia and improving micronutrient status, even when micronutrient-fortified food for children was distributed.

Low birth Weight (LBW)

General food assistance programmes were found to have a positive impact on birth weight and neonatal mortality by one review (Leroy, Koch, et al, 2021), although reviewers noted the questionable quality of the studies included.

A trial in Nepal considering the impact of Participatory Learning and Action (PLA) (a type of SBC intervention) in women's groups with/without food or cash transfers (Saville et al, 2018) suggests an increase in birthweight in the PLA plus food arm, although better nutritional status soon after birth did not persist into early childhood. Leroy et al (2021) found that adding a fortified BEP supplement to a PLA behaviour change intervention in Burundi was likely to increase birthweight, and may be more effective than providing a modest amount of cash with PLA or conducting PLA alone.

UCTs targeting the first 1,000 days also had a protective effect on children's birthweight and linear growth in rural areas of Togo (Briaux et al, 2020).

MDD-W/HHDD/Child DD

There is evidence that CVA at household level can improve dietary diversity of both women and children (ENN 2023; Durao et al, 2020; TASC, 2021; van Daalen et al, 2022; UNICEF, 2020a) by increasing household incomes, with transfer size and type being a significant factor determining outcomes (Trenouth et al, 2018; TASC, 2021; Manley, Alderman and Gentilini, 2022). Existing evidence suggests greater impact on household food security of UCTs, compared to CCTs (Durao et al, 2020; van Daalen et al, 2022).

However, the Cash for Nutrition Programme in Yemen (IFPRI, 2019; Kurdi, 2021) found that purchase and consumption of non-staple foods with CCTs had a large positive effect on child dietary diversity scores as well as on women's dietary diversity, with the greatest effect among the poorest tercile of households, where transfers were largest in relation to baseline household food budgets.

One review (Pega et al, 2017) describes the likely impact of UCTs on health outcomes including individual level disease status, food security and dietary diversity and concludes that UCTs may improve all three outcomes.

Olney et al (2021) found clear evidence of positive impacts of nutrition-sensitive social protection programmes on women's and children's diet-related outcomes, including improvements in intakes of micronutrient-rich foods and dietary diversity among women and children, with more pronounced impacts among women compared with children. Provision of in-kind transfers can also lead to improvements in household diets as well as women and children's dietary intake (Olney et al, 2022).

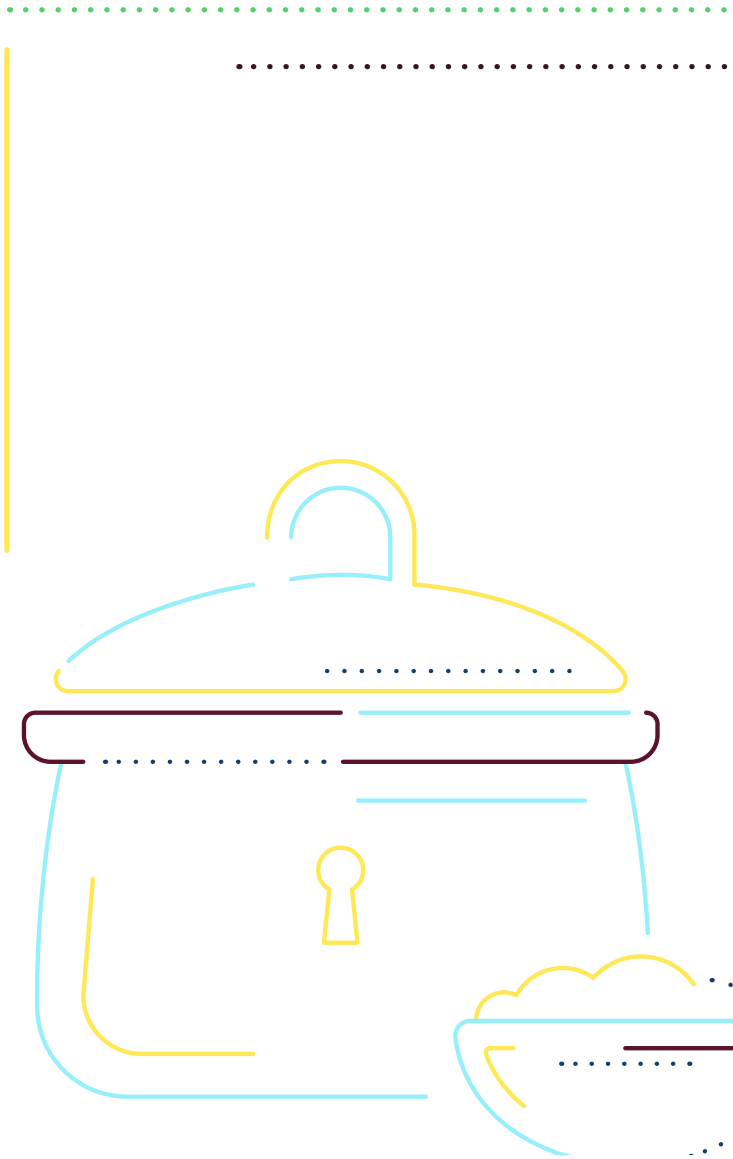
Research gaps

- The current evidence base for CVA and in-kind household assistance is context-specific, mixed and inconclusive. The most important programme design features for achieving impacts on nutrition outcomes is difficult to fully understand from current evidence. The various reviews highlight a need for evidence generation through better-designed evaluations and consistency in programme and evaluation designs across different programmes and contexts (Olney et al 2022; ENN 2023). For example, only a limited number of studies evaluate the effectiveness of cash-plus programmes versus cash alone, highlighting the need to identify effective 'plus' components and models of how cash-plus programmes are designed and implemented (Little et al 2021).
- Only a few studies have assessed impacts of nutrition-sensitive social protection interventions (including food transfers and CVA) on women's nutritional status, with none showing a positive impact on anthropometric outcomes, and a few suggesting potentially negative impacts on women's BMI in contexts where prevalence of overweight and obesity is high (Olney et al 2021)
- There is a need for more data to better understand food assistance impact pathways, as well as negative impacts, such as excess weight gain in pregnancy and reduced birth spacing (Leroy, Koch, et al, 2021).

3.1.2 Agriculture/livestock production and income generation

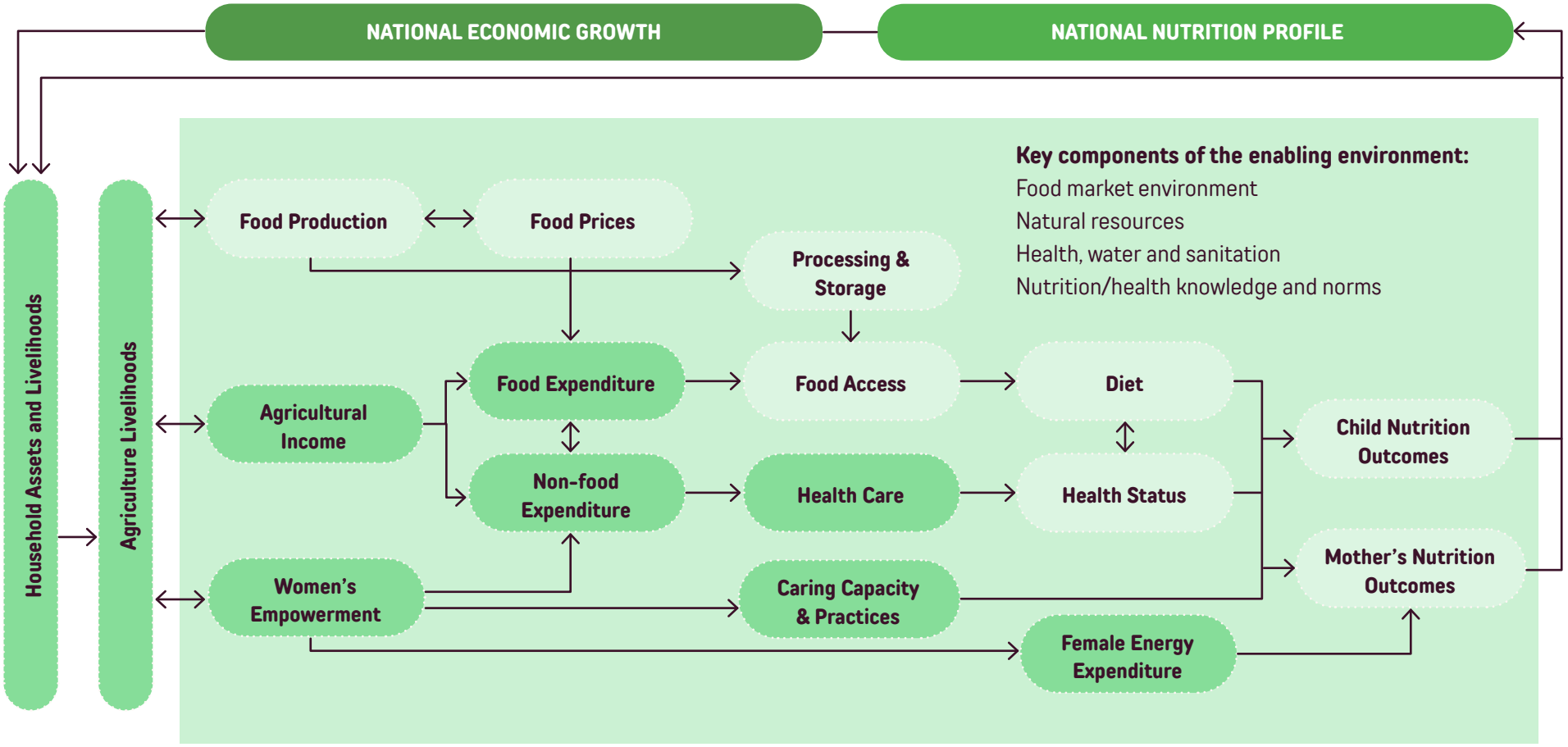
Introduction and impact pathway

The main pathways from agriculture/livestock production and income generation to delivering nutrition outcomes work either through 'own production' (for own consumption) to increase the household supply of nutrient-dense food, or more indirectly through 'income' from sales of produce or other income-generating activity for food or non-food expenditure. Women's empowerment, which impacts how food and income are used, caring practices in the household and her own nutrition, is also understood to have an important influence on outcomes along these pathways – this is discussed in section 3.2.3 below. Whilst Figure 4 below was developed to represent how nutrition is impacted through agriculture/livestock production, the 'Agricultural income' pathway shown here could represent any income generated through agricultural and non-agricultural activity.



RESULTS

Figure 4. The food production-income generation pathway



Source: SPRING, 2014

All three pathways depicted in Figure 4 are interrelated and are expected to influence dietary diversity and access to health and care practices that could drive improvements in nutritional status. Nutrition-sensitive action that increases the supply of diverse home food production and supports income generation is therefore warranted. However, both the feasibility of these actions and the assumption that the same theories and impact pathways can be applied to nutritionally vulnerable populations versus more stable settings needs to be further examined (Baliki et al, 2023).

Evidence summary

While the evidence for the impact of household food production (either agricultural or livestock) on nutritional status is mixed, the seven reviews identified all highlighted significant improvements in dietary diversity in children including in intakes of a range of micronutrients (eg, iron, vitamin A, thiamine and riboflavin) (Girard et al, 2012; Olney et al, 2021, 2022; Sharma et al, 2021; TASC, 2021; Bassey et al, 2022; Margolies et al, 2022). Reviews also highlighted improvements in diet diversity among women, including an increase in vitamin A intake (Girard et al, 2012; Olney et al, 2021, 2022; Sharma et al, 2021; TASC, 2021). Overall, the evidence supports a very limited impact on women's and child nutrition status (ie, stunting, wasting and/or underweight), although there may be some small effects among children on stunting and on wasting (Bassey et al, 2022), and among women on improved BMI and underweight (Sharma et al, 2021). While the impact on nutrition status in children from the meta-analysis by Girard showed 'no overall effect', some individual studies did show significant improvements in child malnutrition (Girard et al, 2012). In these studies, the focus was on the production of foods that were rich in both macronutrients and micronutrients and the interventions included strategies that promoted orange-flesh sweet potatoes and legumes or included animal production. Other more recent reviews have also noted that nutrition-sensitive agriculture interventions may be more likely to impact child wasting if they increase production of micronutrient-rich foods along with foods high in energy or protein (USAID Advancing Nutrition, 2023b).

There is a growing body of work that has focussed specifically on the provision of livestock feed to households in food-insecure pastoralist populations with the aim of sustaining milk access for women and children over the dry season (Sadler, K. et al, 2012; FAO, 2022; Mulei,M, Nyamai,,M, and Mwangi,T, 2022). It has shown positive effects on sustaining milk production, the availability of milk at the household level, an increased frequency and amount of milk consumed and the prevention of acute malnutrition among children and women in pastoralist communities. In Kenya (FAO, 2022), these interventions were shown to be cost-effective for cases of wasting averted, suggesting that these livestock-based interventions could be a valuable tool for addressing the challenge of seasonal spikes in acute malnutrition in drylands Africa. Other work has shown positive impacts of other types of animal husbandry on child nutrition including poultry transfers on consumption of eggs and diet diversity (Alderman et al, 2022). There is also a small amount of published evidence on the impact of income generation projects on nutrition outcomes. One recent review, which included 17 studies on income generation interventions (for example, livestock management or self-help groups), from a range of stable but food-insecure settings, found little or no difference on child stunting or wasting, but that they may improve dietary diversity in children but not for households (Durao et al, 2020). There is ongoing work by Trocaire in Somalia however, that suggests resilience-building and cash grants for business start-ups can improve access to food and essential non-food items and services (eg, sending children to school and accessing basic health services) and can lead to a significant decrease in the rate of admission of children under the age of five into malnutrition treatment programmes (Trócaire, 2023).

With regards to pathways, whilst evidence on production for consumption is most dominant, many studies reported on combinations of more than one pathway to nutrition outcomes, including knowledge-based behaviour change, improved income and women's empowerment (Sharma et al, 2021). Two of the reviews further illustrated the importance of having a

nutrition-focused home food production strategy, whereby a nutrition SBC component had strengthened impact on dietary diversity (Olney et al, 2021; Margolies et al, 2022) and on child wasting (marginal) and anaemia (Olney et al, 2021). One of these reviews found no benefit to diet diversity from agriculture-only interventions (without a nutrition SBC component) (Margolies et al, 2022) and suggests that the SBC components are potentially driving the effect on diets. This is possibly a result of increasing the intent to achieve nutrition-related objectives as well as promoting activities that drive nutrition benefits. USAID's review of agriculture in complex emergencies describes an association between women's, but not children's, diet diversity and participation in agricultural interventions and suggests a need for increased and targeted efforts to improve IYCF practices in addition to improving food access through agriculture (USAID Advancing Nutrition, 2022).

An important characteristic of many of the interventions covered by the reviews discussed above is their duration. The large majority of interventions that focused on support for agricultural production, required, by nature of the production cycle, at least one calendar year (and often two or more) to achieve any measured impacts on diet diversity outcomes (eg, Olney et al, 2015). This may be a constraint in contexts where the need to stabilise a deteriorating food security situation is relatively urgent. One review stated nutrition-sensitive agriculture interventions may be more likely to impact child wasting if they are implemented for longer periods of time (eg, at least four years) (USAID Advancing Nutrition, 2023b).

With regards to factors on intervention impact pathways that can limit or improve outcomes, one review (Sharma et al, 2021) highlighted 11 factors that were seen to influence the effect of nutrition-sensitive agriculture on nutrition outcomes. These included programme participation intensity, programme duration, nutritional status of the target population at baseline, age and sex of children, access to roads, seasonality, agroecology, purchasing power, wealth status, and maternal education.

Research gaps

The extent to which many of these findings can be applied to urgent humanitarian contexts is difficult to assess given the individual studies included in most of the reviews and studies discussed above come from a range of settings and populations. Many of the studies were implemented in African or Asian contexts that could be defined as 'food-insecure', but that were not experiencing an imminent deterioration in food security and nutrition (Bassey et al, 2022; Margolies et al, 2022; Olney et al, 2022). A recent narrative review highlighted the scarcity of evidence on home food production interventions, for example, from more fragile settings (Baliki et al, 2023).

There are significant gaps in the evidence between existing research and the needs and current practices in humanitarian settings. Non-crisis theories and impact pathways of own food production (eg, home garden programmes) might not hold in crises-affected settings. The challenges of these types of programmes in humanitarian contexts eg, insecurity, constraints to land use, poor access to water and veterinary support, knowledge deficits particularly in urban contexts where agriculture/livestock production is less widely practiced, all require better understanding and improved documentation to further knowledge on what is feasible and impactful for nutrition in these settings.

3.1.3 Community level health services

Introduction and impact pathway:

The close relationship between nutrition and health, as described by the malnutrition-infection cycle[7], means that there is a strong case for both health and WASH programming (see next section) to support the prevention of wasting and stunting simultaneously through the reduction of infectious disease, diarrhoea, helminthic infections and environmental enteric dysfunction (EED). The relationship between diarrhoea, infectious diseases such as measles and wasting is fairly well established (Black, Morris and Bryce, 2003; Keats et al, 2021). In addition, we now know that mothers' health characteristics and experiences during pregnancy are critical predictors of wasting and stunting in infants (Mertens, Benjamin-Chung, Colford, Coyle, et al, 2023). Given all this, the separate delivery of health and nutrition services is likely to constrain impacts on nutrition outcomes.

Evidence summary

ANC

Two reviews of demographic and health survey data have led to similar conclusions that the existing and accessed ANC services in LMICs are directly associated with improved birth outcomes and longer-term reductions in child mortality and undernutrition.

A review of data from 193 DHS conducted between 1990 and 2013 from 69 LMICs revealed an association between at least one ANC visit and a 3.8% points reduced probability of giving birth to a LBW baby and a 4.1% and 3.3% points reduced stunting and underweight probability. Having at least four ANC visits and at least a once seen skilled provider reduced the probability by an additional 2.83%, 1.41% and 1.90% points, respectively (Kuhnt and Vollmer, 2017).

Another study focused on sub-Saharan Africa (Adedokun and Yaya, 2021), examined DHS from 31 countries between 2010 and 2018, comprising data for 189,195 children under five. Adverse nutritional status of children was significantly associated with ANC attendance: children of mothers who had never attended ANC were 26% more likely to suffer from wasting; while the odds of being underweight increased by 19% for children whose mothers did not attend ANC. Evidence on IFA/MMS, usually delivered as part of ANC services, is further discussed below.

Immunisation and preventing infection

Prevention of childhood infection, particularly to reduce the occurrence of diarrhoea and measles, has long been supported as an essential component of the prevention of malnutrition. Childhood vaccinations along with routine vitamin A supplementation and therapeutic and preventive zinc supplementation for diarrhoea management are WHO-recommended interventions in humanitarian settings. However, there is limited evidence available for the impacts of these interventions on improved growth outcomes, such as wasting and stunting explicitly (Imdad et al, 2017; Keats et al, 2021) usually because studies have not examined wasting or stunting as an outcome (USAID Advancing Nutrition, 2023c).

The prevention of malaria, either through prophylactic treatment or the distribution and use of bed-nets, has been found to have a positive effect on birthweight, anaemia in pregnant women and child mortality (Keats et al, 2021) and may help to improve the impact of other nutrition specific interventions. A systematic review examining the outcomes of LNS provided with complementary foods to young children (Das et al, 2019), found the largest impact on preventing moderate wasting in one study in which LNS comprised part of a package that included treating malaria and diarrhoea.

7 Malnutrition can make a person more susceptible to infection and infection also contributes to malnutrition which creates a vicious cycle. An inadequate dietary intake leads to weight loss, lowered immunity, cell damage and increased frequency and severity of infection. In turn, infection leads to reduced appetite, impaired absorption of nutrients, weight loss and slowed growth and development in children.

Jump to contents

Integrated Management of Childhood Illness (IMCI) is an approach to deliver treatment for the main causes of under-five mortality using a case management approach. Integrated Community Case Management (iCCM) is an extension of IMCI in which treatment is provided at the community level by community health workers (CHWs). A 2016 Cochrane review found that IMCI programmes may reduce child mortality and infant mortality, but they had little or no effect on nutrition outcomes and immunisation coverage (Gera et al, 2016). A 2019 review on the integration of nutrition into iCCM/IMCI found no statistically significant differences in health outcomes (Salam, Das and Bhutta, 2019). A 2021 review likewise found that integration of nutrition in IMCI/iCCM could enhance complementary feeding practices but did not have an effect on exclusive breastfeeding, stunting or wasting (Abdullahi et al, 2021).

Research gaps

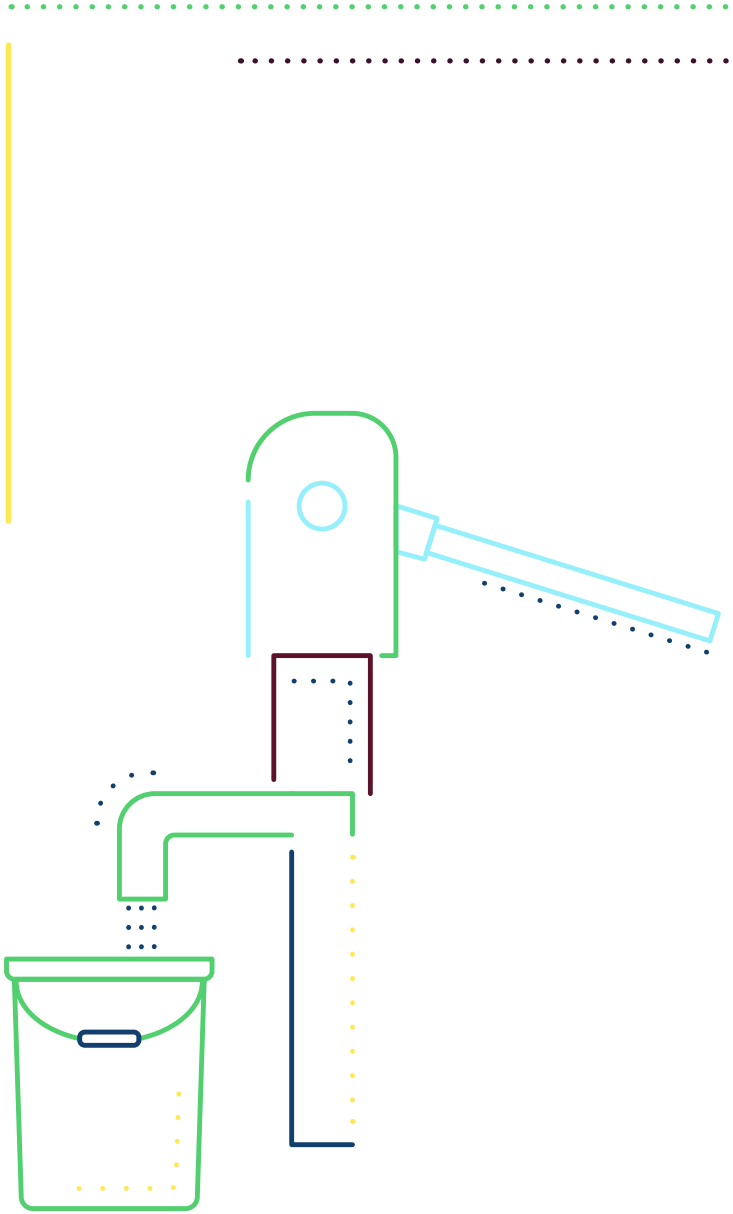
Most studies of the effects of ANC have been limited to direct short-term maternal and child delivery outcomes and there remains limited, contextual evidence on the nutritional outcomes for mothers and infants of the package of care provided. The two studies cited here used cross-sectional DHS data, and as such, the analysis does not allow a causal interpretation of the results. Furthermore, data availability in those studies restricted the investigation of the association of disaggregated quality indicators of ANC with the outcome variables. These are areas that merit further exploration.

Access to health services and uptake by marginalised women and children continues to merit consideration in studying the role of immunisation and disease control in achieving nutrition outcomes. Zero-dose children – those who have received no vaccinations – are often highly vulnerable, with few connections to routine health services. Studies have yet to focus more consistently on the equity of approaches in terms of examining how integration of immunisation and nutrition action could be combined to reduce the number of zero-dose children as well as those stunted and wasted. A recent paper calls for a learning agenda for reaching communities with high numbers of zero-dose children and high rates of malnutrition through an increased supply of integrated services combined with improved demand generation using evidence-based approaches (Davis, Rana and Sarriot, 2023).

3.1.4 Community level WASH services

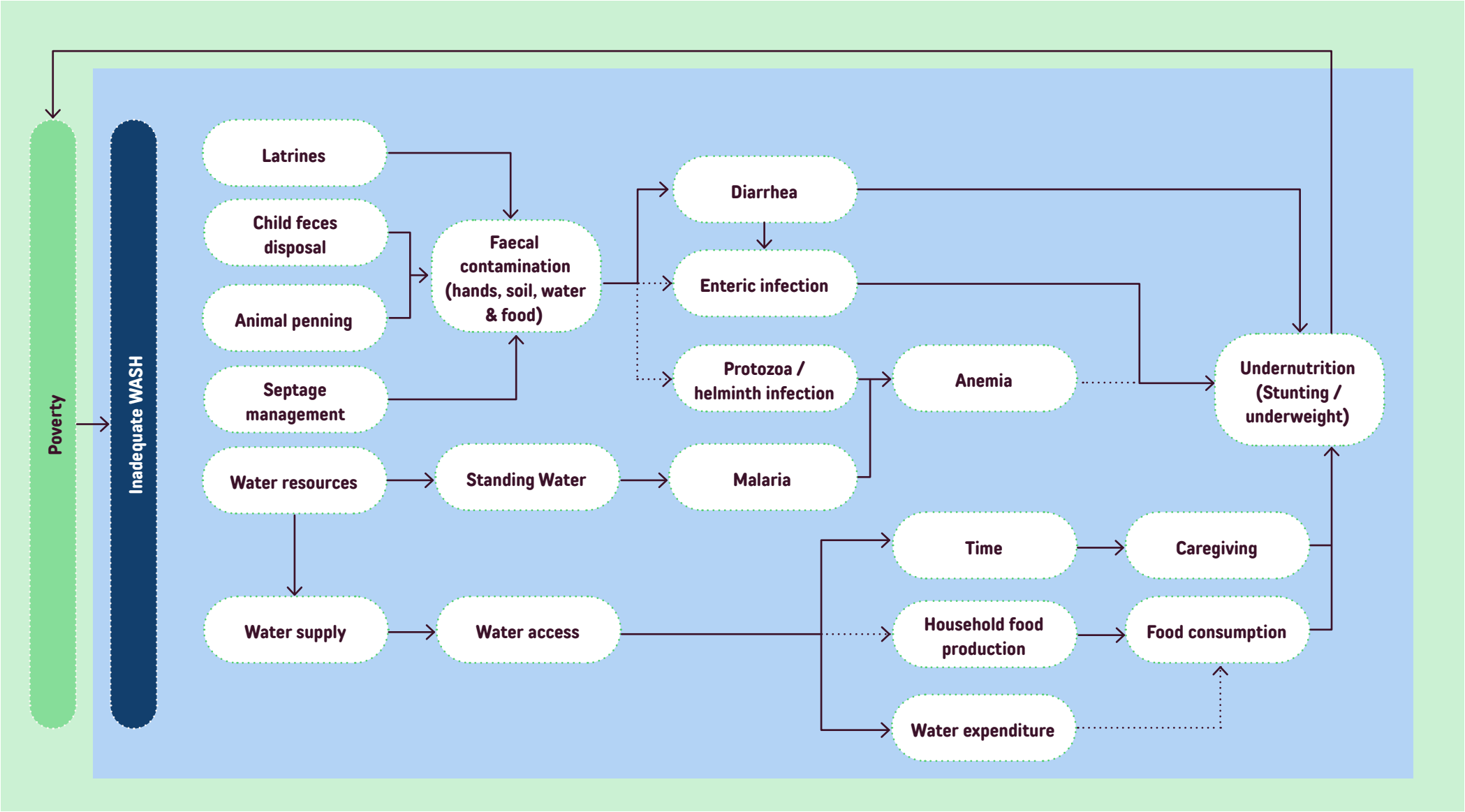
Introduction and impact pathway:

Inadequate WASH affects child nutritional status through several pathways (Figure 5). Three main pathways are diarrhoea, soil-transmitted infections (helminths) and environment enteric dysfunction (EED). Malaria and acute respiratory infections, often associated with poor WASH conditions and practices, are also associated with undernutrition. In addition, a variety of social and economic costs ensue from lack of access to domestic water and sanitation, such as water expenditure, time spent fetching water, insecurity in accessing distant or communal facilities, and costs for treating diseases associated with inadequate WASH. These can all affect the physical and mental health of caregivers – the majority of whom are women – and influence the quality of care for their children (Dominguez, E.I., 2017).



RESULTS

Figure 5: Pathways linking WASH and nutrition



Source: Chase and Ngure, 2016

RESULTS

Evidence summary

Nutrition sensitive WASH studies have shown improvements in WASH and health practices (Gimaiyo et al, 2019) and a recent trial in Pakistan showed that point-of-use water treatment combined with SAM treatment reduced the time taken for children (n=901) to recover from SAM and improved recovery rates by 16.7–22.2%. The adjusted odds of recovery were approximately twice as high for those receiving water treatment compared with controls (Doocy et al, 2018).

Other research has been less successful in finding direct impacts of WASH interventions on nutritional status outcomes. A systematic review of 41 WASH trials in LMICs found one low quality trial that showed an impact on stunting: a combined WASH intervention improved HAZ (MD 0.22; 95% CI 0.12, 0.32) and decreased the risk of stunting by 13% (RR 0.87; 95% CI 0.81, 0.94) (Gera, Shah and Sachdev, 2018). Overall, the review concluded that WASH interventions (considered together) resulted in a lower risk of underweight (RR 0.81; 95% CI 0.69, 0.96), stunting (RR 0.77; 95% CI 0.68, 0.86) and wasting (RR 0.12, 0.85), based on low- to very-low quality of evidence.

Another systematic review (Momberg et al, 2021), focused on sub-Saharan Africa, found only two studies examining the association between WASH and child growth. After adjusting for child, household, parent and community variables in these studies, access to improved water (but not sanitation) was associated with reduced stunting at one and five years of age (relative risk ratios from 0.55 to 0.57).

The WASH Benefits and SHINE trials (Pickering et al, 2019) were three randomised efficacy trials testing improved household-level WASH[8] with and without improved IYCF practices on stunting and diarrhoea in Bangladesh, Kenya, and Zimbabwe. In all trials, improved IYCF had a statistically significant benefit, but WASH had no effect on linear growth. WASH interventions reduced diarrhoea in Bangladesh, but not in Kenya or Zimbabwe. It was noted that promoters visited participants six times per month in Bangladesh compared with monthly in Kenya and Zimbabwe, and high frequency of support visits has been reported elsewhere as critical to achieve sufficient adherence to improve practices and subsequent outcomes. The authors concluded that the WASH interventions trialled were inadequate to interrupt all pathways of faecal-oral microbial transmission in children living in highly contaminated environments (Rogawski McQuade et al, 2020). A recent WHO and UNICEF position paper (UNICEF and WHO, 2020) corroborated this, recommending that entire community coverage is needed with higher service levels; at a minimum, interventions should reach everyone in a community with at least basic WASH services.

The paper also highlighted blind spots in typical WASH programming, particularly concerning the role of animal waste and faecal contamination of food during irrigation, in markets and food preparation, which are often overlooked in programme design. Evidence from Chad has shown that hygiene practices and cattle numbers are correlated with wasting, with a clear, positive association between livestock concentration at the village level, and levels of wasting. Cleaning water containers mediated the negative impact on wasting of living in a village with a large cattle concentration (Marshak et al, 2017).

A recent study (Usman and Gerber, 2020) investigated the relationship between household drinking water quality, irrigation and child nutrition in two rural districts of Ethiopia. More than 58% of household stored drinking water samples were found to be contaminated with Escherichia coli bacteria. Regression analyses suggested that irrigation farming and on-premises water sources were significantly associated with lower HAZ, while uncontaminated household stored drinking water quality was correlated with higher WAZ.

Closer co-ordination with food safety and agriculture programmes is recommended to address exposure to pathogens through contaminated food. Contextualised, risk-informed programming is critical to ensure risks are analysed and contextually-relevant transmission pathways are prioritised (UNICEF and WHO, 2020).

Research gaps

Research is called for on interventions that are radically more effective in reducing faecal contamination in the domestic environment than those trialled to date (Pickering 2019).

The WHO and UNICEF Position Paper notes that evidence gaps remain on how to ensure safe management of both child faeces and contact with animal faeces as essential components of effective sanitation service chains. It also calls for intervention studies on provision of clean play spaces (culturally accepted, practical, efficacious, and easily cleanable) to separate young children from consumption of soil and faeces.

Finally, further research is merited into the exact causes, measurement, and reversibility of EED, as well as its specific relationship to undernutrition.

8 Interventions comprised improved pit latrine, hand-washing stations, liquid soap, point-of-use water chlorination, and clean play space.

3.2 Targeted nutrition support

3.2.1 Complementary feeding and nutrition supplementation for children

Introduction and impact pathway:

Between the ages of six and 23 months, children no longer receive adequate nutrition solely from breast milk and need additional nutrient-rich complementary foods[9] (WHO, 2023a). In settings where food insecurity is common, the quantity and quality of complementary foods are typically inadequate, so children in this age group often experience growth faltering. The most recent data on the quality of complementary foods and feeding practices indicate that, globally, two in every three children aged 6-23 months (72%) are not fed even the minimum diverse diet needed for healthy growth (UNICEF, 2020b). In addition, wasting among these children commonly increases at specific times of the year, often coinciding with pre-harvest depletion of food stocks, rises in food prices and/or increased disease transmission as a result of the rainy season (Young and Marshak, 2018) and this extends to older children between the ages of 24-59 months (Mertens, Benjamin-Chung, Colford, Hubbard, et al, 2023).

We now know that early postnatal growth faltering, often linked to being born with low birthweight, predisposes children to subsequent and persistent growth faltering, particularly in contexts of food insecurity, and that boys appear to have consistently higher risk of all forms of growth faltering than girls (Mertens, Benjamin-Chung, Colford, Coyle, et al, 2023). Interventions that improve the availability and consumption of high-quality foods by children 6-59 months in food-insecure settings are therefore central to the prevention of both wasting and stunting (Keats et al, 2021).

9 Complementary foods are foods or drinks (eg, infant cereals, fruits, vegetables, water) given to young children in addition to breast milk or infant formula. WHO recommends their introduction from six months of age.

Current recommendations on complementary feeding and nutrition supplementation for children

Complementary feeding

The Lancet Maternal and Child Nutrition Series Update 2021 stated strong evidence in support of complementary feeding education with food provision in food insecure populations.

New WHO guidance on complementary feeding (WHO, 2023a) recommends that infants and young children 6–23 months of age should consume, in addition to breastmilk, a diverse diet including

- Animal source foods, including meat, fish, or eggs, should be consumed daily (strong, low certainty evidence).
- Fruits and vegetables should be consumed daily (strong, low certainty evidence), and
- Pulses, nuts and seeds should be consumed frequently, particularly when meat, fish, or eggs and vegetables are limited in the diet (conditional, very low certainty evidence).

Supplementation with specially formulated foods

The Lancet Maternal and Child Nutrition Series Update 2021 (Keats et al, 2021) stated strong evidence in support of:

- Use of small-quantity lipid-based nutrient supplements (SQ-LNS) among at-risk children and that, in contrast to micronutrient powders alone, the benefits on growth and anaemia are advantageous.
- Ready-to-use supplementary food for management of acute malnutrition.

New WHO guidance on the prevention of wasting (WHO, 2023b) recommends (low certainty evidence) that in areas of high food insecurity:

in addition to infant and young child feeding counselling, specially formulated foods (SFFs), including medium-quantity lipid-based nutrient supplements (MQ-LNS) or SQ-LNS, are considered for the prevention of wasting and nutritional oedema for a limited duration for all infants and children 6-23 months of age.

children living in the most vulnerable households should be prioritized for SFF interventions through a targeted approach. However, when targeting is not possible, these SFFs may need to be given to all households through a blanket approach for infants and children 6-23 months of age.

WHO guidance on complementary feeding (WHO, 2023a) recommends that in some contexts where nutrient requirements cannot be met with unfortified foods alone, SQ-LNS may be useful (high certainty evidence).

Micronutrient supplementation

The Lancet Maternal and Child Nutrition Series Update 2021 (Keats, 2021) stated:

- strong evidence in support of vitamin A supplementation for children in vitamin A-deficient contexts.
- moderate evidence in support of micronutrient powders to reduce iron deficiency and anaemia among children.

WHO guidance (2023b) makes a strong recommendation against providing multiple micronutrient powders (MNPs) to infants and children 6-23 months of age for the specific purpose of preventing undernutrition.

WHO guidance on complementary feeding (WHO, 2023a) recommends that in some contexts:

- MNPs can provide additional amounts of selected vitamins and minerals without displacing other foods in the diet (moderate certainty evidence).
- For populations already consuming commercial cereal grain-based complementary foods and blended flours, fortification of these cereals can improve micronutrient intake.

Jump to contents

Evidence summary

Small-quantity lipid-based nutrient supplements (SQ-LNS)

Fortified products for infants and young children have been developed and evaluated in numerous studies. Among these products, SQ-LNS (see Box 1) have been a recent focus of a large body of research and now have the strongest evidence base.

Box 1: SQ LNS

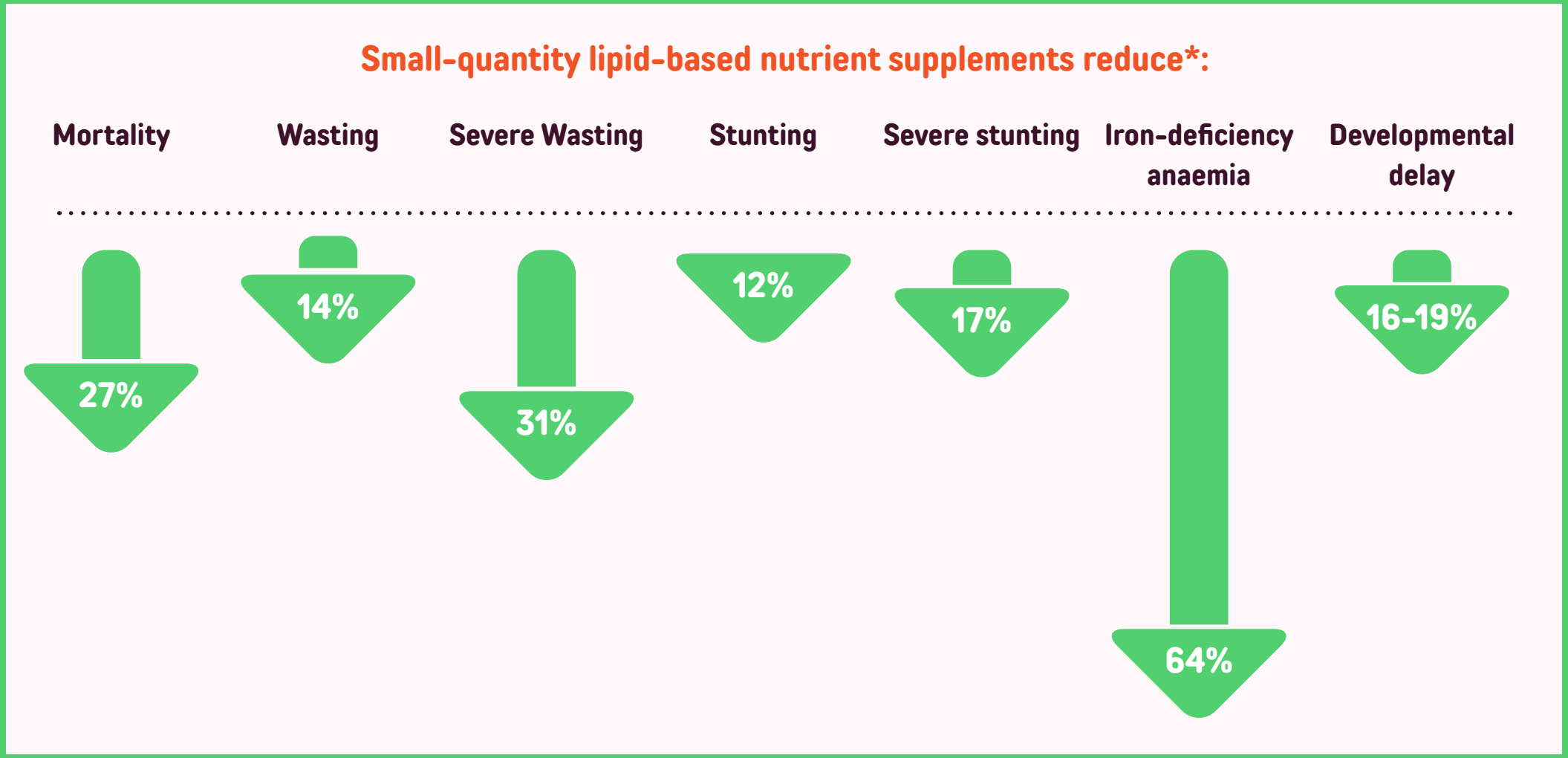
LNS provide >50% of energy from fat (including essential fatty acids). SQ-LNS provide multiple micronutrients embedded in a small amount of food (~20 g/d, ~100-120 kcal/d) that also provides energy, protein, and essential fatty acids. They are based on the same type of lipid-based food matrix used for products intended for the treatment of wasting – ready-to-use therapeutic food (RUTF) and ready-to-use supplementary food (RUSF) – which do not require preparation or refrigeration. However, SQ-LNS are designed for the prevention, not treatment, of undernutrition and thus the daily ration is much smaller than is the case for RUTF and RUSF and accordingly the micronutrient density (per gram) is much higher. Because of the small daily ration, SQ-LNS are considered a type of home fortification (like micronutrient powders), as they can be mixed with foods prepared for infants and young children in the home to enrich nutrient content. But unlike micronutrient powders, SQ-LNS can also be eaten as is, if preferred by the child or caregiver **(UC Davis, 2023).**

A 2019 review (Das et al, 2019) found that SQ-LNS given with the home diet to infants and young children aged six to 23 months of age reduced the prevalence of stunting, wasting, underweight and anaemia versus no intervention. The review also found that the effects of using SQ-LNS were probably better than those supported by interventions using other fortified blended foods (FBFs): of the 2,290 participants (two studies) used for this comparison there was a relative risk reduction for moderate wasting of 21% and for severe wasting of 36% with SQ-LNS versus FBFs. In addition, SQ-LNS was found to be more effective in reducing stunting if it was provided for a duration longer than 12 months.

More recently, a participant data meta-analysis of 14 RCTs of SQ-LNS provided to children aged six to 24 months of age (n > 37,000) confirmed many of these findings (Dewey et al, 2022). It found that children who received SQ-LNS for at least three months had a 12–14% lower prevalence of stunting, wasting and underweight; had a 16% lower prevalence of anaemia; and had a 64% lower prevalence of iron-deficiency anaemia compared with control group children who received no intervention (Dewey et al, 2022), see Figure 6 (UC Davis, 2023). Recent work from Ghana has examined the sustained impact of SQ-LNS on linear growth among children 9–11 years old that had been exposed to SQ-LNS supplementation in utero (mums received SQ LNS through pregnancy) and had received SQ-LNS themselves from 6–18 months (Bentil et al, 2024).

Findings suggest that effects on improved linear growth were sustained particularly among girls and among children born to non-overweight women. In both of these sub-groups, the difference in height-for-age between SQ-LNS and control groups was ~0.25 z-scores which is similar in magnitude to those of the landmark INCAP longitudinal study conducted in Guatemala (Ramirez-Zea and Mazariegos, 2020).

Figure 6: Evidence for preventive effects of SQ-LNS on adverse outcomes



*One packet per day for at least 3 months for children 6-23 months of age

Source: UC Davis, 2023

RESULTS

Whilst the effects of SQ-LNS generally in this research did not differ by study-level characteristics, including region, stunting burden, malaria prevalence, sanitation, water quality, duration of supplementation, frequency of contact, or average compliance with SQ-LNS, there is some data that suggests household food security and the issue of sharing/compliance at an individual level may modify/reduce impacts. Trials with higher-than-average reported compliance (≥80%) with consumption of SQ-LNS and that provided SQ-LNS for durations of longer than 12 months tended to have greater relative reductions in wasting (17% versus 7% for compliance and 18% versus 11% for duration) (Dewey, Wessells, et al, 2021). The meta-analysis by Das et al (Das et al, 2019) suggested a somewhat greater impact on stunting when the duration of LNS supplementation was more than 12 months (as opposed to ≤12 months). Recent work also suggests intervention coverage to be an important modifier of impact (see section 4.2 below) as does the home-based diet that SQ-LNS complements. In a refugee camp in Chad for example, the provision of SQ-LNS, introduced for all children aged 6–23 months, was not enough to sustain progress that had been made in nutrition status prior to a cut in the general household ration; nor to offset the dual burden of stunting and wasting (Fenn et al, 2021).

There is some emerging evidence on the cost and cost-effectiveness of providing SQ-LNS to young children. The Cost and Cost-effectiveness Working Group of the SQ-LNS Task Force has compiled information from projects in several countries that had collected data to estimate costs and/or cost-effectiveness (Adams, K.P., 2022; UC Davis, 2023). The total cost of providing SQ-LNS daily, usually through existing platforms for promoting healthy growth and development such as community health worker programmes, was ~$50 per child-year in most of the case studies used, with product cost averaging 60% of that total. A Copenhagen Consensus assessment of the most cost-effective maternal and child nutrition interventions (Larsen, Hoddinott and Razvi, 2023) estimated a benefit to cost ratio of 13.7 for preventive SQ-LNS for children 6–23 months of age, when targeted to the poorest 60% of the population in the 40 low- and lower middle-income countries with the highest rates of child stunting. These estimates suggest that provision of SQ-LNS can be a very cost-effective intervention if properly implemented using a suitable delivery platform with appropriate support and supervision. In this context, SQ-LNS may be more cost-effective for the prevention of wasting than other options, such as the provision of complementary food, although the total cost for a programme including all age-eligible children would be high. The authors suggested that strategies to reduce costs, such as targeting to the most vulnerable communities including those with high levels of child wasting, stunting, mortality, or household food insecurity, may enhance financial feasibility but this is all yet to be evaluated.

It is noteworthy that researchers designing trials to assess SQ-LNS have acknowledged the importance of accompanying supplement provision with appropriate messaging. These messages extend beyond just instructions on the use and storage of SQ-LNS; they also emphasise recommended IYCF practices. Typically, these messages include the promotion of breastfeeding, the introduction of complementary foods at six months of age, and recommendations regarding dietary diversity and the inclusion of nutrient-rich complementary foods. Consequently, the provision of SQ-LNS is generally integrated into a broader context of services aimed at enhancing IYCF practices. Rather than being an isolated intervention focused solely on delivering a product, SQ-LNS distribution should be part of a comprehensive approach to improve overall IYCF practices. (Dewey, Stewart, et al, 2021).

Other complementary and supplementary feeding interventions

A recent review (Ickes, Craig and Heidkamp, 2022) found that while complementary feeding intervention studies that provided SQ-LNS were most likely to show an impact on one or more wasting outcomes (66.6% of these studies included in the review indicated reduced wasting), other intervention types, such as those supporting fortified complementary foods or household /child-specific staple foods, also had a positive impact on wasting (27.3% and 37.5% of studies, respectively).

In humanitarian programming, blanket supplementary feeding programmes (BSFP), aim to prevent the deterioration of nutritional status of at-risk groups (eg, PBWG and children under five) with targeted nutrition supplements, but evidence on their effectiveness, bar that discussed above linked to SQ-LNS, is scarce. The cost-effectiveness of four specialised nutritious foods (RUSF, corn-soy-whey blend [a new formulation] with oil, Super Cereal Plus, corn-soya blend [CSB Plus or Super Cereal] with separate fortified vegetable

oil) to prevent stunting and wasting in children aged 6–23 months was examined in Burkina Faso (Cliffer et al, 2020). Overall, the results of this study indicated that RUSF used in this setting was not significantly more effective in preventing stunting and wasting than commonly programmed CSB Plus with oil (standard of care), and they were considerably more costly. It is unlikely, however, that RUSF would be recommended for prevention except in very food-insecure situations where medium/large-quantity LNS are sometimes used in blanket programmes. In the Democratic Republic of Congo (DRC), a BSFP delivering medium quantity LNS to children 6–23 months; and fortified blended flour (eg, CSB Plus or SuperCereal), oil, and sugar to PBWG was unable to draw any conclusions about the appropriateness of the timing of BSFP distributions during the lean season or the overall appropriateness of BSFP as a way to prevent/reduce wasting caseload within the DRC context (USAID Advancing Nutrition, 2023a).

Other systematic reviews have also concluded that complementary feeding interventions that included the provision of food or a nutritional supplement with or without an education component, and in the absence of household assistance, had a small but significant impact on stunting and wasting for children under two years, particularly in food-insecure contexts, but that nutrition education alone only impacted stunting (Panjwani and Heidkamp, 2017). Caregiver education or counselling about appropriate complementary feeding practices was found to be an effective strategy to improve food and nutrient consumption, knowledge and dietary practices in complementary feeding in settings where households had sufficient resources and access to healthy diets to put the recommendations into practice (Panjwani and Heidkamp, 2017; Lassi, Rind, et al, 2020) but had limited impacts on child anthropometry (Jardí, Casanova and Arija, 2021). In their 2023 guidance update on the prevention of wasting, WHO (WHO, 2023b) have included a good practice statement on the need to provide IYCF counselling as part of routine care especially in contexts where wasting and nutritional oedema occur (see section 3.2.2).

Other reviews that have examined the impact of early childhood development interventions including nutrition supplementation have suggested growth outcomes are better when two or more interventions are provided together (see section 3.3) and in populations with worse nutrition status at baseline (McWay, Prabhakar and Ellis, 2022). The latter has also been noted by the SQ-LNS research (Dewey, Wessells, et al, 2021).

Treating moderate wasting with specialised foods

The treatment of moderate wasting can be an effective strategy for addressing the burden of wasting and reducing the incidence of severe wasting. A 2019 review found that the provision of supplementary foods supported the recovery from moderate wasting and that these foods were more effective at promoting anthropometric recovery than nutrition counselling, with or without the addition of micronutrient supplements (Lelijveld et al, 2019). The type, quality and duration of supplementary food provided is important, however. The effectiveness of dietary management for moderate wasting among children over six months of age has recently been examined by a systematic review and meta-analysis (Cichon et al, 2023). It found that LQ-LNS (such as RUSF and RUTF) improved recovery compared to non-enhanced FBF but were comparable to enhanced FBF (improved with micronutrients and/or milk). This aligns with recently released WHO guidance that recommends that where children with moderate wasting are identified as needing specially formulated foods, they are provided with the following 1) LNS, as the preferred type; 2) when LNS are not available, with FBF with added sugar, oil and/or milk (improved FBF); and 3) FBF with no added sugar, oil and/or milk (WHO, 2023b). It is of note however, that this guidance emphasises that not all children with moderate acute malnutrition (MAM) will need a specially formulated food (SFF) and recommends evidence-informed risk factors[10] which can be used to prioritise which children with MAM need supplementation, based on risk factors which make them at higher risk of mortality and non-recovery than others.

There has also been considerable focus and a growing evidence base over the last five years around simplified approaches for the treatment of child wasting[11] that includes treatment for both moderate and severe wasting within one programme. This could improve the effectiveness and cost effectiveness of wasting treatment in some settings (IRC, 2023).

10 See Briefing Note for more details on these risk factors: https://www.childwasting.org/_files/ugd/2b7a06_2cf788d9c0f342b89c054b288f4862e3.pdf
11 WHAT ARE SIMPLIFIED APPROACHES | Simplified Approaches

Micronutrient supplementation

A recent systematic review of micronutrient supplementation and fortification interventions for young children compared the effect of micronutrient supplementation with that of an inactive (ie, placebo, no intervention, or standard of care) or active (ie, a different composition of micronutrients or comparison of multiple micronutrient supplementation [MMS], supplementation with LNS) control intervention (Tam et al, 2020). While certain outcomes, such as anaemia, responded to several intervention types, stunting and underweight improved only among children who were provided with LNS in addition to micronutrients, though MMS also slightly increased Length-for-age z-score (LAZ). The risk of anaemia was reduced with iron alone, IFA, MMS, multiple MNPs, targeted fortification, and large-scale fortification. Vitamin A supplementation likely reduced all-cause mortality, while zinc supplementation decreased the incidence of diarrhoea. Importantly, many effects of LNS and MNPs on micronutrient status held when pooling data from effectiveness studies. Whilst this evidence further supports the importance of these strategies for reducing the burden of micronutrient malnutrition in children, particularly in emergency settings (Tam et al, 2020), it is important to note that communities with the highest burden of iron and other micronutrient deficiency also have the highest burden of stunting and wasting. As such, programming should be designed to address undernutrition in all its forms.

Research gaps

While evidence suggests that effects on wasting for vulnerable populations with interventions using SQ-LNS in food-insecure areas are generally more consistent, and more substantial, compared with other nutrition interventions (such as nutrition education, micronutrient supplementation or fortification and FBF) for children under two years of age, there remain important questions linked to the targeting of, and maximising the benefit of, SQ-LNS. Effects on wasting appear to be greater where the potential to benefit is greater – ie, where populations have greater nutritional deficits and where other constraints on response, such as poor sanitation, are alleviated. For this reason, evidence suggests that a greater impact of SQ-LNS might be obtained by targeting support to the most nutritionally vulnerable and co-packaging with interventions that alleviate constraints on response, such as the prevention and control of prenatal and child infections and inflammation; improving access to health care, including mental health care for women (see below); and promoting early child development interventions that improve responsive caregiving. There is a need for better understanding, and better definitions, of this across different programming contexts.

The bulk of the evidence around targeted nutrition support for children (particularly that linked to SQ-LNS) is focused on the under-twos. Whilst this may make sense given the burden and incidence of undernutrition is largest in this age group globally, this may not always be the case in the most food-insecure and urgent humanitarian contexts. In these contexts, there are often high levels of wasting, stunting and micronutrient deficiency in children over the age of two years and effective interventions are needed that can prevent (as well as treat) wasting and other forms of undernutrition in this group. Whilst evidence for interventions that address moderate wasting does cover this age group, there is a need for more evidence on targeted nutrition interventions, including BSFP, that can improve the quality of older (24-59 months) children's diets sufficiently to improve nutritional status and prevent deterioration.

There is little data and research that examines risks of over-supplementation of micronutrients when several different intervention types are being delivered. Whilst the prevalence of micronutrient deficiencies in LMICs continues to overshadow any concern of excess intake, data on both prevalence of deficiencies and micronutrient intakes, particularly where multiple fortified products are being provided, is scarce. There is some multi-agency guidance that recommends that MNPs are withdrawn from children receiving treatment for moderate wasting with specialised supplementary foods such as RUSF, although this guidance is now ten years old (Home Fortification Technical Advisory Group [HF-TAG], 2014). UNHCR also has a spreadsheet which they use to estimate nutrient composition and assess any potential problems with giving multiple supplements.

3.2.2 Nutrition supplementation and support for pregnant women and adolescent girls

Introduction and impact pathway:

Recent research suggests that 30% of child wasting and 15-20% of stunting occurs during pregnancy (Benjamin-Chung et al, 2023; Mertens, Benjamin-Chung, Colford, Hubbard, et al, 2023), while an additional 25% of stunting occurs during the first six months after birth (Benjamin-Chung et al, 2023). Moreover, studies are increasingly demonstrating the links between birth outcomes, such as LBW and SGA, and subsequent child stunting and wasting (Mertens, Benjamin-Chung, Colford, Coyle, et al, 2023).

A recent analysis of 33 longitudinal cohorts demonstrated that improving maternal anthropometry and child condition at birth contributed to population increases in LAZ of up to 0.40 and weight-for-length (WFL) z-scores of up to 0.15 by 24 months of age (Mertens, Benjamin-Chung, Colford, Coyle, et al, 2023).

Interventions to improve maternal health and nutrition status, to break the inter-generational cycle of malnutrition and prevent LBW, SGA, wasting and stunting, are therefore critical during pregnancy and potentially, pre-conception. In situations of food insecurity, two interventions for the prevention of adverse maternal, neonatal, and child outcomes for which there is now a body of evidence, are antenatal supplementation with BEP and provision of IFA-containing MMS.

Current recommendations on nutrition supplementation for pregnant women and adolescent girls

Macronutrient supplementation

The Lancet Maternal and Child Nutrition Series Update 2021 recommended BEP supplementation for undernourished women and adolescent girls in pregnancy, especially in food-insecure populations. BEP supplementation for pregnant women in undernourished populations has been included in the UN Global Action Plan (GAP) framework on child wasting as one of the priority actions to reduce LBW and child wasting.

WHO recommends BEP supplements during pregnancy in settings with a high prevalence of underweight pregnant women (20% is considered a high prevalence of underweight in women assessed by BMI) (WHO, 2020). WHO is currently in the process of developing BEP implementation guidance.

Micronutrient supplementation

The Lancet 2021 series recommended that MMS containing IFA should be provided in the antenatal period (Keats, 2021).

WHO recommendations (2020) for micronutrient supplementation in PBWG include:

- Daily oral IFA supplementation as part of antenatal care, containing 30–60mg of elemental iron and 400µg of folic acid to prevent maternal anaemia, puerperal sepsis, LBW, and preterm birth. (Note: this recommendation is not applicable if MMS is provided instead).
- Daily calcium supplementation for pregnant women and adolescent girls in populations with low dietary intake, for the prevention of pre-eclampsia.
- In contexts where vitamin A is a severe public health problem, vitamin A supplementation is recommended for the prevention of night blindness in pregnant women and adolescent girls, to a maximum dosage of 10,000 IU per day or a weekly dose of up to 25 000 IU. Vitamin A has also been associated with a reduction in anaemia during pregnancy. Vitamin A supplementation is not recommended for postpartum women or adolescent girls, as the available evidence does not support a reduction in either maternal or infant morbidity or mortality.

For non-pregnant women and adolescent girls WHO (WHO, 2018) also recommends WIFAS in a dose of 60mg iron and 2.8mg folic acid. It is also recommended by WHO with a dose of 120mg iron and 2.8mg folic acid once weekly for pregnant women to improve maternal and neonatal outcomes if daily iron is not acceptable due to side-effects, and in populations with an anaemia prevalence among pregnant women of less than 20%.

WHO stresses that health educators need to understand micronutrient nutrition and also regional and local variations in the diet, different cultural practices, different methods of food processing and meal preparation, and economic constraints when seeking to manage anaemia and implement micronutrient interventions (WHO, 2017).

RESULTS

BEP and LNS supplementation

BEP supplements and LNS may be given to PBWG at risk of undernutrition in food-insecure settings. Defined by WHO as supplements where protein provides less than 25% of total energy content, BEP is a generic term for supplements that exist in various forms, including fortified cereals, biscuits, dairy products, beverages, or powdered supplements in sachets; they may also be made using locally sourced ingredients.

When LNS (see Box 1) is provided in medium- and large-quantities, they can be considered as 'fortified BEP'. Both BEP and LNS products are typically (though not necessarily) fortified with micronutrients or administered along with IFA or MMS in programming[12].

Systematic reviews and meta-analyses have demonstrated that BEP supplementation of pregnant women and girls is beneficial for improving infant outcomes (Lassi, Padhani, et al, 2020; Ciulei et al, 2023): A systematic review of trials conducted in Asia, Africa, the Middle East, and South America showed that BEP supplementation during pregnancy reduced the rates of stillbirth, LBW and SGA by 61%, 40%, and 29%, respectively, and increased mean birth weight (Lassi, Padhani, et al, 2020).

However, there is less clarity on the BEP supplement composition needed to achieve positive maternal outcomes and which pregnant women (ie, linked to contextual factors or nutritional status) benefit most from BEP[13]. The use of different nutrient compositions, formulations and different ration sizes across trials and programmes, has complicated the consolidation of evidence to inform guidance on BEP supplementation. The wide variation in supplementation modalities, including timing, duration and target population has exacerbated this challenge (UNICEF, 2023a). For example, a 2023 review found that the foods or products defined as BEP ranged widely in energy (118–1017 kcals), protein (3–50g), and fat (6–57g) (Ciulei et al, 2023). A 2018 RCT found that supplements comprising a higher proportion of dairy increased maternal[14] weight, height, BMI, and MUAC, correlated with a reduction in illness; the authors noted a protective effect on the mother's iron status compared to the controls (Schlossman, 2018).

A 2021 review of 11 RCTs conducted in South Asia (Sethi et al, 2021), concluded that BEP supplementation combined with nutrition education needs to be carried out for a longer duration – starting with pre-conception and continuing throughout pregnancy – and at scale to improve its impact on both GWG and reduction of LBW.

Few studies have examined the impact of BEP supplementation on maternal outcomes. A recent programming review revealed that the majority of programmes enrol participants based on pregnancy status in food-insecure settings, while assessment and monitoring of maternal nutritional status is less commonplace (UNICEF, 2023a). However, a 2022 scoping review of systematic reviews and meta-analyses found improved outcomes of BEP on maternal anaemia and GWG, particularly in deficient populations (Zavala, Rhodes and Christian, 2022). An analysis of data from India, Pakistan, Mali and Tanzania demonstrated that, while providing BEP supplementation (containing MMS) universally to women at antenatal care has the greatest impact on child health and nutrition outcomes, a targeted approach of providing BEP supplementation for underweight women and providing MMS to women with an adequate BMI was more cost-effective than supplying MMS alone (Young et al, 2022).

There is currently a lack of evidence of long-term benefits for infants and children in terms of growth and cognitive development or of benefits to infants from postnatal maternal supplementation (Visser et al, 2018; Salmuth et al, 2021); and a lack of BEP supplementation trials specifically in pregnant adolescents or disaggregated for adolescents (Lassi et al, 2017; Salam et al, 2019).

A 2022 study in Pakistan found that the provision of wheat soya blend plus (WSB Plus) to 1017 mothers during pregnancy and the first six months of their breastfeeding period, followed by provision of a MQ-LNS to their children between 6-23 months of age improved child linear growth and reduced stunting in children at 24 months (Soofi et al, 2022). There was a significant difference in mean length, weight, LAZ and

12 Note that high protein supplements have been associated with risk and harm (increased risk of SGA babies).

13 Study protocol: prospectively planned individual patient data (IPD) meta-analysis testing the effect of balanced energy-protein (BEP) supplementation provided to lactating women on maternal and infant outcomes. Available at: https://osf.io/9nq7z

14 A mixture of pregnant women and mothers of children under 30 months.

RESULTS

WAZ among infants in the intervention compared to the control group, who received routine public health services, including counselling on maternal and child nutrition, health and hygiene. At 24 months of age, a significant difference in the prevalence of stunting (absolute difference, 10.2%, 95% CI 18.2 to 2.3, p=0.017) and underweight (absolute difference, 13.7%, 95% CI 20.3 to 7.0, p=0.001) was observed in the intervention as compared to the control group. The prevalence of wasting was not significantly different between the intervention and control groups.

IFA and MMS

Pregnant women require additional iron and folic acid to meet their own nutritional needs as well as those of the developing foetus. Evidence has shown that the use of IFA supplements is associated with a reduced risk of iron deficiency and anaemia in pregnancy (Peña-Rosas et al, 2015), which has led to the current WHO guideline recommendation of daily IFA supplements for pregnant women.

Recently, increasing focus has turned to MMS, which provides a selection of vitamins and minerals to fill the gap between the typically low micronutrient intakes observed in low-resource settings and the higher requirements of pregnancy. There is strong evidence demonstrating that MMS containing IFA results in a consistent relative risk (RR) reduction over IFA alone for several outcomes, including LBW (RR reduction of 12–14%), SGA births (RR reduction of 2–9%), preterm births (RR reduction of 6-8%) and stillbirths (RR reduction of 8%) (Keats et al, 2019, 2021; Gomes et al, 2023; Sight and Life, 2023). The benefits of MMS (compared to IFA) are even greater among anaemic and underweight pregnant women, those who initiate supplementation earlier, and those with higher adherence. A 2023 Lancet Series (Hofmeyr et al, 2023) recommended the provision of MMS as one of eight[15] proven preventive interventions, that if fully implemented in 81 LMICs, could prevent·202 million small and vulnerable new-born births per year. A recent paper reported positive modelled benefit–cost ratios for replacement of IFA by MMS (37.5), or replacement of IFA by a combination of MMS and calcium (19-24), in terms of four of the identified benefits: reduced risk of stillbirths, LBW, preterm births (PB) and being SGA (Larsen, Hoddinott and Razvi, 2023).

A 2022 individual patient data (IPD) meta-analysis of 14 studies (Liu et al, 2022) showed that, compared to IFA, MMS resulted in a greater percentage adequacy of GWG (weighted mean difference of 0.86%; 95% CI: 0.28% to 1.44%), higher GWG at delivery (weighted mean difference of 209g; 95% CI 139 to 280g) and a 2.9% reduced risk of severely inadequate GWG. Moreover, analyses have demonstrated that a transition from IFA with 60mg of iron to MMS with 30mg of iron would not adversely affect maternal anaemia (Gomes et al, 2022). A greater effect on LBW was noted with an iron dose of less than 60 mg and with the use of the UN International Multiple Micronutrient Antenatal Preparation (15 micronutrients) compared with MMN formulations that comprised only three to four micronutrients (Keats et al, 2019).

SQ-LNS supplements have been studied as a potential vehicle for MMS in pregnancy. In a recent review of four trials, LNS was not found to increase weekly GWG or reduce maternal mortality when compared to IFA or MMS alone (Zavala, Rhodes and Christian, 2022). The limited number of trials suggest that SQ-LNS supplementation has a slight, positive effect on weight at birth, length at birth, SGA and newborn stunting compared to IFA. However, SQ-LNS and MMS have been found to be comparable for all maternal, birth and infant outcomes (Das et al, 2018).

WIFAS has been shown to be efficacious in increasing haemoglobin concentrations and reducing anaemia among anaemic adolescent girls in targeted interventions, especially through schools (Fernandez-Gaxiola and De-Regil, 2019). Recent research adds substantial data for a weekly folic acid dose of 2.8mg to improve red blood cell (RBC) folate concentrations and reduce the risk of neural tube defects (NTDs) affected pregnancies (Samson et al, 2020). There has also been improvement in the quality of evidence available on these outcomes, with more data available from both high-quality trials and from programme data on the levels of compliance and adherence to WIFAS (versus daily supplementation) that are possible and on the factors that have been shown to support improved demand for and adherence to WIFAS. Nutrition education through school clubs has contributed to assuring compliance in WIFAS programmes in Somalia and Indonesia (Digital and Desie, 2018; Go and Olney, 2020). Authors note that the Indonesia project may have been more effective if adolescent boys and out-of-school girls had also been included.

15 The interventions are: MMS, BEP supplementation, low-dose aspirin, progesterone provided vaginally, education for smoking cessation, malaria prevention, treatment of asymptomatic bacteriuria, and treatment of syphilis.

Research gaps

There remains a dearth of evidence on effective interventions to prevent wasting among at-risk mothers – the focus continues to be on improving the outcomes of the infant, with limited attention to the mother-infant dyad. There is also a need for more understanding of the support needed for breastfeeding among working women and adolescent girls (Keats et al, 2021) and of the role of families and communities in supporting PBWG and their infants and how this can be strengthened.

Further research is required to better understand how baseline nutritional status (maternal BMI/MUAC and height) may affect pregnancy and birth outcomes following supplementation with MMS, as well as research to determine the optimal formulation for MMS supplements.

The optimal timing and duration of supplementation is still under debate[16] and more experience from programming MMS interventions is needed, particularly from humanitarian contexts, to better understand and advise on optimal modalities for reaching pregnant women and girls in a timely way and ensuring good coverage, uptake and adherence to supplementation protocols.

High adherence to MMS has been associated with greater benefits (Gomes et al, 2021). The contribution of the timing of initiation, adherence and total number tablets on the impact of MMS on birth and infant outcomes is being studied by an ongoing IPD meta-analysis (Smith, ER. et al, 2023)

The Sight and Life report 2023 calls for better documentation and dissemination of actual experiences of MMS supplementation in humanitarian settings, particularly pertaining to alignment with national health systems, policy and practice (See section 4.2.5 below). This is a particularly important consideration in contexts where IFAS is well-established in national ANC programmes and the risk to disruption of long-term programmes merits consideration alongside potential benefits of a switch to MMS.

3.2.3 Breastfeeding and management of infants less than 6 months of age at risk of poor growth

Small and nutritionally at-risk infants under six months of age face increased risk of death, malnutrition and poor development. Many infants are born stunted and/or wasted, while others are at high risk of growth faltering early after birth. Interventions designed to protect, promote and support early-initiation, exclusive and continued breastfeeding are a cornerstone for ensuring good newborn and long-term child nutrition (WHO, 2017).

Few interventions address growth faltering among infants under six months. A 2024 review stresses the continued need to support lactation in the context of growth faltering as part of an integrated approach (Tomori et al, 2024), and that further investment is necessary to ensure that the protection, promotion and support of breastfeeding is a central intervention, even in complex humanitarian emergencies.

Other systematic review and meta-analysis (Lassi, Rind, et al, 2020; Keats et al, 2021) of breastfeeding education interventions reported a 20% increase in rates of early initiation of breastfeeding, a 102% increase in exclusive breastfeeding at three months and a 53% increase in exclusive breastfeeding at six months. No effects were observed on the prevalence of child stunting and wasting, but a 24% decrease in diarrhoeal diseases was recorded. Educational strategies were effective regardless of the setting (including facilities, communities and homes), although more effective when conducted by healthcare professionals and tailored to the specific context. Regular visits to breastfeeding mothers improved outcomes by ensuring ongoing contextually appropriate support, responding to locally identified needs or concerns (Keats et al, 2021).

Kangaroo care was shown to improve head circumference (mean difference: 0.20 cm/week; 95% confidence intervals [CI]: 0.09,0.31 cm/week) and length (mean difference: 0.23 cm/week; 95%CI: 0.10,0.35 cm/week) compared to standard-of-care in a recent study (Park et al, 2020), adding further evidence to the role of nurturing care in improving nutrition outcomes.

16 In principle, MMS should be provided daily throughout pregnancy. Studies are yet to show the benefits that might accrue from initiating supplementation earlier in pregnancy or even prior to conception.

RESULTS

WHO have incorporated these findings on the value of IYCF counselling, particularly for breastfeeding practice, in their recent guidance update for the prevention of wasting (WHO, 2023b) with a good practice statement:

Infant and young child feeding counselling must be provided as part of routine care especially in contexts where wasting and nutritional oedema occur. In order for this counselling to have the most benefit for the prevention of wasting and for other child health and nutrition outcomes, personnel carrying out the counselling should have comprehensive training and be supervised regularly, with dedicated resources and time within health system strategic planning for this intervention.

The management of nutritionally at-risk mothers and infants (MAMI) approach supports infant and maternal nutrition, health and maternal mental health in an integrated manner to reduce the risk of adverse outcomes among infants under six months of age. It builds on and integrates with existing systems and services, strengthening the links between these services. Another WHO good practice statement (WHO, 2023b) aligns with this approach:

Among mothers/caregivers of infants less than six months of age at risk of poor growth and development, comprehensive assessment and support are recommended to ensure maternal/caregiver physical and mental health and well-being. These actions are also important to optimise growth and development in infants at risk of poor growth and development.

Systematic reviews to explore whether maternal nutritional supplementation and/or counselling and/or maternal-directed mental health interventions improve infant outcomes were not able to identify relevant interventions to inform new WHO recommendations (WHO, 2023b). Evidence was found to exist predominantly on interventions for mothers/caregivers of preterm and/or low birth weight infants during the neonatal period.

Evidence on the effectiveness of interventions to manage breastfeeding difficulties in mothers or caregivers of infants less than six months with growth faltering to improve breastfeeding practices and increase breastmilk intake, was found to be limited and, where it exists, was defined as low to very low quality. In addition, the majority of the infants included in studies were neonates, restricting extrapolation of findings to older infants under six months (Mohandas et al, 2023).

A systematic review and meta-analysis of interventions that employed supplemental milks to address growth faltering among infants under six months, found only two studies that generated direct evidence. These studies had limited generalisability. However, neither study was found to comprehensively support lactation. The authors concluded that breastfeeding receives inadequate attention in growth faltering interventions and called for investment in research that addresses growth faltering following a new research framework that prioritises comprehensive lactation support (Tomori et al, 2024).

The 2022 'WHO recommendations on maternal and new-born care for a positive postnatal experience' (WHO, 2022) define a positive postnatal experience as one in which women, new-borns, partners, parents, caregivers and families receive information, reassurance and support in a consistent manner from motivated health workers; where a resourced and flexible health system recognises the needs of women and babies, and respects their cultural context (see discussion in next section on work on 'baby tents' in emergencies).

3.2.4 Maternal mental health and women's empowerment

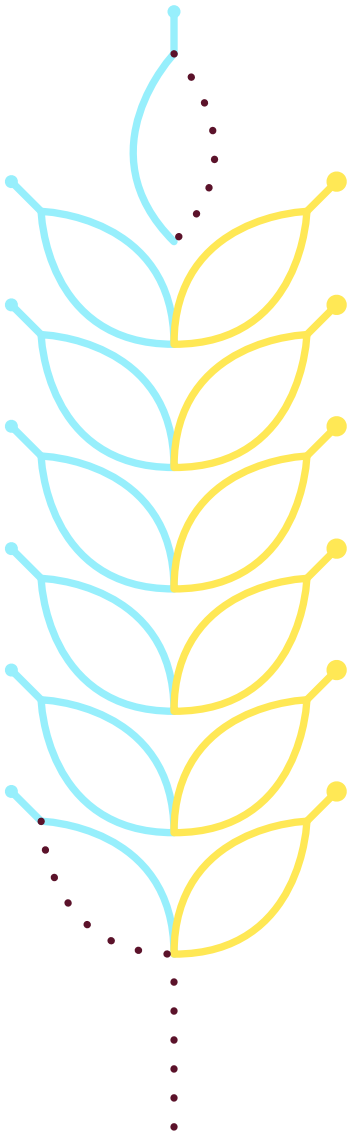
Introduction and impact pathway

Box 2: Defining women's empowerment and maternal mental health

Women's empowerment is related to interventions that support women's ability to make strategic life choices. It focuses on multiple processes, involving the process of gaining access to and control over the necessary resources to make choices, as well as the process of developing self-confidence. The resources necessary for empowerment encompass more than just financial resources and include knowledge, skills, self-confidence, and social support networks. Specific aspects of women's empowerment, such as control of resources, reduced workload, and stronger social support may facilitate better child feeding, care, and health-seeking behaviours and ultimately affect maternal and child nutritional outcomes.

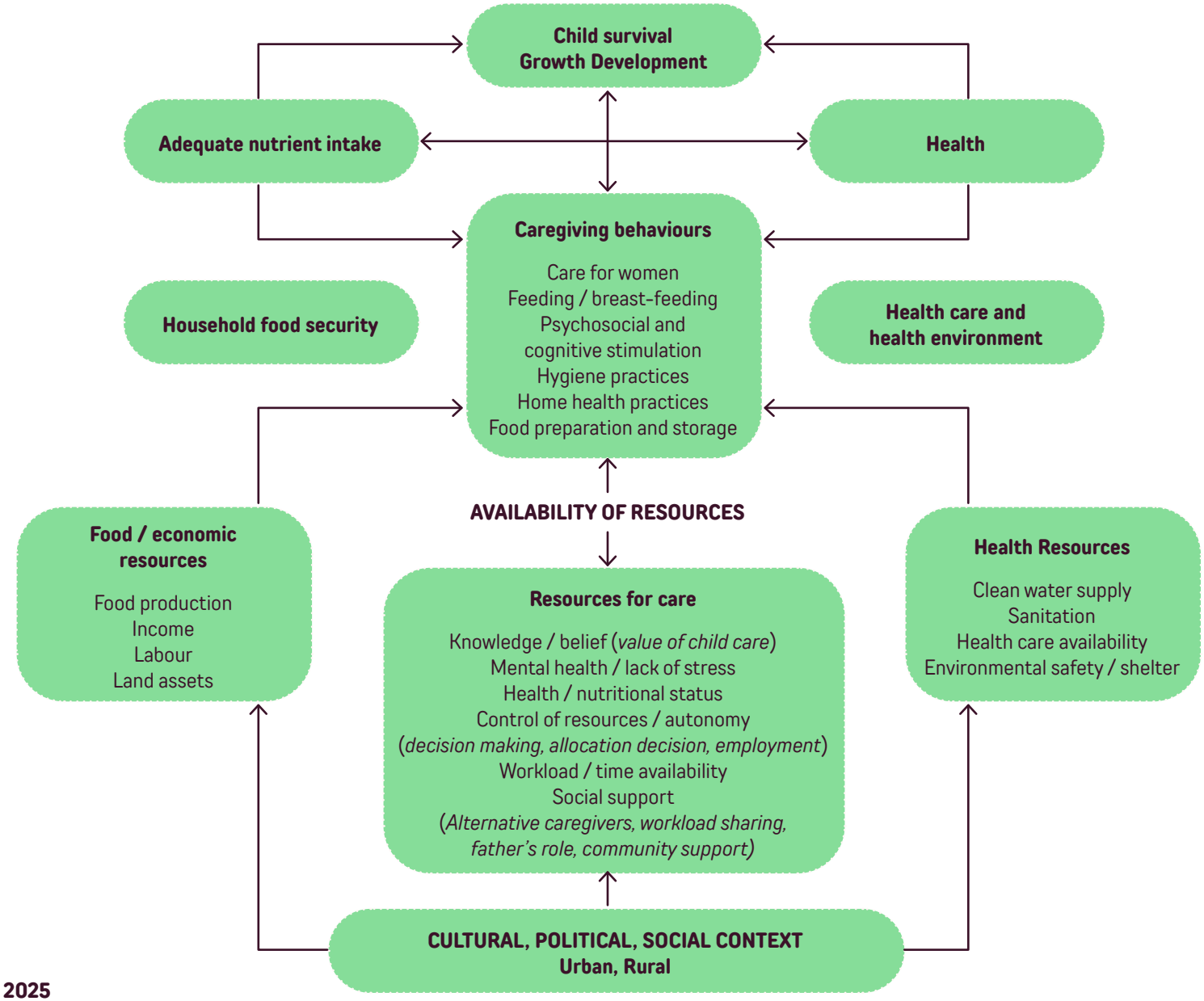
Maternal mental health interventions refer to programmes and services aimed at improving the mental health and wellbeing of mothers. Some common types of maternal mental health interventions are screening and treatment for depression, anxiety and postpartum depression, and could include counselling, psychosocial support, therapy, support groups, and medication when needed. Integrating mental health services into maternal and child healthcare systems, as well as training health workers and raising public awareness are also possible interventions. The overall goals are to identify and treat mental health conditions early, reduce stress and improve coping abilities, decrease risks for poor mental health, and provide psychosocial support to empower mothers and improve mother-child bonding. This in turn can improve maternal and child health outcomes.

Pathways of maternal mental health and women's empowerment interventions to child outcomes are highlighted in an expansion of the 1990 UNICEF analytic framework, that aimed to distinguish between "care practices" and "maternal resources for care" as determinants of child nutritional well-being (Cunningham et al, 2015).



RESULTS

Figure 7: Maternal resources for care



Source: Cunningham et al, 2025

RESULTS

"Maternal resources for care" are those that may affect how mothers are able to care for their children, ultimately operating as determinants affecting a child's nutritional status, and include: education and knowledge, physical health, mental health; and three domains related to women's empowerment: autonomy and control of household resources, workload and time availability and social support networks (Cunningham et al, 2015). Maternal mental health and women's empowerment interventions can therefore affect childcare practices and decision-making regarding issues like healthcare, nutrition, etc, which in turn impacts child growth and development.

Ruel and Alderman (2013) identified six pathways through which agricultural interventions can impact nutrition specifically. Three of these are related to women's empowerment, which highlights the importance of women's roles in agriculture, and of women's empowerment in general, to achieving health and nutrition outcomes. Other authors (Malapit et al, 2015; Pandey, Mahendra Dev and Jayachandran, 2016) also showed the crucial role that empowerment of women and nutrition knowledge play in establishing linkages between agriculture and nutritional outcomes.

Evidence summary

Women's empowerment

A growing body of research evidence supports the use of women's empowerment as part of nutrition-sensitive programs (Heckert, Olney and Ruel, 2019). Several studies (Yoong et al, 2012; Salmuth et al, 2021; Trócaire, 2023) demonstrate that integrating women's empowerment interventions into nutrition-sensitive and nutrition-specific interventions improves nutrition outcomes. Evidence is also mounting on the importance of women's empowerment and women's control over assets and decision-making for increasing household consumption of animal-source foods (ASFs) and equitable intrahousehold ASF allocation as well as for improving other nutrition outcomes in livestock-keeping households (Flax et al, 2023).

Previous observational and experimental studies found cross-sectional associations linking women's empowerment and child nutritional status. However, limited evidence exists to support the hypothesis that empowering women will, in turn, improve child nutritional outcomes, with indicators of empowerment being somewhat more strongly associated with maternal rather than child outcomes (Malapit et al, 2015). Women's group membership, control over income, reduced workload, and overall empowerment are positively associated with better maternal nutrition (Malapit et al, 2015).

Cunningham et al (2015) categorise women's empowerment interventions into three domains:

- Social Support Interventions: Participation in women's groups and social support lead to improved maternal nutrition knowledge, better birth outcomes, and reduced likelihood of underweight children. Pandey et al (2016) emphasised the importance of women's nutrition knowledge in influencing food production, consumption, and expenditure, thus being crucial for nutritional outcomes as it runs through all the pathways.
- Workload and Time Interventions: Interventions that free up women's time can improve child nutrition by allowing more caregiving and feeding support. However, the impact depends on how the freed-up time is utilised.
- Control of Resources and Autonomy Interventions: These interventions modestly improve maternal healthcare use, leading to better birth outcomes and can have a small-to-moderate impact on food security and child nutrition status. Control over income has been found to be positively associated with HAZ, and a lower gender parity gap improves children's diets and HAZ (Malapit et al, 2015). Cash transfers targeted to women are found to be more effective in improving child nutrition than those targeted to men (Cunningham et al, 2015 and Yoong et al, 2012). However, evidence on the impact on child nutrition outcomes of targeting cash to women remains limited and mixed, as noted above. In a nutrition-sensitive agricultural programme in Burkina Faso, Heckert et al (2019) supports the association between women's empowerment and a lower likelihood of child wasting, with spousal communication being identified as a key empowerment domain. Analyses of DHS have found that women's increased household decision-making power relative to men has a strong positive effect on children's nutritional status. For example, higher levels of decision-making power were associated with improved nutritional status in children and a reduced risk of stunting (Taukobong et al, 2016; Salmuth et al, 2021), with the reduction higher when combined with a nutrition intervention (Kraft et al, 2014).

The Women's Empowerment in Livestock Index (WELI), a standardised measure to capture the empowerment of women involved in the livestock sector, examines the domains of 'access to and control over land and livestock'; 'control and use of income'; 'workload and control over own time' and is based on evidence from the literature that women's bargaining power, control over income, control over time and workload affect the health and nutritional status of children under five years old. A study in pastoral communities in Tanzania found that women's control over livestock assets and income was positively associated with individual dietary diversity by increasing women's ability to produce or purchase more diverse, nutritious foods and suggests that opportunities to enhance gender equity can be particularly important in communities undergoing dramatic livelihood changes (eg, sedentarisation) and facing new environmental challenges, such as increasing droughts. Other studies have looked specifically at the links between livestock rearing, workload and burden on women's time allocation. They highlight that livestock programmes and interventions can put constraints on women's time, which in turn may have negative consequences on nutrition and health by reducing time for childcare, healthcare seeking, food preparation, and leisure (Sadler, K., 2020).

Studies that have specifically examined the association between women's empowerment and child anaemia or haemoglobin are scarce. In a nutrition-sensitive agricultural program in Burkina Faso, Heckert et al (2019) found that improvements in women's empowerment did not contribute to an increase in haemoglobin.

Overall, while there is some support for the positive impact of women's empowerment on maternal and child outcomes, the evidence base remains limited and mixed, highlighting the complexity of these relationships.

Maternal mental health

Taneja (Taneja et al, 2022) showed that preconception interventions including health, nutrition, psychosocial care and support, and WASH interventions helped reduce LBW but not stunting at 24 months, while pregnancy and early childhood interventions reduced both LBW and stunting. The package of interventions across the three periods had the biggest impact on these key undernutrition indicators (see section 3.3 below). Similarly, McWay et al (2022) shows that a package of health, nutrition, psychosocial care, and WASH interventions delivered during preconception, pregnancy, and early childhood reduces the risk of LBW by 24% and stunting by 51% at 24 months of age compared to control.

A study on baby tents in Haiti that provided a safe place for mothers to breastfeed and for non-breastfed infants to receive ready-to-use infant formula, also provided psychosocial support in the areas affected by the earthquake (Ayoya et al, 2013). The authors recommended important measures to be applied in future catastrophes, such as identifying psychologists before the emergency and creating a confidential space for psychosocial support. There is promising evidence from relaxation therapy during breastfeeding that indicates benefits such as reduced maternal stress, increased milk yield, and milk fat levels, particularly in mothers of preterm infants. A randomised controlled trial found greater weight gain and WFL in infants in the relaxation group (Mohd Shukri et al, 2019).

Maternal mental health, while under-researched, has shown potential to positively impact infant growth. However, those impacts are mainly shown in observational work of packages of interventions, and intervention studies are still lacking (Salmuth et al, 2021).

Research gaps

Women's empowerment

Overall, multisectoral programmes incorporating women's empowerment components have shown that they can effectively prevent wasting, but more evidence is needed, especially on impacts of specific empowerment domains on wasting outcomes, micronutrient deficiencies and child and maternal dietary diversity (Cunningham et al 2015).

A harmonised definition of women's empowerment is still needed to define which key domains it targets, and how it is measured. Work in the livestock sector has recently developed WELI for assessing empowerment (Flax, 2023). There is a need to explore options for creating a shorter version of this type of indicator for broader integration across sectors (Galiè et al, 2019). Additional tools are needed to understand how empowerment affects the consumption of ASFs and to address gaps in the connection between empowerment and nutrition.

For livestock programmes impacting human diets and nutritional status, a shift from focusing solely on women in nutrition interventions is recommended. Involving male partners and other household decision-makers is crucial for effective nutrition behaviour change, drawing from evidence supporting the engagement of men, grandmothers, and

influencers (Flax et al, 2023). Such approaches can be applied to nutrition-sensitive livestock programming. Likewise, it is also essential to anticipate and avoid unintended negative consequences for women in livestock programmes, such as potential shifts in control over resources.

Maternal mental health

The exploration of the impact of maternal mental health on infant growth reveals a field with significant potential, yet notable research gaps. While under-researched, observational evidence suggests a positive association between maternal mental health and infant growth. However, the near absence of intervention studies, particularly in humanitarian and fragile settings, limits our understanding of the nature of maternal mental health challenges and their direct effects on child nutrition outcomes.

Studies that do exist predominantly focus on maternal depression and breastfeeding. However, there is a lack of studies evaluating the efficacy of psychological assistance for caregivers on infant and young child feeding in humanitarian crises (Prudhon et al, 2018)

Action Against Hunger is a promoter of psychosocial support as an essential component of both IYCF and community-based management of acute malnutrition (CMAM) programmes. One paper (Seguin, 2015) considers the psychosocial situation of caregivers and young children as potential factors that interfere with the capacity to recover from malnutrition, as well as factors influencing the causes of undernutrition. Various difficulties exist in these programmes, such as caregiver capacity to care for their children appropriately due to their own or their children's psychosocial status, calling for further assessments to have a better understanding of the impact of psychosocial difficulties on child nutritional status.

There is a crucial need for a comprehensive review of psychological support initiatives targeting pregnant and breastfeeding caregivers facing armed conflicts to establish care standards. Additionally, future research should delve into identifying obstacles to breastfeeding and suggest innovative behavioural health and psychosocial interventions aimed at fostering the initiation and continuation of breastfeeding amidst and after traumatic armed conflicts (Corley, 2021)

3.3 Multisectoral packages of support

Introduction and Impact Pathway

The drivers of undernutrition are known to be diverse and interconnected, and any one child and/or community will experience a mix of the potential pathways discussed above that impact dietary diversity and access to health and care practices. Subsequently, a common and logical perception is that combining different interventions along a combination of the different pathways to nutrition outcomes can supplement and enhance their impact. Indeed, the first Lancet nutrition series (Black et al, 2013) reported that nutrition-specific interventions alone would only reduce malnutrition by 20% if implemented on a large scale, whereas the remaining 80% would be addressed through nutrition-sensitive interventions. In this review, a 'package of interventions or support' refers to the delivery of two or more interventions delivered together that address more than one pathway or driver of undernutrition in the same population (multi-sector). Combinations of interventions delivered in packages of support can include those targeting access to food and feeding-related issues as well as non-food-related factors such as health and WASH.

A 'good practice statement' that appears under section D: Prevention of wasting and nutritional oedema, of the new 2023 WHO guidance on prevention and management of child wasting (WHO, 2023b) states:

> In contexts where wasting and nutritional oedema occur, preventive interventions should ideally be implemented through a multisectoral and multisystem approach (ie, food, health, safe water, sanitation and hygiene, and social protection systems). These interventions should include access to healthy diets and nutrition and medical services as appropriate, counselling (breastfeeding, health and nutrition related, especially helping families use locally available nutrient-dense foods for a healthy diet), should address maternal and family needs, and should involve psychosocial elements of care to ensure healthy growth and development.

Evidence summary

Some recent published reviews have noted the improved impact of combining interventions on child growth. A systematic review by McWay examined the impact of early childhood development interventions on children's health in developing countries and found that combining two or more interventions from different sectors in a comprehensive package can lead to considerable and statistically significant impacts on child growth outcomes including wasting and stunting (McWay, Prabhakar and Ellis, 2022). Examples of this include CCTs plus nutrition supplementation (in the case of PROGRESA); cash plus maternal education; and early stimulation curriculum and nutrition supplementation. Meta-analysis (Dewey et al, 2022) suggested that co-packaging SQ-LNS with interventions that reduce constraints on response, such as the prevention and control of prenatal and child infections, improving healthcare access, and promotion of early childhood development, may lead to greater impact (see discussion above). Salmuth et al (2021) found that while breastfeeding promotion, education, support, and counselling interventions were able to show small effects on improving infant growth (ie, preventing growth faltering) or feeding outcomes, effectiveness was increased when they were implemented as part of a multi-sectoral programme. Addressing women's empowerment and adding SBC as part of multisectoral interventions is increasingly shown to improve nutrition outcomes. This is discussed under the relevant sections above.

Some individual studies have highlighted the positive impact of multisectoral interventions on maternal malnutrition. A post-intervention experimental study in a food-insecure context in Rwanda found that the prevalence of maternal malnutrition (undernutrition and anaemia) was significantly lower among pregnant women who received integrated nutrition-specific and nutrition-sensitive interventions (Habtu et al, 2022). The interventions entailed a package of nutrition education and counselling, promotion of agricultural productivity, financial literacy/economic resilience as well as provision of WASH services. Similarly, in a randomised control trial in low resource settings of Delhi (Taneja et al, 2022), the provision of an integrated and concurrent package of health, nutrition, psychosocial care, and WASH interventions during preconception, pregnancy, and early childhood periods, not only improved several maternal outcomes (higher haemoglobin concentration, GWG and reduced respiratory tract infections, anaemia, and hypertension), but also significantly reduced the risk of both LBW and stunting at 24 months. In comparison, the provision of a similar package during the preconception period alone helped reduce LBW but not stunting at 24 months. Notably, the same paper highlights the significance of providing an integrated package of interventions during critical and strategic periods (eg, the first 1,000 days) when adequate nutrition is essential for growth.

Further evidence on the prevention of undernutrition using a multisectoral approach among children is emerging from individual studies/evaluations, but results are mixed and the heterogeneity of the combination of interventions delivered and of programme contexts make drawing broad conclusions difficult.

An integrated prevention package in Cameroon (Ngwenyi, Jenkins and Patricia, 2019) that used the BSFP as an operational platform to deliver multiple services, including household food assistance, specialised nutritious food, SBC, and health and WASH services, improved the coverage of assistance and showed a reduction in the prevalence of wasting in all target regions. Notably, this programme was a reorientation of a purely treatment intervention to a more-preventive focus given the persistent low coverage in a dynamic context (chronic food insecurity and persistent malnutrition deteriorated rapidly with the gradual influx of internally displaced persons and refugees).

In the area of CVAs, there is some narrative synthesis that suggests that in crisis contexts cash plus food transfers (for preventing wasting) (Kerac and Seal, 2014) and cash plus primary health care (for preventing mortality) may have greater benefits than cash alone (Little et al, 2021). In Niger, preventive distributions combining supplementary food and cash transfer had a better preventive effect on MAM and SAM than strategies relying on cash transfers or supplementary food alone (Langendorf et al, 2014) and an evaluation in Mali of the delivery of a package of multi-sector nutrition interventions found that households living close to areas of conflict and receiving at least two forms of assistance – particularly general food distribution and school feeding – experienced statistically positive effects on nutrition outcomes, whereas the effects were not significant for households that received only one form of food assistance (Kaul, 2018). In Chad, a package of integrated and multi-sectoral services to reduce child wasting improved maternal knowledge on nutrition and health practices, including

some increased daily consumption of Super Cereal Plus among children (Becquey, E. et al, 2022). However, the coverage of the intervention was limited, and this may have contributed to the absence of any impact on the prevalence of wasting or morbidity. Another study in a pastoralist community in Chad, showed that children in communities that received a multi-sectoral intervention (including nutrition, health, WASH, and food, income and markets [FIM]) were less likely to be severely wasted and underweight, and had a higher WHZ compared with control communities that received only food aid (Marshak et al, 2017).

Few studies of packages of interventions, because of their cross-sectional nature, are able to identify and quantify the pathways of impact. However, some provide plausible evidence that effects on wasting operated through improvements in child diet and reductions in morbidity. Tubaramure, for example, a food-assisted integrated health and nutrition programme in Burundi, showed a significant protective effect on wasting and on WLZ, and increased the likelihood of children aged 6–24 months achieving the minimum recommended dietary diversity and meal frequency (Leroy, Olney, et al, 2021). The programme also improved the percentage of food-secure households, and increased household energy and micronutrient consumption. The effects on many of these outcomes were attributable to the food rations (a monthly family and individual ration of CSB and micronutrient-fortified vegetable oil). Tubaramure also lowered the prevalence of symptoms of illness and fever, as reported by mothers.

Sustainability of multi-sector programme gains post-implementation has been cited as a challenge. One study (Stobaugh et al, 2017) noted that the provision of a package of health and nutrition services in addition to traditional SFP treatment had no significant effect on improving sustained recovery in children after treatment of MAM. Similarly, an evaluation undertaken two years after the implementation of a multi-sectoral nutrition intervention that provided WASH, livelihood, health, and nutrition support in eastern Chad found that sustained improvement was confined to individuals who directly benefited from the intervention but not at the household-level (Marshak et al, 2021). Specifically, significant sustained improvement in underweight, WAZ, and HAZ was observed in children born during the intervention but not in those born after the completion of the intervention. Interestingly, boys aged 6-23 months and born after the programme ended were the most affected, with a significantly higher prevalence of wasting and being underweight. Given the complex and long pathways of undernutrition, the authors recommend the need to include sustainability in programme design eg, by including data collection points past programme implementation and organisational presence as part of initial programme evaluation design.

Research gaps

There is a broad need for more data on the impact and cost-effectiveness of different combinations of interventions across different contexts that take into account a range of impacts and implementation modalities. For example, more research is needed on identifying effective CVA plus components and effective models of how these CVA plus programmes are designed and implemented. For SQ-LNS, an important next step is additional cost-effectiveness analyses of incorporating SQ-LNS within integrated programmes to prevent and treat wasting, taking into account the potential for reducing the number of cases of both moderate and severe wasting that would need treatment with supplemental or therapeutic foods, as well as reduced numbers of children requiring hospitalisation.

While most interventions provided during pregnancy and early childhood are often part of several national programmes, delivering them as an integrated and concurrent package requires consistency in quality of service provision, which could be a challenge in humanitarian settings as well as in routine care (Taneja et al, 2022). Studies to explore feasibility of integrating the provision of integrated interventions into existing platforms of delivery in humanitarian contexts and the support required to establish a basic quality of service are warranted.

Given the complexity of determining the sustainability of multi-sectoral programme impacts, there is a need to incorporate long-term monitoring post-implementation (Marshak et al, 2021) in evaluation designs.

Finally, unpacking the complex and locally specific causes of wasting is necessary to develop appropriate and effective prevention packages. While causal analysis tools exist, there has not been wide uptake of these, due to the complexities of their implementation, and limitations in their ability to determine causality and produce results that can be used to prioritise interventions (Chalimbaud J., 2017). There is a real need for improved tools for causal pathway analysis and for gap analyses of known effective preventive measures that are feasible to implement in all settings and that better profile context-specific risks for undernutrition, as well as actions to address them.

Jump to contents

CONCLUSIONS

CONCLUSIONS

Jump to contents

4.1 State of knowledge on the prevention of undernutrition in humanitarian contexts

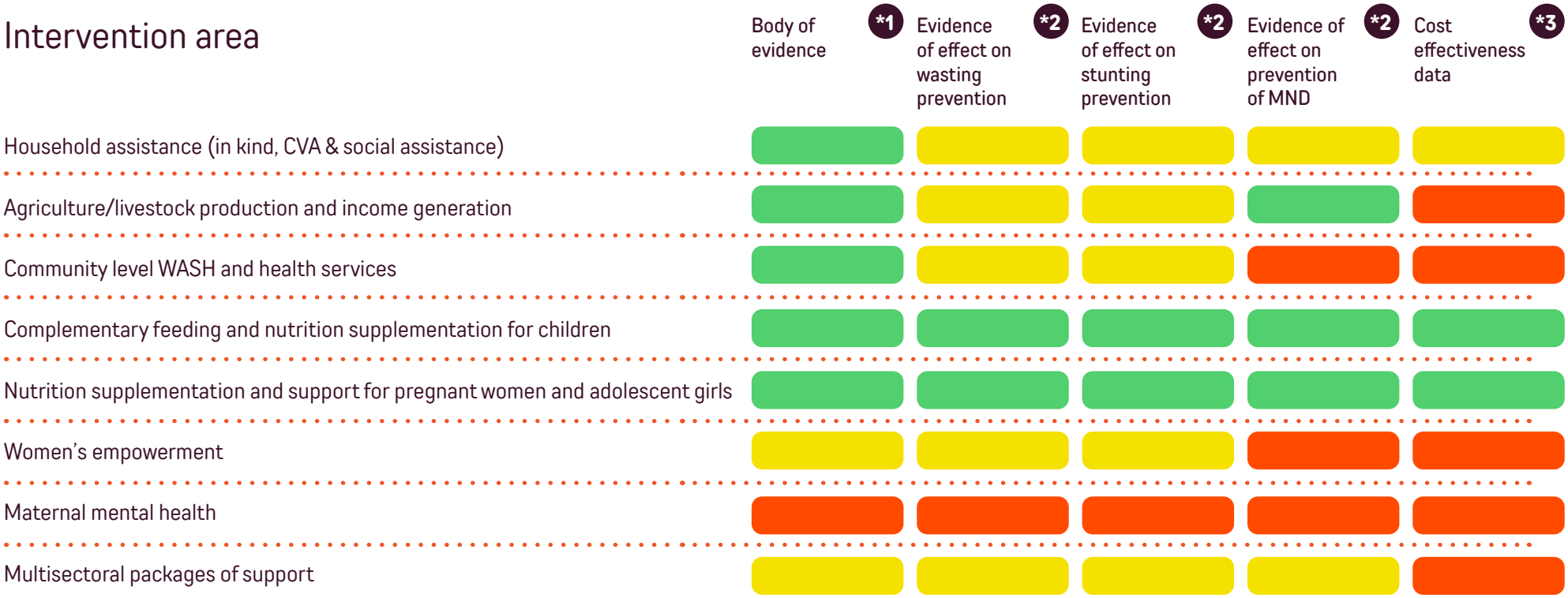
In general, when looking at the state of evidence on the prevention of undernutrition with multi-sectoral interventions (provided as single interventions or in packages of support), this review found a growing body of evidence in nearly all of the intervention areas investigated, and high-quality evidence in some areas. It is important to note however that in many areas evidence is drawn from studies implemented outside acute humanitarian contexts (although most evidence does come from populations in LMICs that suffer food insecurity), and this should be considered when applying findings from this review to development of guidance. The duration of intervention needed to see preventive impacts depends on the outcomes studied and the intervention type. This is also an important consideration for the prevention of undernutrition across different food-insecure/humanitarian contexts eg, immediate acute crisis versus long term protracted. Box 3 (below) presents a summary of the evidence for each intervention area examined by this review.

Table 2 provides a visual overview of the findings from the literature review. It highlights the view of the authors on three areas: the strength of the body of evidence, evidence of an effect on wasting stunting and micronutrient deficiency, and the availability of cost-effectiveness data. Given the fact that this review was a rapid synthesis, this table gives a broad indication of the state of evidence, rather than a precise representation.

"...this review found a growing body of evidence in nearly all of the intervention areas investigated... however...in many areas evidence is drawn from outside acute humanitarian contexts..."

CONCLUSIONS

Table 2: State of evidence on the prevention of undernutrition by intervention area.



*1
- Several quality studies (including systematic reviews, RCTs);
- Medium/limited number of quality studies;
- Very few or no quality studies.

*2
- Significant effects observed on prevention and in several studies
- Modest effects observed in some trials and on outcomes along the pathway to prevention (eg, diet diversity, LBW, infection), or effects found but in poor-quality trials
- No significant effects found on the outcomes examined

*3
- Some cost-effectiveness data exist on the prevention of wasting or key outcomes on pathways to wasting (diet diversity, LBW)
- No cost-effectiveness data exist.

CONCLUSIONS

Box 3: Summary of the evidence by intervention area

Community and household-level assistance

Food, cash/voucher and social protection: There is a substantial evidence base on the impact of CVA on nutrition outcomes, sourced mainly from stable contexts; and a growing body of evidence emerging from humanitarian settings. Evidence for impact of CVAs on child dietary diversity, household food security and uptake of health and nutrition services is good, whilst the evidence base on impact of CVA on wasting and stunting is mixed. In-kind food assistance can support good impacts for women's and children's dietary intakes, stunting and anaemia, and also possibly birth outcomes such as LBW (although evidence is weaker), especially when combined with other interventions (eg, cash + supplement/food transfer, cash + SBC). Evidence indicates that interventions are most effective when targeted directly to women and children. The duration of food, cash/voucher and social protection interventions and timeline to measurement of nutrition status outcomes assessed varies widely across studies with many studies targeting women and children during the first 1,000 days and recording nutrition outcomes at around the 6–12 months age group in children. Measured changes in diet diversity and household food security outcomes have been observed within much shorter timeframes and some studies examining impacts of CVA/food transfers implemented in crisis settings have seen improvements in nutrition status of children within six months. There is some limited evidence for an impact of CVA on care behaviours.

Agriculture/livestock production and income generation: Available evidence suggests a significant impact on women's and children's dietary diversity but very limited impact on child nutrition status. Nutrition-sensitive agriculture interventions may be more likely to impact child wasting if they increase production of micronutrient-rich foods along with foods high in energy or protein. Livestock-based interventions that help to maintain livestock health and access to milk, could help to address seasonal spikes in acute malnutrition in drylands Africa. Home food production with a nutrition SBC component is more effective than an agriculture intervention alone. The pathway through which home food production may have an impact is not clear, although evidence on production for consumption is most dominant. However, the duration of intervention required to achieve nutrition impacts may be a constraint in contexts where the need to stabilise a deteriorating food security situation is urgent. Evidence on the impact of income generation projects on nutrition outcomes, particularly in humanitarian contexts, is very limited.

WASH services: Current evidence is insufficient to demonstrate a consistent preventive effect of WASH interventions against stunting or wasting in children. Multiple RCTs and observational studies have found no impacts of household water treatment, latrines or hygiene practices on reducing wasting prevalence. Some systematic reviews have found a small number of low quality trials reporting reductions in stunting from WASH interventions and more promising results where WASH interventions have been included in packages of support, however there is general consensus that WASH interventions piloted in nutrition studies may not have been adequately robust to generate results. Conversely, the historical significance of WASH in disease control, the strong conceptual basis for WASH and research findings that suggest that high levels of WASH service coverage are needed to improve nutrition and health outcomes, all point to the need for more effective joint programming, as well as linked research.

Health services: Access to ANC services, including IFA or MMS in pregnancy as part of ANC (see targeted assistance below), is directly associated with improved birth outcomes and longer-term reductions in child mortality and undernutrition. Whilst prevention of childhood infection, particularly to reduce the occurrence of diarrhoea and measles, is accepted as an essential component of the prevention of malnutrition there is limited evidence available for the impacts of these interventions on improved growth outcomes.

Targeted assistance

Complementary feeding and nutrition supplementation for children: The use of SQ-LNS among at-risk children (under two years of age) reduces the prevalence of stunting, wasting and underweight. Early data suggests some of the positive effects on linear growth are still evident among children 9–11 years of age. However, compliance, duration of supplementation and coverage are important modifiers.

Whilst studies in food insecure settings that provide specialised foods to young children, such as SQ-LNS, appear to be more likely to show an impact, and more likely

CONCLUSIONS

to show larger impacts, on one or more wasting outcomes, compared with fortified complementary foods or household or child-specific staple foods, there may be other benefits to incorporating 'non-specialised'/local foods in programme design. Design of complementary feeding interventions, including the foods used, should depend on issues linked to context, availability, feasibility, cost and cultural acceptability. Growth outcomes are likely to be better when two or more interventions are provided together and in populations with worse nutrition status at baseline. Most of the evidence in this area comes from settings that could be described as food insecure and humanitarian. Caregiver education/ counselling can improve food consumption, knowledge and dietary practices, but only in settings where households have sufficient resources and access to healthy diets, and has limited impact on child anthropometry in any setting.

Micronutrient supplementation interventions alone demonstrate good impacts on micronutrient deficiency, such as anaemia, but not on stunting and wasting.

Nutrition supplementation and breastfeeding support for pregnant and breastfeeding women: There is increasing evidence that BEP supplementation of pregnant women and girls is beneficial for improving infant outcomes, reducing the rates of stillbirth, LBW and SGA and increasing mean birth weight. Although fewer studies have focused on outcomes for women/girls themselves, studies are increasingly showing positive outcomes of BEP supplementation on maternal anaemia and gestational weight gain. The use of different nutrient compositions and formulations of BEP and different ration sizes across trials and programmes has complicated the consolidation of evidence to inform implementation guidance on BEP supplementation.

Supplementation with IFA is associated with a reduced risk of iron deficiency and anaemia in pregnant women. There is also strong evidence that MMS containing IFA leads to improved outcomes over IFA alone in terms of reduction of LBW, SGA births, preterm births and stillbirths. The benefits are greater among anaemic and underweight pregnant women, those who initiate supplementation earlier, and those with higher adherence. To date, much MMS programming has been small-scale and more experience with implementing MMS interventions is called for, particularly in humanitarian contexts.

WIFAS has been shown to be efficacious in increasing haemoglobin concentrations and reducing anaemia among anaemic adolescent girls in targeted interventions, especially through school platforms where nutrition education can support compliance.

Maternal mental health and women's empowerment: Evidence shows women's empowerment interventions, such as nutrition education, entrepreneurship training, livelihood programmes that increase spousal communication, financial decision-making and healthcare decision-making, can reduce likelihood of child wasting. Empowerment allows women greater control over resources to provide nutritious food and make healthcare decisions benefitting child nutrition. However, the relationship is complex, as increased autonomy may reduce care time, or social support trade-offs can emerge. Further research is needed to delineate the specific impacts of maternal mental health interventions, especially in the context of standalone approaches.

The multifaceted nature of maternal mental health, coupled with its integration into broader intervention packages, underscores the need for targeted investigations to optimise outcomes for both maternal mental health and child nutritional well-being. Further research is needed in humanitarian and fragile settings affected by conflict.

Multisectoral packages of support

There is growing evidence to suggest that a combination of interventions is more effective at preventing wasting than separately implemented interventions. This is particularly true of the combination of CVAs, food supplementation and/or agricultural/food production and health, and of the addition of nutrition SBC to any of these interventions/ intervention packages. Furthermore, addressing women's empowerment as part of multisectoral interventions is also increasingly shown to improve nutrition impacts. Concurrent provision of these combined interventions during critical periods such as preconception, pregnancy, and early childhood, while incorporating sustainability in monitoring and evaluation designs, is also recommended. There is emerging evidence that indicates effects on wasting operate through improvements in child diet and reductions in morbidity in some contexts.

4.2 Operational factors that affect nutrition outcomes

Critical considerations that modify, limit or enhance impacts on nutrition outcomes include the following:

4.2.1 Seasonality

There is a growing body of evidence on the seasonality of child wasting. Seasonality influences access to food, feeding practices, infectious disease and birthweight. Recent work has shown that there can be large variation in nutritional status at birth depending on the month or season of birth. One study in the Gambia found that infants who were wasted during the first rainy season (typically the lean/'hungry' season) of their lives had an increased risk of wasting during the same season the following year, even if they recovered in the intervening dry season (Schoenbuchner et al, 2019). This is also confirmed through recent work by Mertens et al, showing the population-level effect of season on WLZ, with higher WLZ in drier periods and the lowest mean z-scores occurring during the rainiest months (Mertens, Benjamin-Chung, Colford, Coyle, et al, 2023).

The importance of seasonality as a driver of malnutrition is underscored by Fracassi et al's findings from surveys in Chad, Sudan, and South Sudan, indicating two seasonal peaks in acute malnutrition in children under five years: the first and larger peak at the end of the hot dry season, as the rains start, and the second peak coinciding with the end of the rains and the beginning of the harvest season (Young and Marshak, 2018). This seasonal pattern coincides with pre-harvest depletion of food stocks, rises in food prices and/or increased disease transmission as a result of the rainy season. Other studies (Venkat et al, 2023) in African drylands show similar results, with two peaks of wasting during the calendar year, one being during the primary peak of temperature and the second during the primary peak of rainfall and secondary peak of temperature. Marshak et al (Marshak, Young and Naumova, 2023) show that a one celsius degree monthly increase in temperature is significantly associated with a 5% and 12% increase in the odds that a child is wasted and severely wasted, respectively, adding proof of the effects of climate change on nutritional outcomes, through directly impacting the four systems that are crucial for health for nutrition: agri-food, water, health services and social protection systems.

The Directorate-General for European Civil Protection and Humanitarian Aid Operations (DG ECHO) highlights the need for a strategic shift from addressing "immediate nutritional needs" to reducing structural vulnerability in the Sahel region, emphasizing the importance of addressing both seasonal, high intensity peaks and long-term resilience (European Civil Protection and Humanitarian Aid Operations [ECHO] [European Commission] and ICF, 2022). As such, national multi-sectoral nutrition plans such as that in South Sudan and elsewhere have referenced the need to integrate livelihood dynamics and seasonality in the design and delivery of emergency and resilience-building programmes to meet the nutritional needs of children in situations of acute food insecurity (Fracassi et al, 2023). In addition, given the evidence around the impact of season both on wasting prevalence and on birthweight, and the future risk for growth failure, should be one factor considered for interventions that target both women and children.

4.2.2 Intervention coverage and convergence

This has the potential to significantly affect population-level outcomes, such as change in the prevalence and incidence of wasting. A recent example from the SQ-LNS research (discussed above) shows coverage to be an important modifier of impact. In Mali, the distribution of preventive SQ-LNS within an integrated package of services to strengthen the continuum of care for child wasting reduced the incidence of child wasting by 20% ($p<0.05$), SAM by 19% ($p<0.05$) and MAM by 21% ($p<0.05$) (Huybregts et al, 2019). In Burkina Faso, a similar programme did not see the same impacts on the incidence of acute malnutrition, most likely due to important differences in the delivery strategy and coverage achieved (Becquey et al, 2019). In Mali, community distribution of SQ-LNS rapidly achieved 60% coverage, such that the majority of infants from six months onward were receiving SQ-LNS every month over the intervention period. In Burkina Faso, coverage only surpassed 50% for children at nine months of age and hovered around 40% for the remaining nine months. Whilst recent work has shown that peak incidence of wasting is between birth and three months (Mertens, Benjamin-Chung, Colford, Hubbard, et al, 2023) a large proportion of this is associated with LBW. Other work has shown that the development of wasting after birth (wasting incidence) remains high after three months of age and peaks again between 12 and 23 months (Thurstans et al, 2022). Given this, the SQ-LNS work appears to suggest that it is important to reach young children with supplementation early in the complementary feeding period to avert episodes of wasting.

CONCLUSIONS

Maximising intervention coverage requires a programme design that focuses on reducing barriers to access, including those linked to culture, geography/distance and programme quality. Similarly, and as discussed under the logic of providing packages of support, addressing multiple pathways to wasting simultaneously could improve impacts. A growth response to nutritional supplementation, for example, may be constrained by infection, foetal growth restriction, or suboptimal caregiving (Dewey, Wessells, et al, 2021). Hence, integrated programmes and packages that combine supplementation with interventions to prevent and control prenatal and postnatal infection and inflammation, optimise foetal growth via improved maternal nutrition and other strategies, and support care for women and children should be further evaluated.

4.2.3 Ration size, quality, targeting and timing of supplementation

In food-insecure populations, providing larger rations, that fill a larger proportion of the nutrient gap, is likely to support better effects on nutrition outcomes. Tubaramure, a food-assisted integrated health and nutrition programme in Burundi, for example, reduced child wasting by approximately half – a much larger effect size than that seen in many other trials using supplementation (Leroy, Olney, et al, 2021). This could be related, at least in part, to the larger ration targeted at children (458 kcal per day) and the supplementation during pregnancy, and suggests that an understanding of the nutrient gap among children is important for programme design.

Similarly, a malnutrition prevention programme in South Sudan that relied on household ration distribution to supplement the diets of pregnant women and children under two found few households had any ration remaining less than one month after distribution and that the food assistance provided was a primary rather than supplementary source of food, and as such, was not sufficient to avert increases in wasting (Paul et al, 2014). This same programme also noted the importance of understanding practices of intra-household food allocation for programme design with, in their context, the culture of shared-plate feeding of children of similar age resulting in children above the target age range of food assistance also sharing in a portion intended for one child. This study noted there to be few mechanisms to ensure a specific child consumes the intended ration portion. Further, the lack of priority given to adult women in South Sudan, including pregnant women, suggested that pregnant women were most vulnerable to inadequate food intake in times of scarcity (Paul et al, 2014).

The potential to benefit is important to consider. This can include targeting and maximising coverage of interventions to coincide with the peak incidence of wasting, particularly linked to season, age, and vulnerability (see above) and by food security status (in some settings): for example, greater impacts of SQ-LNS have been seen among children with moderate to severe food insecurity than among those in households with less food insecurity. In Burundi (Leroy, Olney, et al, 2021), effects on wasting and WLZ were highest among children who had illiterate mothers or mothers who had received no education, and children in the worst-off households, defined as those that had fewer assets or had a household head without any education.

Finally, choice of supplement is discussed above, with recent work suggesting that LNS may support more consistent and larger impacts than either FBF or household- or child-specific staple foods (Ickes, Craig and Heidkamp, 2022). The reasons for this are not well defined but may come down to a combination of factors including improved quality and 'targetability' (ie, it may be less easily shared than other forms of food assistance – see above). However, consideration of programme objective and costs versus impacts will be important when choosing the supplement. In programmes that are aiming to treat moderate wasting and prevent deterioration to severe, RUSF is found to be more cost-effective than other supplementary foods, such as Super Cereal Plus or local products (Cichon et al, 2023).

4.2.4 Choice of delivery platform

Maximising coverage and effectiveness can be achieved through the use of various delivery strategies and platforms that have been found to improve the reach and impact of nutrition actions. These delivery platforms include community-based and food-distribution platforms, financial incentives platforms, mHealth[17], and the use of mass media and social media (Janmohamed et al, 2020; Keats et al, 2021). For example, variations were seen in BEP malnutrition prevention programming for pregnant women in terms of delivery platform.

17 Digital technologies, such as mobile wireless technologies, have the potential to revolutionize how populations interact with national health services. Digital health and specifically mHealth have been shown to improve the quality and coverage of care, increase access to health information, services and skills, as well as promote positive changes in health behaviours to prevent the onset of acute and chronic diseases (WHO, 2018. mHealth Use of appropriate digital technologies for public health)

CONCLUSIONS

Where prevention programming was most closely linked to general food assistance platforms, there were advantages in terms of low cost and ability to scale up rapidly, whereas programming linked to health services have reported benefits in increasing the uptake of other services and ensuring a package of care was provided to PBWG (UNICEF, 2023a). Poor coverage and compliance are particular challenges in IFA programmes for various reasons, including lack of awareness of its benefits, negative beliefs, side effects (particularly linked to taking iron daily), difficulty in accessing the supplements and forgetfulness. Positive, context appropriate messaging is required to communicate the health benefits of supplementation to women and girls themselves, as well as to influential family and community members. Mass-media campaigns designed to change social norms around perceptions of anaemia and raise awareness of programmes, as well as sensitisation of political and community leaders can be pivotal in increasing coverage and uptake. The use of social media has potential as a platform to provide nutrition education and to motivate adolescents, increasing their knowledge and awareness and influencing attitudes, as has the use of mHealth interventions more broadly which may improve intake of micronutrient supplementation and nutritional status of pregnant women in LLMIC (Saronga et al, 2019).

4.2.5 Existing capacity and programmes

A good understanding of existing country capacities and programmes is vital in informing decisions around intervention type and choice of delivery platform. Ultimately, if interventions to improve nutrition outcomes are to be sustainable, they should be integrated into national programming. As an example, recent work by ENN (James et al, 2024) to understand how MMS is delivered in humanitarian contexts found that it is usually delivered through health services, with no examples of stand-alone interventions. However, delivery is still predominantly through small-scale programmes and pilots and supplements are mostly imported, adding to concerns over its cost in comparison with IFA. Furthermore, the lack of local/context-specific evidence on its effectiveness and implementation was reported as a barrier to any switch from IFA to MMS. Coverage and adherence data was lacking for both IFA and MMS, but where it existed there were huge gaps in both coverage and uptake of MMS. The study concluded that MMS ultimately needs to be integrated into national ANC programming if it is to be used sustainably in humanitarian contexts. It may therefore be preferable to continue with an existing national IFA programme, where it is successful, rather than switching interventions during an emergency. Alternatively, where new strategies are introduced during emergencies, it is important to ensure that these can be integrated within government plans post emergency.

4.2.5 The role of nutritional information

Accurate data on the nutrition status of children and trends in prevalence of malnutrition are required for timely and effective nutritional interventions in humanitarian contexts. A scoping review of nutrition surveillance systems (NSS), nutrition registry systems (NRS) and nutrition information systems (NIS) notes that these systems only exist in a few countries, use significantly different methods and that their effectiveness is scarcely evaluated (Sadeghi et al, 2021). Systems should reflect the treatment/remedial solutions available, as well as information on how parents and carers can protect themselves and children in their care from malnutrition. This includes highlighting risks for malnutrition (over and undernutrition) and the consideration of variation in the underlying causes of malnutrition. It also includes identifying capacity gaps to manage and prevent malnutrition.

Recent studies describe the need for a 'nutrition data revolution' (Piwoz et al, 2019) to improve the quality, availability and accessibility of data, alongside building capacity and transforming information into sound decisions. National surveys are important sources of information but limited in the range of indicators required for decision-making, while few have adequate sample sizes to enable the necessary disaggregation to highlight inequities among population sub-groups. For example, data on the effective coverage of interventions is lacking. Innovations are needed to reduce the cost and complexity of nutrition data collection. Recent innovation has focused on technology-enabled automated processes, including the use of mobile technology and open-source software to collect data in real time. Advances are needed across a range of issues from improved sampling methodologies to validated methods for assessing the coverage and quality of interventions, as well as easier and more accurate means for measuring food intake, length and body composition and micronutrient status. Additionally, innovations are needed to strengthen methods used in nutrition early warning systems, particularly for areas that face repeated crises.

CONCLUSIONS

Jump to contents

The WFP-UNICEF joint initiative Nutrition Vulnerabilities Assessment in Crisis (NuVAC) is a new nutrition information systems-strengthening approach for use in fragile and conflict-affected states (FCS) that ultimately aims to optimise the impact of nutrition responses through:

1. Reliable and predictable nutrition information and analysis on where and when to focus
2. Consensus-based nutrition security analysis focused on drivers of malnutrition
3. Better communication to influence decision-making on resource allocations and strategic recommendations.

It also aims to provide a mechanism to define "early warning triggers and thresholds that facilitate more coordinated anticipatory actions to prevent and respond to any deterioration of nutrition status" (Hailey, P. et al, 2023).

Nutrition outcomes are affected by a variety of combinations of underlying factors in humanitarian contexts. The sequence and duration of shocks can quickly lead to spikes in acute malnutrition. The Action Against Hunger Modelling Early Risk Indicators to Anticipate Malnutrition (MERIAM) project uses available secondary data for forecasting the risk of child wasting based on a range of household and community characteristics to provide subnational forecasts. Their research to date shows promising potential to advance early warning 'in a manner that enables effective responses to manage and mitigate nutritional risk'.

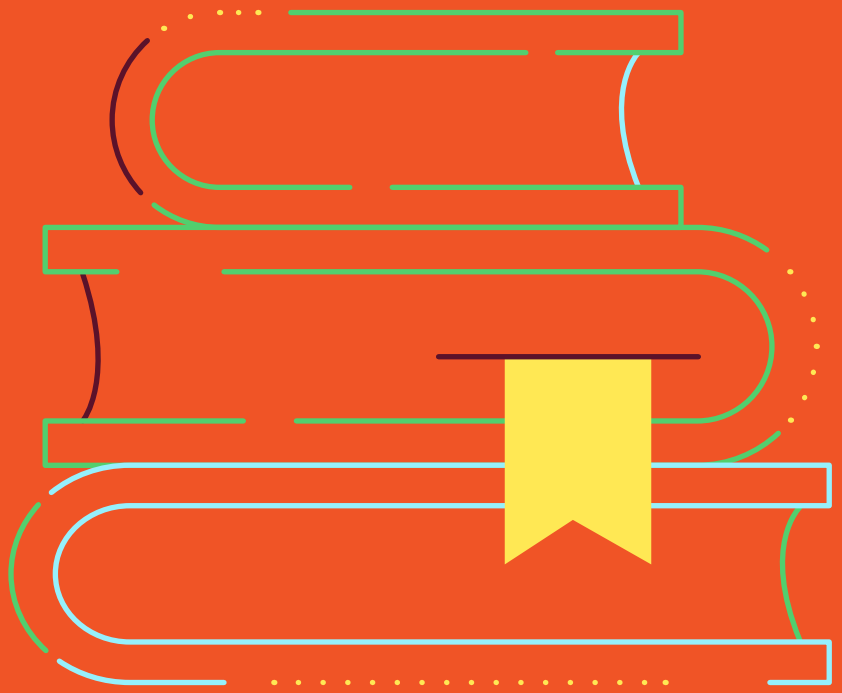
4.3 Next steps and evidence gaps

This evidence synthesis was carried out as an initial step to inform the development of guidance on multi-sectoral preventive package(s) of interventions for children and PBWGs that are evidence-based, practical and responsive to need across different humanitarian policy and programming contexts. As such, informed decisions need to be taken on whether there are enough data of sufficient quality across intervention areas to develop such guidance. Our analysis presented in Table 2 (see Section 4.1) suggests that there is sufficient evidence in the key intervention areas to move ahead with guidance development.

Whilst some interventions are under-evidenced, we conclude that this shouldn't necessarily exclude them from any guidance development process at this stage, especially if they form part of an essential package we have long known to be important for maternal and child health and if they come out strongly as important during the consultations that will support next steps. Work linked to these next steps should discuss caveats to acknowledge that more evidence in some areas would help to strengthen understanding of the most effective and cost-effective combinations of interventions needed to prevent undernutrition in different contexts. The future testing and evaluation of any guidance developed (that is planned for the next phase of work under this Elrha project) could help to provide some of the additional evidence needed. Annex 3 summarises the research gaps discussed in the main narrative above.

Jump to contents

ANNEX 1 STAKEHOLDERS CONTACTED



Jump to contents

ANNEX 1

Name of Institution	Category of Institution	Location
WFP	UN Agency	Pakistan
WFP	UN Agency	Italy
WFP	UN Agency	Kenya
WFP	UN Agency	Netherlands
UNICEF	UN Agency	Kenya
UNICEF	UN Agency	Senegal
UNICEF	UN Agency	Jordan
UNICEF	UN Agency	Sudan
UNICEF	UN Agency	Kenya
UNICEF	UN Agency	France
UNICEF	UN Agency	Yemen
UNICEF	UN Agency	USA
FAO	UN Agency	Italy
WHO	UN Agency	Switzerland
World Vision	INGO	USA
Action Against Hunger	INGO	UK
Concern Worldwide	INGO	Ireland
Goal Global	INGO	Ireland
Trocaire	INGO	Somalia
Save the Children UK	INGO	UK
Save the Children International	INGO	USA
IRC	INGO	Kenya
Alima	INGO	France

ANNEX 1

Jump to contents

Catholic Relief Services	INGO	Kenya
Mercy Corps	INGO	Kenya
American Institute of Research	Research Institute	USA
Tufts/FIC	Research Institute	USA
JHU	Research Institute	USA
IFPRI	Research Institute	USA
Exemplars in Global Health	Research Institute	USA
APHRC	Research Institute	Kenya
KEMRI	Research Institute	Kenya
Kenyatta University	Research Institute	Kenya
Gates Foundation	Donor	USA
World Bank	Donor	USA
USAID	Donor	USA
EC/ECHO	Donor	Belgium
ECHO	Donor	Belgium
MoH	Government	Malawi
MoH	Government	Pakistan
MoH	Government	Kenya
SUN-Yemen Secretariat	Coordination Mechanism	Yemen
SUN civil society network, hosted by Save the Children UK	Coordination Mechanism	UK
Global Nutrition Cluster	Coordination Mechanism	Switzerland
Nutrition Cash Voucher Assistance Global Technical Working Group	Coordination Mechanism	UK
YAD	NGO	Yemen
Centre for Humanitarian Change	Humanitarian think tank	Kenya

Jump to contents

ANNEX 2: PICO AND DETAILS OF THE SEARCH STRATEGY

ANNEX 2

First, a broad search strategy was performed in both Google Scholar and Pubmed using the following search terms and their consecutive MeSH terms: (prevention) AND (wasting OR stunt* OR micronutrient deficiency) AND (undernutrition OR Malnutrition OR hunger) AND (child* OR infant* OR adolescent OR maternal OR mother* OR pregnant OR breastfeed* OR lactat*) AND (food assistance OR household assistance OR Cash and voucher assistance OR in-kind assistance OR food distribution OR nutrition OR social protection OR social and behaviour change communication OR agriculture OR food security OR WASH OR sanitation OR Women's empowerment) AND (low- and middle-income countries OR vulnerable population OR developing countries).

Jump to contents

P **Population** — Households targeted for assistance, Children 0-5 years, Pregnant and breastfeeding women, adolescent girls living in low- and middle-income

I **Intervention** — Interventions that include an objective to prevent undernutrition

C **Comparison** — Any or No comparison

O **Outcome** — Wasting incidence/prevalence, stunting prevalence, MND prevalence, women/child/household dietary diversity

Jump to contents

ANNEX 2

After running MeSH/non-MeSH word testing, it was decided to go without MeSH words as the free text keyword search resulted in more relevant articles and was more tailored to our PICO. To further highlight our desired outcomes (wasting, stunting, micronutrient deficiencies and low birth weight) and bring relevant articles to the top of the search, it was decided that four searches were to be done separately in both PubMed and Google Scholar, as follows:

1. (prevention) AND (wast*) AND (undernutrition OR Malnutrition OR hunger) AND (child* OR infant* OR adolescent OR maternal OR mother* OR pregnant OR breastfeed* OR lactat*) AND (supplement* OR food assistance OR household assistance OR cash and voucher assistance OR in-kind assistance OR food distribution OR nutrition OR social protection OR social and behaviour change communication OR nutrition education OR agriculture OR livelihood OR livestock OR food security OR WASH OR sanitation OR Women's empowerment) AND (low- and middle-income countries OR vulnerable population OR developing countries)

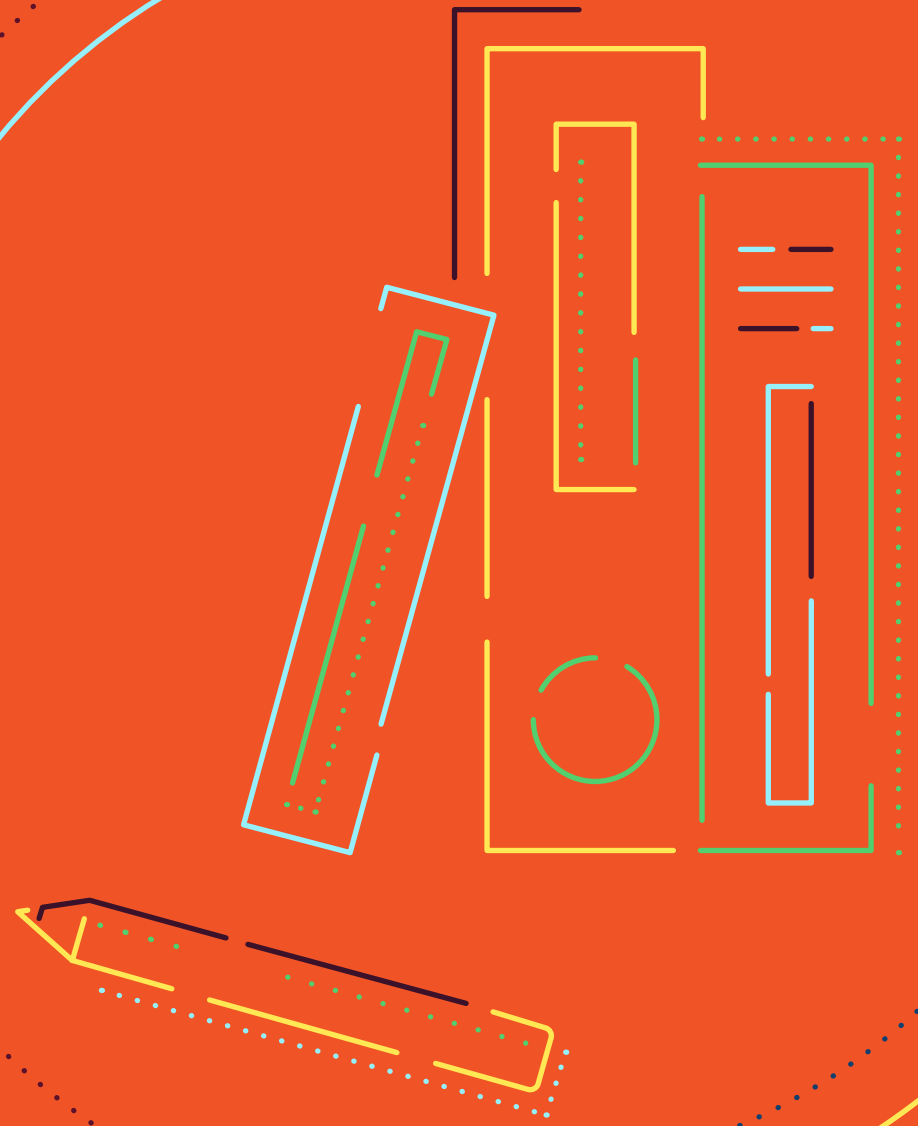
2. (prevention) AND (stunt*) AND (undernutrition OR malnutrition OR hunger) AND (child* OR infant* OR adolescent OR maternal OR mother* OR pregnant OR breastfeed* OR lactat*) AND (supplement* OR food assistance OR household assistance OR Cash and voucher assistance OR in-kind assistance OR food distribution OR nutrition OR social protection OR social and behaviour change communication OR nutrition education OR agriculture OR livelihood OR livestock OR food security OR WASH OR sanitation OR women's empowerment) AND (low- and middle-income countries OR vulnerable population OR developing countries)

3. (prevention) AND (micronutrient deficiency) AND (undernutrition OR malnutrition OR hunger) AND (child* OR infant* OR adolescent OR maternal OR mother* OR pregnant OR breastfeed* OR lactat*) AND (supplement* OR food assistance OR household assistance OR cash and voucher assistance OR in-kind assistance OR food distribution OR nutrition OR social protection OR social and behaviour change communication OR nutrition education OR agriculture OR livelihood OR livestock OR food security OR WASH OR sanitation OR women's empowerment) AND (low- and middle-income countries OR vulnerable population OR developing countries)

4. (prevention) AND (low birth weight) AND (undernutrition OR malnutrition OR hunger) AND (child* OR infant* OR adolescent OR maternal OR mother* OR pregnant OR breastfeed* OR lactat*) AND (supplement* OR food assistance OR household assistance OR cash and voucher assistance OR in-kind assistance OR food distribution OR nutrition OR social protection OR social and behaviour change communication OR nutrition education OR agriculture OR livelihood OR livestock OR food security OR WASH OR sanitation OR women's empowerment) AND (low- and middle-income countries OR vulnerable population OR developing countries)

Jump to contents

ANNEX 3: SUMMARY OF KEY EVIDENCE GAPS BY INTERVENTION AREA



ANNEX 3

Community and household-level assistance

There are significant gaps in the evidence on agricultural home food production between existing research and the needs and current practices in humanitarian settings. More evidence is needed from well-defined studies with specific nutrition objectives to garner clarity on the pathways through which agriculture can operate best to achieve nutrition results.

The evidence for social assistance programmes (CVAs/in-kind assistance) is difficult to summarise because of mixed and inconclusive results. The heterogeneity between studies makes syntheses and meta-analyses of the data difficult. More evidence generation, with better-designed evaluations and consistency in programme and evaluation designs across different programmes and contexts, is needed.

Access to health services and uptake by women and children particularly the role of immunisation and disease control in achieving nutrition outcomes merits further consideration. There remains limited, contextual evidence on nutrition outcomes for mothers and infants of the ANC package of care provided, apart from that linked to provision of IFA/MMS to pregnant women specifically.

Research is needed on WASH interventions that are radically more effective in reducing faecal contamination in the domestic environment and understanding their impacts on nutrition outcomes. Safe management of both child faeces and contact with animal faeces as essential components of effective sanitation service chains should form an important part of this research.

Complementary feeding and nutrition supplementation for children

There remain important questions linked to the targeting of, and maximising the benefits of, SQ LNS.

There is limited evidence on the cost and cost-effectiveness of providing SQ-LNS to young children. While the evidence that exists is positive in term of cost-effectiveness (compared to other programmes), the total cost for a programme including all age-eligible children would be high. Strategies to reduce costs, such as targeting to the most vulnerable populations, may enhance financial feasibility.

Evidence suggests greater impact of SQ-LNS might be obtained by co-packaging them with interventions that alleviate constraints to response, including relating to health, mental health for women, and early childhood development. More evidence is needed to define these packages across different programming contexts.

More evidence is needed on the impact of SQ-LNS and other complementary/supplementary feeding programmes on children over two years; ie, between the ages of 24 and 59 months.

Nutrition supplementation for pregnant and breastfeeding women and adolescent girls

While the use of BEP and MMS has been shown to improve birth outcomes such as LBW, there remains a need to better understand how and to what degree this can reduce the subsequent risk of wasting among children across different contexts as well as prevention of wasting among at-risk mothers.

More research is needed on effective platforms and mechanisms for the delivery of interventions to women, particularly across different humanitarian contexts, which support accessibility, adherence and high coverage. This is a particularly important consideration in contexts where IFAS is well-established in national ANC programmes and the risk to disruption of long-term programmes merits consideration alongside potential benefits of a switch to MMS.

Greater efforts are needed to increase appropriate, feasible and ongoing monitoring of intervention performance, and evaluation of impact for pregnant and breastfeeding women and adolescent girls, and for their children.

ANNEX 3

Maternal mental health and women's empowerment:

More evidence on impacts of specific empowerment domains on wasting outcomes, micronutrient deficiencies and child and maternal dietary diversity

A harmonised definition of women's empowerment is still needed to define which key domains it targets, and how it is measured

Maternal mental health studies predominantly focus on maternal depression and breastfeeding, leaving gaps in research on child nutritional outcomes. There is a tendency to incorporate maternal mental health interventions into broader packages which can limit our understanding of added value for impact.

Multisectoral packages

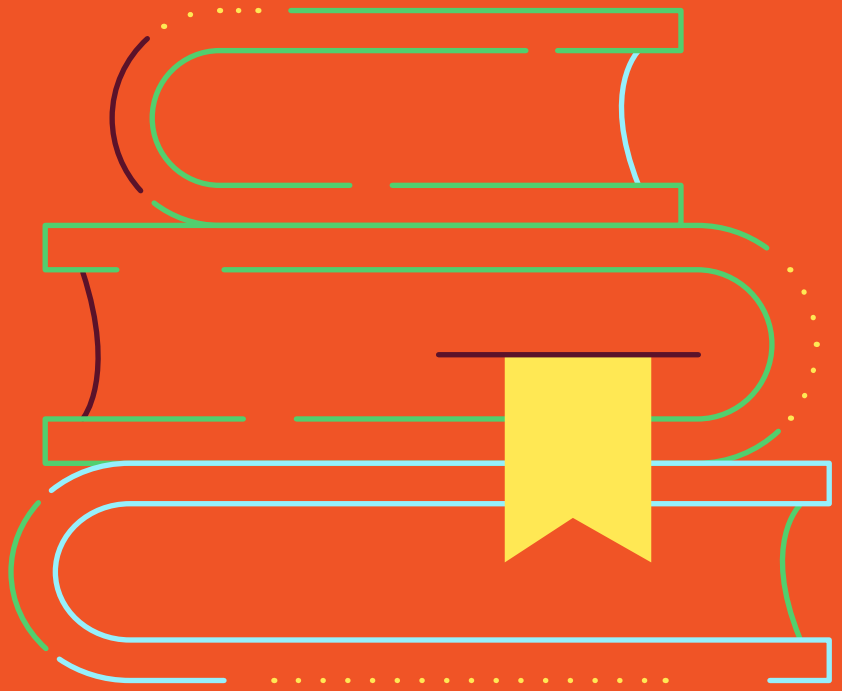
The heterogeneity of intervention packages, as well as different programming contexts, makes it very difficult to draw any broad conclusions around different packages.

More data are needed on the impact and cost-effectiveness of different combinations of interventions across different contexts, that take into account a range of impacts and implementation modalities.

There is a lack of feasible tools to help with understanding the specific causes, pathways and gaps in wasting prevention to support the appropriate and effective programme design of packages for nutrition support.

Jump to contents

REFERENCES



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