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Technical Brief

Desk Review on Health Systems Approaches to Support Wasting Reduction

Introduction

USAID Advancing Nutrition developed a learning plan on wasting in collaboration with the USAID Bureaus for Global Health; Humanitarian Assistance; and Resilience, Environment, and Food Security (2022). The objectives of the learning plan were to **synthesize learning and build the evidence base** to accelerate reduction of wasting in both non-emergency and humanitarian settings. The learning plan includes six main learning questions to inform decision-making for impact on wasting prevention and treatment (annex I) (USAID Advancing Nutrition 2022).

This brief presents findings to help answer learning question 2:

- Which evidence-based strategies/approaches can USAID strengthen/scale-up to support wasting prevention and treatment through the health system?
  - What does the evidence/research show about strengthening (improving the coverage, effectiveness, and sustainability through cost-effective means) wasting programming through integration[1] of different packages (integrated community case management [iCCM], community-based management of acute malnutrition [CMAM], integrated management of childhood illness [IMCI], growth monitoring and promotion [GMP])?
  - What factors facilitate and constrain the effective implementation of these health service interventions?

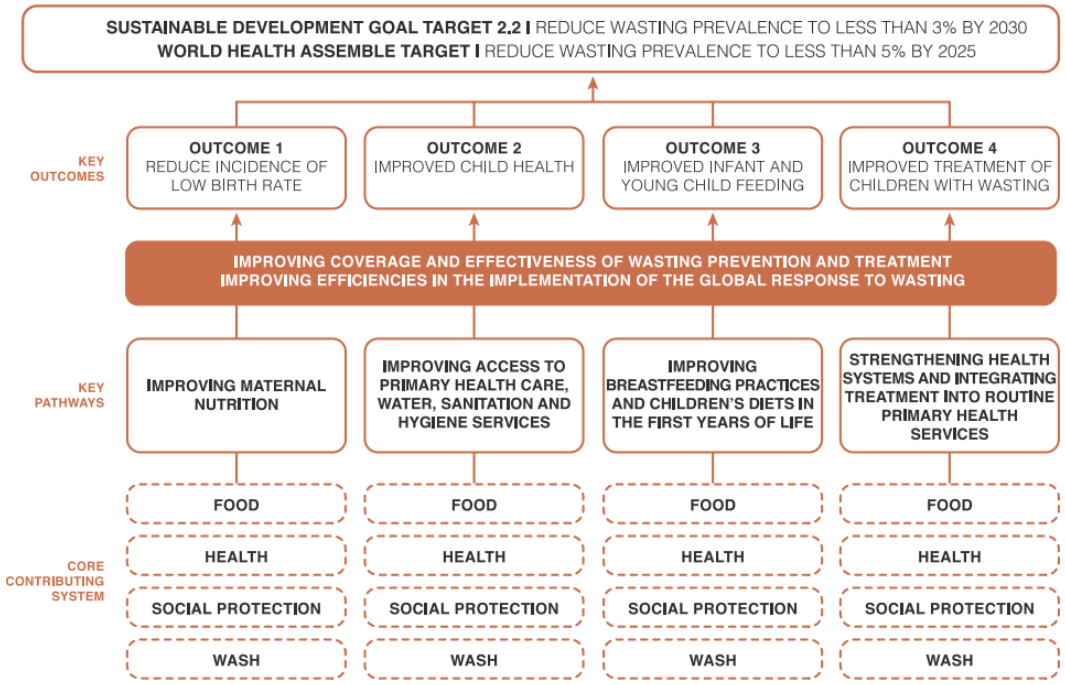
To answer the questions, the brief presents evidence for effectiveness of health system approaches, documented considerations for implementation of the approaches, and areas for further research. For this brief, we define intervention as an action taken to prevent or treat illness or poor nutritional status; package as more than one intervention delivered together; and approach as an intervention or package. A companion brief outlines evidence on food systems approaches (learning question 1) (USAID Advancing Nutrition 2023).

Desk Review Methods

To help answer the learning questions, the project conducted a desk review guided by the Global Action Plan (GAP) on Wasting framework (figure 1). The objective of the GAP is to reduce global wasting prevalence to less than 5 percent by 2025 and reduce global wasting prevalence to less than 3 percent by 2030 (UNICEF et al. 2021). The GAP aims to achieve this outcome by targeting four key outcomes: 1) reduced incidence of low birth weight (LBW); 2) improved child health, 3) improved infant and young child feeding, and 4) improved treatment of child wasting. For each outcome, the GAP identified pathways based on evidence and programmatic experience. The GAP further lists priority interventions for several systems: health; food; water, hygiene, and sanitation (WASH); and social protection (UNICEF et al. 2021).

[1] We define integration as incorporating services/interventions into existing service delivery, which is distinct from co-location, which we define as services/interventions delivered to the same population.

Figure 1. Global Action Plan on Wasting Framework



Source: UNICEF et al. 2021, 6

For the desk review, we took two approaches. First, to understand what we know about the effectiveness of interventions implemented through the health system on wasting prevention and treatment, we reviewed the *2021 Lancet Series on Maternal and Child Undernutrition* (Keats et al. 2021). The Lancet Series is the most recent publication that synthesizes evidence on interventions that effectively improve maternal, infant, and young child nutrition behaviors and nutritional status. We also conducted a search on PubMed to update the evidence since the publication of the *Lancet Series* (box 1).

Second, to understand the evidence on packages of interventions implemented through the health system, we conducted a Google Scholar search (box 2). We did this because the *Lancet* reports on the effectiveness of a single intervention rather than a combination of interventions. In our search, we prioritized review articles, systematic reviews, and meta-analyses because our objective was to identify interventions and packages for which strong evidence exists. However, if a synthesis was unavailable, we reported findings from a single study and noted it as such.

Box 1. Google Scholar Search for Integration of Packages

Dates: 2012 2022

Type: review articles

Search terms: (wasting OR "acute malnutrition") AND (iCCM OR ICCM OR IMCI OR "growth monitoring and promotion") AND children AND (impact OR effectiveness) AND integration

Box 2. PubMed Search to Update Evidence since *the Lancet Series*

Dates: 2018 2023

Type: any (not restricted to review articles)

Search terms: ("acute malnutrition" OR "child wasting") AND "intervention"

Evidence on Reducing Wasting through the Health System

Below we summarize evidence for health system approaches that contribute to the four GAP outcomes and their related pathways. When evaluating impact, the primary study outcome was prevalence or incidence of wasting (defined using mid-upper arm circumference [MUAC] or weight-for-height Z score [WHZ]), risk of wasting, low birth weight (LBW), recovery from wasting, or mortality (only for treatment programs). Pooled estimates based on relative risks are reported as reductions in the risk of wasting or risk of LBW. The secondary outcomes were intermediate outcomes such as illness, micronutrient status, breastfeeding practices, complementary feeding practices, program coverage, or care-seeking practices that are on the pathway to preventing or treating wasting (figure 1). We also included the strength of the impact based on what the systematic reviews reported and cost-effectiveness data, if available (annex 2).

Outcome 1: Reduce Incidence of Low Birth Weight (Prevention of Wasting)

Pathway 1: Improving Maternal Nutritional Status

Preconception: A pooled analysis of 18 longitudinal cohorts from 10 low- and middle-income countries (LMICs) in South Asia, sub-Saharan Africa, and Latin America showed that the prevalence of wasting was highest at birth—likely due to intrauterine growth restriction or preterm birth (Mertens et al. 2022). However, few studies have examined the effect of preconception supplementation on child wasting. Secondary analysis of data from two sites in South Asia (India and Pakistan) of the Women First Preconception Maternal Nutrition Trial found that small quantity lipid-based nutrient supplements (SQ-LNS) with balanced energy protein (BEP)[2] supplements (if women had a body mass index <20 kilogram [kg]/meter^2) given to women before pregnancy and continued into pregnancy[3]—compared with no supplementation—reduced the risk of newborn wasting by 24 percent (Dhaded et al. 2020).

Antenatal: Among the interventions delivered to women during pregnancy (the antenatal period), there is strong evidence for supplementation with iron and folic acid (IFA) compared with folic acid/placebo, and supplementation with multiple micronutrient supplementation (MMS) compared with IFA on reducing the risk of LBW by 12 percent and 15 percent,[4] respectively (Lassi, Padhani et al. 2020; Keats et al. 2019). There is moderate quality evidence for the effect of malaria chemoprevention and food distribution (in LMICs) and low-quality evidence for supplementation with BEP (in LMICs) in reducing the risk of LBW (Lassi, Padhani et al. 2020; Keats et al. 2019). Nutrition education compared with no counseling or education reduces the risk of LBW by 96 percent, but the evidence comes from only one study of unspecified quality (Ota et al. 2015). Similarly, there is some evidence for the effect of malaria prevention interventions such as insecticide-treated bed nets compared with no bed nets on reducing the risk of LBW, but the quality of evidence is unspecified (Gera et al. 2016).

Outcome 2: Improved Child Health (Prevention of Wasting)

Pathway 2: Improving Access to Primary Health Care Services and Strengthening Quality of Care

Child health: Studies on interventions delivered to children through the health system reported an impact on intermediate outcomes, such as a reduction in the incidence or prevalence[5] of illness (diarrhea, pneumonia); improvement in micronutrient status (vitamin A deficiency, anemia); and increase in program coverage or care seeking, but the studies did not find an effect on the risk of wasting or did not examine this relationship. The interventions that did not find an effect on the risk of wasting were iron supplementation (three studies), zinc supplementation (six studies), and IMCI (two studies) (Tam et

[2] Food supplements where protein comprises less than 25 percent of the total calories
[3] Pregnant women who did not meet guidelines for gestational weight gain in the second and third trimester also received the BEP.
[4] Researchers observed a 15 percent reduction in LBW when MMS includes at least three micronutrients and 21 percent reduction in LBW when MMS includes more than four micronutrients.
[5] Some studies reported on incidence while others reported on prevalence of an illness.

al. 2020; Gera et al. 2016). For this relationship, the reviews either did not report on the quality of evidence or the quality of evidence was considered to be moderate. The interventions that did not examine wasting as an outcome were vitamin A supplementation (16 studies), malaria prevention [insecticide-treated bed nets (6 studies) and intermittent preventive treatment (4 studies)], and iCCM (2 studies) (Pryce, Richardson, and Lengeler 2018; Esu, Oringanje, and Meremikwu 2019; Oliphant et al. 2021). We did not find a synthesis of studies that examined the effect of vaccinations on wasting, but we found an observational study from Nigeria that reported no association between uptake of four childhood vaccines[6] and wasting status at one point in time (Sato 2021).

Outcome 3: Improved Infant and Young Child Feeding (Prevention of Wasting)

Pathway 3: Improving Breastfeeding Practices and Children's Diets in the First Years of Life

Breastfeeding: Breastfeeding education delivered at the home, community, or facility by community health workers (CHW), volunteers, or health care professionals have shown to improve intermediate outcomes, such as early initiation, exclusive breastfeeding, and diarrhea prevalence (Lassi, Rind et al. 2020; Keats et al. 2021). However, these studies have not found breastfeeding education to have a direct effect on the prevalence of wasting (two studies). This is surprising because the pooled analysis cited above found that the incidence of wasting peaks from birth to three months of age. This may be because the studies on breastfeeding promotion were not measuring the incidence of wasting but assessed the prevalence of wasting (Mertens et al. 2022).

Complementary feeding: Complementary feeding interventions, including education and provision of food, improve some child anthropometric outcomes, but have not shown to have a direct effect on the risk of wasting in either food secure or insecure settings (Lassi, Rind et al. 2020). This may be because the design of the nutrition education and the foods provided varied greatly across the studies. A scoping review of peer-reviewed literature examining the effect of food supplementation and nutrition education interventions found 25 studies that had an impact on wasting related outcomes: weight gain, mean change in weight-for-height Z score, mean change in MUAC, prevalence of wasting, incidence of wasting, or recovery from moderate wasting (annex 3) (Ickes, Craig, and Heidkamp 2022). Examples of the nutrition education interventions included interpersonal communication, group-based nutrition education, and positive deviance/hearth. Examples of the food supplementation intervention included fortified complementary foods; household/child-specific locally available foods; SQ-LNS; and ready-to-use supplementary food (RUSF) or fortified cereals for treatment of moderate wasting. Of the food supplementation interventions, SQ-LNS (66.6 percent of studies) were more likely to show an impact on one or more wasting related outcomes than RUSF for moderate wasting treatment (33.3 percent), fortified complementary foods (27.3 percent) or household/child-specific locally available foods (37.5 percent) (Ickes, Craig, and Heidkamp 2022).

Below we present evidence for interventions included in the synthesis described above as well as a few additional interventions for which there is evidence for an impact on reducing the prevalence, incidence, or risk of wasting.

- **SQ-LNS:** Among the specialized nutritious foods provided during the complementary feeding period (6–24 months of age), small quantity lipid-based nutrient supplements (SQ-LNS) are the most extensively studied in the past 15 years. Strong evidence from 14 trials shows that SQ-LNS, started at close to six months of age, resulted in a 14 percent reduction in the risk of wasting and 31 percent reduction in the risk of severe wasting (Dewey et al. 2021; Dewey et al. 2022).

[6] Bacille Calmette-Guérin (BCG), diphtheria-pertussis-tetanus (DPT)/Pentavalent1, DPT/Pentavalent3, and measles.

- **RUTF:** A study from Niger found that provision of one sachet of RUTF per day over the lean period (three months) to children without wasting resulted in a lower incidence of wasting and severe wasting over eight months of follow-up (Isanaka et al. 2009).
- **Locally available foods:** Three studies from Egypt, Kenya, and South Africa found that provision of locally available foods provided with nutrition education improved WHZ, but the foods themselves varied across the studies. The study from Egypt did not provide details of the foods, but noted that they included two meals rich in protein, iron, vitamins, and a fruit snack for children (Ghoneim, Hassan, and Amine 2004). The study from Kenya noted that the monthly child ration included millet flour, pigeon peas, milk, eggs, vegetable oil, mango, and sugar plus a monthly family ration of maize flour and beans (Tomedi et al. 2012). In the study from South Africa, the foods included corn meal, oil, legumes, and milk powder for children (Walsh, Dannhauser, and Joubert 2002).
- **Cash:** In addition to nutrition education and food supplementation, other forms of household assistance may also have an impact on wasting. In general, cash alone is as effective as cash plus programs (nutrition behavior change communication or food transfer) at reducing the odds of wasting; however, there is some evidence that in crisis contexts, cash plus food transfers are more effective (Little et al. 2021).
- **Household-level food assistance plus health and nutrition services:** In some settings, food assistance may need to be provided to other members of the household in addition to the child. One study from Burundi found that household and individual[7] food assistance (corn-soy blend [CSB] with fortified vegetable oil) from pregnancy to 24 months, from pregnancy up to 18 months, or from birth to 24 months led to a statistically significant 3.3 percentage points reduction in the prevalence of wasting compared with the control group (no intervention) (Leroy et al. 2021). The reduction in wasting prevalence was highest in the 18-month group (4.5 percentage points). Along with food assistance, the intervention groups also received health services and behavior change communication.

Outcome 4: Improved Treatment of Children with Wasting (Treatment)

Pathway 4: Strengthening Systems and Integrating Treatment into Routine Primary Health Services

Treatment foods: For severe wasting, community-based treatment should use standard ready-to-use therapeutic food (RUTF) that meets the Codex guidelines. Studies involving a variety of foods (standard RUTF, no-milk/peanut butter RUTF, high oleic RUTF; energy-dense home prepared food) performed comparably in improving recovery rates and reducing mortality, but including dairy in the treatment foods was found to be important for recovery from severe wasting (Das et al. 2020; Potani et al. 2021). Antibiotics as part of severe wasting treatment protocol was also found to improve recovery and mortality (Das et al. 2020). For moderate wasting, treatment foods performed better than only nutrition counseling for recovery (Lelijveld et al. 2019). Among the foods, RUSF or lipid-based nutrient supplements (LNS) performed slightly better than fortified blended foods for recovery from moderate wasting, but the evidence was of low or unspecified quality (Das et al. 2020; Gluning et al. 2021). The *2023 World Health Organization (WHO) Guideline on the Prevention and Management of Wasting and Nutritional Oedema (Acute Malnutrition) in Infants and Children under Five* will outline different approaches to supplement moderately wasted children (WHO 2023).

[7] The individual rations were given to pregnant women, to women up to six months after delivery, and to children starting at six months of age.

Other treatment program elements: While several systematic reviews have examined the effect of various foods on treatment outcomes for moderate and severe wasting, emerging evidence is available for the following in improving recovery from wasting.

- **Water treatment:** Improving drinking water quality during severe acute malnutrition treatment, improved recovery from wasting in two studies (Patlán-Hernández et al. 2022). The intervention was a WASH package[8] in one study and point-of-use water treatment (flocculant/disinfectant, chlorine disinfectant, ceramic water filter) in the other study. The three point-of-use treatment methods were found to be equally effective at improving recovery; however, a separate analysis found the chlorine disinfectant to be most cost-effective (Rogers et al. 2018).
- **Program management:** Strengthening the management of severe and moderate wasting treatment programs may also contribute to recovery from wasting by improving the quality of care. A few studies found quality improvement efforts, performance-based financing, and level of supervision as required by iCCM to have a positive effect on recovery from severe wasting (Mokori et al. 2023; Korachais et al. 2020; Charle-Cuéllar et al. 2021).[9]
- **Simplified approaches:** Several adaptations to the wasting treatment protocol have been implemented: family MUAC; modified admission and discharge criteria; combined treatment protocol for severe and moderate wasting; modified dosage of treatment foods; and treatment by community health workers (Action Against Hunger 2021). At this time, WHO has not endorsed implementation of these approaches outside of exceptional circumstances (GNC MAM Task Force 2017). The new WHO guideline notes that treatment by community health workers may be best utilized if they receive adequate training, supervision, and support (WHO 2023).

Integration of Wasting Services with Existing Primary Health Services

Integration of wasting treatment and prevention services into existing primary health service delivery has the potential to increase coverage and effectiveness, reduce cost, and ensure sustainability. However, the evidence for successful integration of interventions into the health system resulting in reduced prevalence or incidence of wasting and improving treatment outcomes is limited. Below we present some promising findings:

Antenatal care: A four-country study showed that integrating nutrition interventions[10] into national antenatal care (ANC) platforms was feasible and effective at improving intermediate outcomes (breastfeeding, maternal diet diversity, IFA consumption) but the impact on LBW has yet to be examined (Sanghvi et al. 2022).

Community outreach/referral/follow-up: It is critical to identify children with wasting so health workers can refer them to timely treatment. However, it is difficult to find all children who need treatment on time. There is some evidence that existing health platforms can be used for this purpose:

- **Nutrition/immunization campaigns:** In Mali, a larger proportion of children were screened during the National Nutrition Week compared with the number screened at the health center or community (Nyirandutiye et al. 2011). Similarly, in Nigeria, health workers were able to

[8] The package containted drinking water, a fitted lid container, chlorine tablets, a cup with a handle, handwashing soap, and a leaflet with hygiene messages.
[9] Quality improvement efforts included training of regional and district coaches, routine on-site coaching and mentoring, collaborative learning sessions, and harvest meetings to discuss successful and unsuccessful changes and action plans. Performance-based financing included payments for specific hospital, health facility, and community-level services (e.g., screening for wasting, enrolling identified children in treatment programs, organizing promotion session).
[10] Micronutrient supplementation, weight gain monitoring, dietary counseling, and counseling on breastfeeding.

successfully screen children for wasting during a polio vaccination campaign without compromising on coverage (Chamla 2018).

- **GMP:** In Syria, the national nutrition surveillance system built on the GMP platform included screening, identification, and referral for children with wasting. After implementing this approach, the prevalence of wasting reduced from 5.3 percent in 2015 to 2.4 percent in 2018 (Bozo, Khudari, and Mohammad 2019).
- **SQ-LNS:** In Mali and Burkina Faso, a prevention package (behavior change communication and SQ-LNS) increased participation in screening for wasting, but not the number of children who health workers referred, enrolled, and completed treatment (Becquey et al. 2019; Huybregts et al. 2019). In Mali, where health workers delivered the intervention in the community (as opposed to the facility as in Burkina Faso), there was a 30 percent reduction in the incidence of wasting (Huybregts et al. 2019).

Treatment: Integrating severe wasting treatment with iCCM meets Sphere standards for recovery (at least 75 percent) (López-Ejeda et al. 2019). Key factors influencing successful integration of severe wasting treatment with iCCM include training and supervision for health workers, good community engagement, and a functional referral system (López-Ejeda et al. 2019).

Conclusions and Recommendations

Wasting prevention and treatment: This desk review found strong evidence for supplementing pregnant women with IFA and MMS to prevent LBW, and supplementing children 6–24 months with SQ-LNS to prevent wasting. There is also some evidence that supplementation with other types of food and nutrition education can have an impact on wasting related outcomes. It was difficult to understand which child health interventions had the most impact on reducing the prevalence of wasting. This may be due to several reasons: studies were not designed to examine the impact of the intervention on wasting, the studies did not examine if the intervention had an impact on wasting, or the studies did not measure wasting appropriately. Design factors of interventions limit drawing conclusions about impact on wasting prevention (Ickes, Craig, and Heidkamp 2022). However, it is important to note that several child health interventions did have an impact on the intermediate outcomes (child illness and micronutrient status), which are on the pathway to preventing wasting (figure 1).

For wasting treatment, emerging evidence suggests that further decentralizing screening and treatment through family MUAC and community health worker–led treatment, ensuring access to safe household water through the provision of water treatment products; and improving the management of wasting treatment programs through staff retention, training, and supervision may improve treatment outcomes, but further investigation is needed.

Opportunities for integrating into health services: There is some evidence that primary health care services (e.g., health/nutrition campaigns, GMP) or provision of SQ-LNS through community groups and/or health facilities can increase coverage of wasting screening, but gaps remain in understanding how to strengthen referral, enrollment, and completion of wasting treatment. Integrating wasting treatment with iCCM (provision of RUTF by community health workers) meets Sphere standards for recovery (at least 75 percent), but health workers need adequate supervision and support.

Further research: Based on the findings of this desk review, we recommend investing in effectiveness studies (or secondary data analysis, as appropriate) to answer the following questions:

- How can national ANC platforms be strengthened to improve maternal nutrition to prevent newborn wasting and LBW?

- Can existing breastfeeding support interventions delivered through the health system prevent the incidence of wasting in the first six months of life?
- How can child health interventions (e.g., IMCI) be strengthened to contribute to the prevention of wasting?
- How can food supplementation (e.g., SQ-LNS, CSB, locally available foods) and nutrition education interventions that show promising results on preventing wasting be implemented through the health system?
- How can existing community health/nutrition platforms (weeks/campaigns, GMP, iCCM) be leveraged to improve the early detection and management of wasting?
- What design and program management factors support positive wasting treatment programs?

Finally, to ensure that findings are comparable across studies, we encourage all future studies to follow the recommendations we have adapted from Ickes et al.: 1) report on consistent metrics, including MUAC; 2) measure change in wasting incidence; 3) measure wasting prevalence among the general under five population (not just those who were given treatment) to capture population-level preventive effects;[11] 4) follow children post-intervention to assess relapse; 5) measure food insecurity, food safety, and diet quality to better understand the pathways to wasting prevention; and 6) use harmonized protocols across different settings (Ickes, Craig, and Heidkamp 2022).

[11] This recommendation is specifically for moderate wasting treatment programs.

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Annex I. Wasting Learning Plan Questions

The following learning questions, and their associated sub-questions, aim to achieve the learning plan objectives. These questions aim to generate actionable information to inform USAID decision-making and accelerate the Agency's impact on wasting prevention and treatment.

1. Which evidence-based strategies/approaches can USAID strengthen/scale-up to support wasting reduction through the food system?
    a. Which food systems strategies/approaches are effective and most cost-effective?
    b. What factors facilitate and constrain the effective implementation of these food systems strategies/approaches?
2. Which evidence-based strategies/approaches can USAID strengthen/scale-up to support wasting prevention and treatment through the health system?
    a. What does the evidence/research show about strengthening wasting programming through integration of different packages (iCCM, CMAM, IMCI, GMP)?
    b. What factors facilitate and constrain the effective implementation of these health service interventions?
3. How can USAID Missions better layer and coordinate wasting programming across activities and across the wasting continuum of care?
4. How can USAID strengthen systems capacities to better manage supply chains for therapeutic feeding supplies, including medicines that are essential for wasting treatment?
5. What programming adaptations should USAID consider to strengthen early detection of wasting, including assessment, GMP, or other service delivery platforms using alternative screening approaches?
6. What metrics/indicators are appropriate for monitoring and evaluating wasting prevention in the context of USAID programming?

Annex 2. Effectiveness of Wasting Approaches Implemented Through the Health System

Intervention/Approach	Description	Outcome (Studies, Quality of Evidence)
Outcome 1: Reduce Incidence of Low Birth Weight		
Preconception care: supplementation	Small quantity lipid-based nutrient supplements + additional balanced energy-protein versus no supplements (Dhaded et al. 2020)	Newborn wasting: ↓ 24% (1 study, two countries, unspecified)
Antenatal care: weight gain monitoring	Limited data	
Antenatal care: nutrition counseling	Nutrition education versus no counseling or education (Ota et al. 2015)	LBW: ↓ 96% (1 study, unspecified) Small for gestational age (SGA): ↓ 3% (1 study, low) Mean birth weight: • ↑ 490 grams (g) among undernourished (2 studies, low) • ↑ 15 g among well nourished (1 study, low)
Antenatal care: malaria prevention	Insecticide-treated bed nets versus no bed nets (Gamble et al. 2006) Malaria chemoprevention versus no chemoprevention (Radeva-Petrova et al. 2014)	LBW: ↓ 23% (3 studies, unspecified) LBW: ↓ 27% (8 studies, moderate) Mean birth weight ↑ 93 g (9 studies, moderate)
Antenatal care: Supplements (IFA versus FA/control)	IFA versus folic acid or placebo (Lassi, Padhani et al. 2020)	LBW: ↓ 12% (4 studies, high)

Intervention/Approach		Outcome (Studies, Quality of Evidence)
Antenatal care: Supplements (MMS versus IFA)	MMS versus IFA (Keats et al. 2019)	LBW: ↓ 15% (28 studies, high)
Antenatal care: Supplements (BEP)	BEP versus no intervention or low-energy supplement (Lassi, Padhani et al. 2020)	LMICs: • LBW: ↓ 40% (3 studies, low) • SGA: ↓ 29% (7 studies, unspecified)
Antenatal care: Supplements (food distribution)	Food (not BEP with or without nutrition counseling) versus no food (Lassi, Padhani et al. 2020)	LMICs: • LBW: ↓ 8% (4 studies, moderate) • Newborn wasting: ↓ 13% (2 studies, unspecified) • Mean birth weight: ↑ 46 g (3 studies, unspecified)
Antenatal care: Package	Alive & Thrive testing feasibility of including a package of interventions in four country ANC programs	
Outcome 2: Improved Child Health		
Vitamin A supplementation	Preventive vitamin A supplementation versus placebo or no supplementation among children 1–59 months (Tam et al. 2020)	Mean plasma retinol: ↑ 0.33 micromole/liter (16 studies, unspecified) *Did not examine effect on wasting
	Preventive vitamin A supplementation versus placebo or no supplementation among children 6–59 months (Imdad et al. 2017)	Diarrhea incidence: ↓ 15% (15 studies, low) Measles incidence: ↓ 50% (6 studies, moderate) Vitamin A deficiency: ↓ 29% (4 studies, moderate) *Did not examine effect on wasting

Intervention/Approach	Description	Outcome (Studies, Quality of Evidence)
Zinc supplementation	Preventive zinc supplementation versus placebo or no intervention among children 1–59 months (Tam et al. 2020)	Diarrhea incidence: ↓ 11% (11 studies, unspecified) Zinc deficiency ↓ 63% (11 studies, unspecified) *No effect on wasting (6 studies)
Iron supplementation	Preventive iron supplementation versus placebo or no intervention among children 1–59 months (Tam et al. 2020)	Anemia prevalence: ↓ 45% (14 studies, unspecified) *No effect on wasting (3 studies); WHO recommends providing with malaria treatment in malaria endemic areas
Malaria prevention	Insecticide-treated bed nets compared with no bed nets (Pryce, Richardson, and Lengeler 2018) Intermittent preventive treatment in infants versus no treatment (Esu, Oringanje, and Meremikwu 2021)	Malaria (P falciparum) prevalence: ↓ 17% (6 studies, high) *Did not examine effect on wasting Clinical malaria incidence: ↓ 27% (4 studies, moderate), but less effective over time *Did not examine effect on wasting
Vaccination	Vaccination (BCG, DPT/Penta 1, DPT/Penta 3, measles) versus no vaccination (Sato 2021) Gavi and Eleanor Crook Foundation conducting case studies of immunization and nutrition integration	*Not associated with wasting (1 study, not review)
IMCI	IMCI versus routine care (Gera et al. 2016)	*No effect on wasting (2 studies)
iCCM	iCCM versus facility-based services (Oliphant et al. 2021)	Care-seeking coverage: ↑ 68% (2 studies, moderate) *Did not examine effect on wasting (2 studies)

	Description	Outcome (Studies, Quality of Evidence)
Management of small and nutritionally at-risk infants under six months and their mothers (MAMI) Care Pathway	London School of Hygiene and Tropical Medicine, Emergency Nutrition Network (ENN), Goal Ethiopia and Jimma University are conducting an evaluation in Ethiopia	
Outcome 3: Improved Infant and Young Child Feeding		
Breastfeeding	Breastfeeding promotion (education) versus standard of care (Lassi, Rind et al. 2020)	Early initiation: ↑ 20% (14 studies, low) Exclusive breastfeeding at 3 months: ↑ 102% (6 studies, very low) Exclusive breastfeeding at 6 months: ↑ 53% (19 studies, very low) Diarrhea prevalence: ↓ 24% (8 studies, unspecified) **No effect on wasting*
Complementary feeding	Complementary feeding education versus control (Lassi, Rind et al. 2020)	Food secure setting: No effect on wasting (2 studies, moderate) or WHZ (3 studies, moderate) Food insecure setting: No effect on wasting (1 study, moderate), WHZ ↑ 0.5 (1 study, high)
	Complementary food provision with or without education versus control (Lassi, Rind et al. 2020)	Food secure setting: Effect on wasting unspecified, no effect on WHZ (1 study, low) Food insecure setting: No effect on wasting (6 studies, moderate) or WHZ (10 studies, low)
Micronutrient powder (MNP)	MNP versus placebo or no intervention (Tam et al. 2020)	Anemia: ↓ 24% (21 studies, unspecified) Diarrhea: ↑ 30% (21 studies, unspecified)

	Description	Outcome (Studies, Quality of Evidence)
		*No effect on wasting
SQ-LNS	Preventive SQ-LNS versus no supplementation (Dewey et al. 2021; Dewey et al. 2022)	Wasting: ↓ 14% (14 studies, high) Severe wasting: ↓ 31% (14 studies, high)
Corn-soy blend with fortified vegetable oil	Household and individual CSB (pregnancy–24 months, pregnancy–18 months or birth–24 months) versus control (Leroy et al. 2021)	Combined CSB arms versus control: ↓3.3 percentage points prevalence of wasting
Cash	Cash versus cash plus nutrition behavior change communication (Little et al. 2021) Cash versus cash plus food transfer (Little et al. 2021)	Wasting: no difference (6 studies, unspecified) Wasting (long term): no difference Wasting (short-term crisis): cash plus more effective (1 study, unspecified
Outcome 4: Improved Treatment of Children with Wasting		
Severe/moderate wasting: treatment location	Integrated community-based versus no community-based management (Das et al. 2020) Facility-based strategy to screen and manage severe wasting versus standard of care (Das et al. 2020)	Recovery: ↑ 4% (1 study, moderate) Weight gain: ↓ 0.80 g/kg/day (1 study, moderate) Mortality: no difference (1 study, moderate) Recovery: no difference (1 study, very low) Weight gain: not reported by studies Mortality: no difference (2 studies, low)
Severe wasting: treatment food	Facility-based treatment of severe wasting with RUTF versus F100 (Das et al. 2020)	Recovery: not reported by studies Weight gain: no difference (3 studies, very low)

Intervention/Approach	Description	Outcome (Studies, Quality of Evidence)
		Mortality: no difference (2 studies, low)
Severe wasting: treatment food	Community-based treatment of severe wasting with standard RUTF versus other food (non-milk/peanut butter) (Das et al. 2020)	Recovery: no difference (5 studies, moderate) Weight gain: ↑ 0.5 g/kg/day (1 study, low) Mortality: no difference (9 studies, low)*
	Community-based treatment of severe wasting with RUTF versus other food (energy-dense, home prepared food) (Das et al. 2020)	Recovery: no difference (4 studies, low) Weight gain: no difference (3 studies, low) Mortality: no difference (9 studies, low)*
	Community-based treatment of severe wasting with RUTF versus other food (high oleic RUTF) (Das et al. 2020)	Recovery: no difference (1 study, moderate) Weight gain: no difference (1 study, moderate) Mortality: no difference (9 studies, low)*
	Community-based treatment of severe wasting with RUTF versus F100 (Das et al. 2020)	Recovery: not reported by study Weight gain: ↑ 5.5 g/kg/day (1 study, low) Mortality: Not reported by study
	Standard RUTF versus no or low dairy (<50%) RUTF (Potani et al. 2021)	Recovery: ↑ 7% (4 studies, moderate) Weight gain: ↑ 0.2 g/kg/day (6 studies, high) Mortality: no difference (5 studies, low)
Severe wasting: treatment (antibiotics)	Prophylactic antibiotic for uncomplicated severe wasting versus no antibiotic (Das et al. 2020)	Recovery: ↑ 6% (2 studies, high) Weight gain: ↑ 0.67 g/kg/day (2 studies, moderate)

Intervention/Approach	Description	Outcome (Studies, Quality of Evidence)
		Mortality: ↓ 26% (3 studies, moderate)
Severe wasting: treatment (vitamin A)	High-dose vitamin A versus low-dose vitamin A (Das et al. 2020)	*Did not report on recovery Weight gain: no difference (1 study, moderate) Mortality: no difference (1 study, moderate)
Severe wasting: simplified approaches (family MUAC)	Caregivers versus community health workers (Bliss et al. 2018; Ale et al. 2016)	Severe wasting: same level of accuracy (3 observational studies) Median MUAC: higher (1 pilot study) Complications: fewer (1 pilot study)
Severe wasting: simplified approaches (CHW-led treatment/iCCM integration)	CHW versus facility (Lopez-Ejeda et al. 2019; Chiu et al. 2020)	Recovery: >75% (9 studies, operational) Cost-effective: Yes (3 studies)
Severe wasting: simplified approaches (admission criteria)	MUAC/edema versus WHZ (Briend et al. 2016) MUAC and WAZ versus WHZ (Thurstans et al. 2022) ENN protocol on treatment of children who are weight-for-age <-3 and MUAC < 115 millimeters	Mortality: MUAC better identifies children at risk of mortality (6 separate studies) Mortality: MUAC and WAZ better identify children at risk of mortality (45 studies)
Severe/moderate wasting: simplified approaches (combined protocol)	Simpler and reduced dosing versus standard (Action Against Hunger 2021)	Recovery: non-inferior (3 studies, unspecified) Weight gain: slower (1 study, unspecified) Coverage: non-inferior (2 studies, unspecified)

Intervention/Approach	Description	Outcome (Studies, Quality of Evidence)
Severe wasting: treatment and improved drinking water quality	Severe wasting treatment with WASH package (chlorine, soap, water container, promotion on use) versus severe wasting treatment only (Altman et al. 2018)	Recovery: ↑ 10.5% (study did not evaluate the effect of each WASH component separately (1 study, unspecified)
	Severe wasting treatment with point-of-use water treatment (aquatabs, flocculent or ceramic filter) versus severe acute malnutrition treatment only (Doocy et al. 2018)	Recovery: ↑ 16.7–D22.2% (no different in recovery rate by type of intervention) (1 study, unspecified)
Severe wasting: treatment program management	Severe wasting treatment with quality improvement measures pre-post comparison (Mokori et al. 2023)	Recovery: 74% pre-intervention to 80% post-intervention (1 study, unspecified)
	Severe and moderate wasting treatment with performance-based payment versus wasting treatment only (control) (Korachais et al. 2020)	Recovery (moderate wasting): 97% intervention; 78% control (1 study, unspecified)
	Severe wasting treatment plus (iCCM supervision or iCCM and nutrition supervision) versus wasting treatment only (control) (Charle-Cuéllar et al. 2021)	Recovery: 81.4% iCCM plus nutrition; 86.2% iCCM; 66.9% control. No difference between iCCM plus nutrition and iCCM (1 study, unspecified)
Severe wasting: screening during GMP	Integrating wasting screening into GMP pre-post comparison (Bozo, Khudari, and Mohammad 2019)	Global acute malnutrition: ↓ 2.9 percentage points (1 study, unspecified)
Severe wasting: screening during child nutrition week	Wasting screening during national nutrition week versus screening with facility	Screened: 52% nutrition week; 22% facility activities: 5% community activities (1 study, unspecified)

Intervention/Approach	Description	Outcome (Studies, Quality of Evidence)
	and community activities (Nyirandutiye et al. 2011)	
Severe wasting: screening during immunization campaign	Wasting screening during polio vaccination campaign versus polio vaccination campaign only (Chamla 2018)	Polio vaccine coverage: no difference (1 study)
Severe wasting: screening with SQ-LNS	Wasting screening at the community level with SQ-LNS and behavior change communication versus screening and behavior change communication only (Huybregts et al. 2019)	Incidence of wasting: ↓ 30% (1 study) Participation in screening: ↑ 30–40 percentage points (1 study)
	Wasting screening at the facility level with SQ-LNS and behavior change communication versus screening and behavior change communication only (Becquey et al. 2019)	Participation in screening: ↑ 20–35 percentage points (1 study)
Moderate wasting: treatment food	Standard RUSF versus other foods (local home foods) (Das et al. 2020)	Recovery: no difference (3 studies, low) Weight gain: no difference (1 study, low) Mortality: no difference (8 studies, moderate)*
	Standard RUSF versus other foods (whey RUSF) (Das et al. 2020)	Recovery: no difference (1 study, high) Weight gain: no difference (1 study, high) Mortality: no difference (8 studies, moderate)*
	Standard RUSF versus other foods (CSB) (Das et al. 2020)	Recovery: ↑ 7% (6 studies, low) Weight gain: ↑ 0.49 g/kg/day (5 studies, low) Mortality: no difference (8 studies, moderate)*

Intervention/Approach	Description	Outcome (Studies, Quality of Evidence)
	LNS versus fortified blended foods (Gluning et al. 2021)	Recovery: ↑ 5% (6 studies, unspecified) Weight gain: Not reported Mortality: no difference (3 studies, unspecified)
	Food products versus nutrition counseling and/or micronutrient supplementation (Lelijveld et al. 2019)	Recovery: better (7 studies)
	Food supplements versus nutrition education alone (Gluning et al. 2022)	Recovery: ↑ 16% (2 studies, unspecified)

Annex 3. Factors of Food Supplementation and Nutrition Education Interventions That Had a Statistically Significant Impact on Wasting-Related Outcome

TABLE 2 Intervention impact by intervention design factors and population factors[1]

	Number of studies	Statistically significant impact on wasting-related outcome, *n* (%)
	56 (total)	25 (44.6)
Intervention design factors		
Intervention type		
FS	21	7 (33.3)
FS/NE	16	7 (43.8)
NE	19	11 (61.1)
FS subtype ($n = 37$)		
Fortified complementary food	11	3 (27.3)
Household or child-specific staple foods	8	3 (37.5)
Small-quantity lipid-based nutrient supplements	6	4 (66.6)
Ready-to-use supplemental foods for MAM treatment	12	4 (33.3)
Supplement dose		
Low (<30% daily energy)	17	6 (35.3)
Medium (30–59% daily energy)	12	3 (25.0)
High (>60% daily energy)	8	4 (50.0)
Author-stated study purpose		
Wasting-focused	14	5 (35.7)
Stunting-focused	19	4 (21.1)
Wasting- and stunting-focused	23	16 (69.6)
Age of beneficiary at enrollment		
6–11 mo	25	11 (44.0)
12–23 mo	14	6 (42.9)
24–59 mo	17	8 (47.1)
Intervention duration		
Short duration (≤12 wk)	8	4 (50.0)
Medium duration (13–24 wk)	16	6 (37.5)
Long duration (≥25 wk)	32	15 (46.9)
Population factors		
Geographic region		
Sub-Saharan Africa	32	13 (40.6)
South Asia	10	5 (50.0)
East Asia/Pacific	5	2 (40.0)
Latin America/Caribbean	7	3 (42.9)
Middle East/North Africa	2	2 (100)
Nutritional status at baseline		
Targeted moderately wasted children	9 (4 FS, 5 FS/NE, 0 NE)	3 (33.3)
General population (included moderately wasted children)	28 (9 FS, 9 FS/NE, 10 NE)	16 (57.1)
Excluded moderately wasted children	19 (8 FS, 6 FS/NE, 5 NE)	6 (31.6)

[1] FS, food supplementation; MAM, moderate acute malnutrition; NE, nutrition education; NE/FS, nutrition education and food supplementation.

Source: Ickes, Craig, and Heidkamp 2021, 335

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