



Technical Brief

Desk Review of Food 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 (REFS) (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 questions to help address the objectives (see annex 1). This brief presents findings to help answer learning question 1:

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?

We produced a companion brief (USAID Advancing Nutrition 2023a) summarizing the evidence base on health systems approaches (learning question 2).

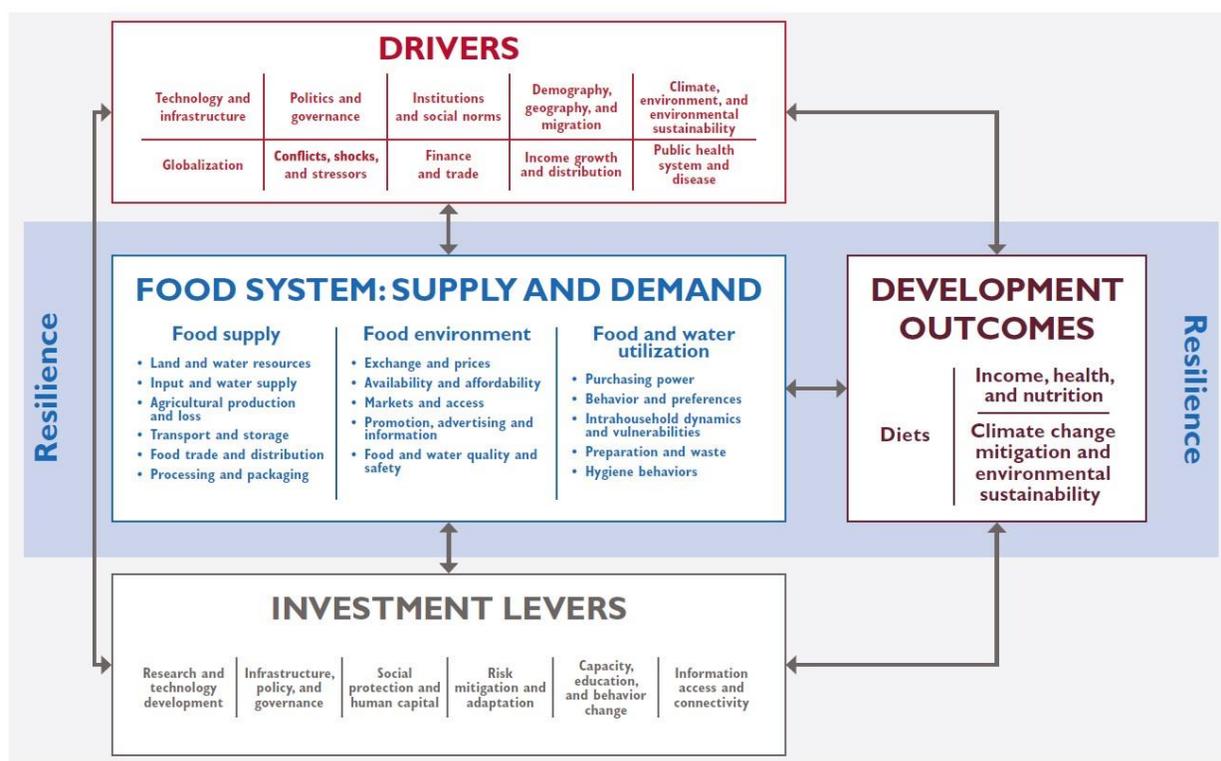
As USAID has increased its commitments to invest in wasting, it has raised the importance of reducing wasting through both prevention and treatment (USAID 2022; 2023). There is potential to help reduce wasting through the food system as several key drivers of wasting are rooted in food systems—namely the immediate driver of unhealthy diets and the underlying driver of household food insecurity (UNICEF et al. 2021). There may also be potential for actions that help reduce both wasting and stunting, as common factors drive stunting and wasting and growing evidence shows the overlap and link between the two, frequently within the same children (Thurstans et al. 2021).

In this brief, we synthesize the existing evidence base on reducing wasting through food systems approaches, summarize implementation considerations, and recommend areas for further research based on evidence gaps. The evidence base on wasting reduction through the food system is relatively limited. The summaries below reflect the current evidence base; practitioners should not interpret the lack of evidence on a particular intervention as a lack of effectiveness.

Desk Review Methods

We used two conceptual frameworks to guide the scope of this desk review. First, we used the REFS Food Systems Conceptual Framework to identify which components of the food system we would focus on (USAID 2021a). In the REFS conceptual framework, we examined evidence that falls within the supply and demand portion of the framework (food supply, food environment, and food and water utilization) (figure 1). Second, we identified the five [Global Action Plan \(GAP\) on Child Wasting](#) priority actions that relate to the supply and demand portion of the food systems (box 1) (UNICEF et al. 2021). We then searched for literature related to the relevant GAP priority actions.

Figure I. REFS Food Systems Conceptual Framework



Source: USAID Advancing Nutrition 2023b

We used Google Scholar to search for reviews and meta-analyses published between 2012–2022 on interventions in the food system related to the relevant GAP priority actions. We used the following search terms:

- (wasting OR “acute malnutrition”) AND prevention AND (“food” OR “food system” OR “food based” OR “agriculture” OR “food markets” OR “food production” OR “food supply” OR “water” OR “food availability” OR “food affordability” OR “storage” OR “food access” OR “value chain” OR “food safety”) AND children AND (impact OR effectiveness OR cost OR cost-effectiveness)

We reviewed search results until they were no longer relevant. Beyond the Google Scholar search, we reviewed the *2021 Lancet Series on Maternal and Child Undernutrition*. We also searched the USAID Development Experience Clearinghouse for final evaluations from the last 10 years of USAID activities with interventions in the food system that reported on wasting as an outcome. Finally, we reviewed the International Initiative for Impact Evaluation evidence maps on food systems and nutrition (Moore et al. 2021); food security in humanitarian settings (Zie 2022); and water, sanitation, and hygiene (WASH) (Waddington et al. 2021) to identify systematic reviews, or individual studies where systematic reviews were not available for the intervention type. We included studies and evaluations that reported a measure related to wasting in children 6–23 months or under five—weight-for-height z-scores (WHZ), weight-for-length z-scores (WLZ), wasting prevalence, and mid-upper arm circumference (MUAC).

The studies and evaluations assessed prevalence rather than incidence. When presenting the results below, we indicate which wasting-related measure was assessed. The effect size is only included if the difference was statistically significant. For reviews, we indicate the number of studies that found an effect on a wasting-related indicator out of the total number of studies in the review that assessed wasting. In

addition, for meta-analyses, we present the mean difference in the pooled estimates for wasting-related indicators. For individual studies, we indicate the mean difference if provided in the review article or the individual study. We also included estimates of cost-efficiency and cost-effectiveness,¹ although we only found cost-efficiency information from one review on nutrition-sensitive agriculture. See annex 2 for details on the reviews and studies included.

Box 1. Food Related GAP Priority Actions

- Strengthen food value chains to improve availability and affordability of healthy nutritious foods for women of reproductive age and children 6–23 months.
- Support the integration of livelihood dynamics and seasonality in the design and delivery of emergency and resilience building programs to meet the nutritional needs of children in situations of acute food insecurity.
- Improve the design of micronutrient fortification programs through food fortification of common staples and condiments.
- Increase the implementation of joint nutrition and WASH programs and increase the coverage of handwashing facilities and WASH services (safe water and sanitation).
- Align nutrition and social protection policies, strategies, and programs to leverage social protection systems to more effectively contribute to nutrition results for vulnerable adolescent girls and women.

Source: UNICEF et al. 2021

Evidence on Reducing Wasting through the Food Systems

Below we summarize the evidence for the food supply, food environment, and food and water utilization components of the REFS conceptual framework. For each component, we present evidence for related GAP priority actions. When specified in the reviews, we report the effect size for wasting outcomes, the age group assessed, and the quality of evidence.

Food Supply

GAP Priority: Strengthen Food Value Chains to Improve Availability and Affordability of Healthy Nutritious Foods for Women of Reproductive Age and Children 6–23 Months

Nutrition-sensitive agriculture (crop and/or animal source food production): Nutrition-sensitive agriculture has been shown to have a small, positive impact on child wasting and may reduce maternal underweight. However, the evidence is mixed and, when rated, most studies included in the reviews were of low quality.² There is limited evidence about whether interventions only targeting animal source food production affect wasting. Nutrition-sensitive agriculture interventions may be more likely to impact child wasting if they: a) increase production of micronutrient-rich foods along with foods high in energy or protein; and b) are implemented for longer periods of time (e.g., at least four years).

Four reviews included a range of nutrition-sensitive agricultural interventions, including biofortification, home gardens, aquaculture, and livestock production; some included additional interventions like livestock asset transfers and nutrition education and social and behavior change (SBC). All four reviews found a positive effect on wasting for children under five from at least one study. Two systematic reviews included studies that found a positive effect on wasting (2 of 7 studies [Masset et al. 2012]; and 1 of 15 studies [Sharma et al. 2021]). Masset et al. (2012) and Sharma et al. (2021) both identified the

¹ Cost-efficiency is the monetary cost to reach a program output (e.g., cost per child reached), and cost-effectiveness is the monetary cost per unit of each outcome (e.g., cost per wasting case averted) (USAID Advancing Nutrition 2021b).

² Low quality studies are those with methodological flaws in the design, conduct, or analysis that result in a high risk of bias or factors beyond bias, such as imprecision (Page et al. 2021).

same study on an orange-flesh sweet potato (OFSP) intervention in Mozambique, which resulted in a lower wasting prevalence of 3 percent in the project group compared to 6 percent in the control. Masset et al. also identified an intensive dairy farming project in Kenya that resulted in a 3-percentage point reduction in wasting prevalence (2012). Masset et al. found that nutrition-sensitive agriculture had relatively better effects on wasting than on stunting (2012). The authors hypothesized this may be because these interventions are better suited to addressing short-term rather than chronic undernutrition, or because the studies assessed effects too soon after the interventions to capture longer term changes (Masset et al. 2012). Sharma et al. outline four possibilities for why only one study in the review found a positive effect on wasting: 1) the interventions may not have adequately improved food access, 2) few studies addressed drivers besides food access, 3) researchers implemented the studies over short periods, or (4) there were methodological limitations (2021). A systematic review on homestead interventions in South Asia found one study (1 of 2 studies) that had a positive effect on wasting prevalence (15 percentage point reduction); however, this effect was only seen after four years of the intervention (but not after two years) suggesting that longer exposure made a difference (Bird et al. 2019). A narrative review found a positive effect on wasting prevalence (2 of 5 studies) from livestock and home gardening interventions in Bangladesh and Burkina Faso that were integrated with health/nutrition interventions, included asset transfers, and—in Bangladesh—included cash transfers (Olney et al. 2021).

Two reviews, which were systematic reviews and meta-analyses, focused on homestead or home garden production specifically. One found a small effect on WHZ among children under five (mean difference [MD] 0.05; 5 studies), with larger effects in Asia (MD 0.59) than in Africa (MD 0.04) but no differences based on intervention duration or type. The authors conclude that home food production may be appropriate to improve child wasting in contexts where it is more prevalent and intensive nutrition support is not available (Bassey et al. 2022). The other review found no effect on wasting prevalence for children under five from pooled estimates (five studies); however, three interventions had a positive effect on wasting (dairy goat project in Ethiopia; OFSP intervention in Kenya; integrated homestead gardening in Bangladesh with small animal production, nutrition education, and gender interventions after four years). In general, studies that saw improvements on anthropometric indicators had interventions that targeted production of not only micronutrient-rich foods, but micronutrient-rich foods including foods high in energy or protein (Girard et al. 2012).

Only one review reported cost-efficiency information. In Bangladesh, the cost per year per garden was \$23.20 including project costs, women's opportunity cost, and the cost for seedlings. In Cambodia, the project cost \$239 per household for a garden, a fish pond, and training (Bassey et al. 2022).

Livestock and aquaculture: One review focused on small livestock and aquaculture projects. It found that a dairy cow and meat goat donation program in Rwanda had a positive effect on WHZ for children under five (MD 0.47; 1 of 4 studies) (Blackmore, Lesorogol, and Iannotti 2018).

Livestock vaccination: There is very limited evidence on the effect of livestock vaccination and wasting, with only one primary study and no reviews available. An impact evaluation of Newcastle vaccination for chickens in Kenya found no effect on WHZ (Otiang et al. 2022).

Livestock insurance: We found one primary study and no reviews on the effect of livestock insurance on child wasting. The study was an impact evaluation of a cash transfer and index-based insurance product for pastoralist households in Kenya. It found no effect on MUAC from participation in the index-based insurance (Jensen, Barrett, and Mude 2017).

Food Environment

GAP Priority: Support the Integration of Livelihood Dynamics and Seasonality in the Design and Delivery of Emergency and Resilience-Building Programs to Meet the Nutritional Needs of Children in Situations of Acute Food Insecurity

Income generation: There is limited evidence on income generation, and it has not been shown to positively affect wasting. A Cochrane systematic review of community-level interventions found that income generation did not affect wasting based on moderate quality evidence (two studies) and concluded that income generation interventions probably have little or no effect on wasting prevalence (Duraio et al. 2020).

GAP Priority: Improve the Design of Micronutrient Fortification Programs through Food Fortification of Common Staples and Condiments

Large-scale food fortification: Large-scale fortified food with multiple micronutrients may reduce child wasting; however, the evidence is mixed and of low quality. Large-scale zinc fortification may not have an effect on wasting.

Three systematic reviews and meta-analyses synthesized the effects of large-scale food fortification on wasting. A Cochrane systematic review and meta-analysis found that large-scale multiple micronutrient fortification for the general population (in both high- and low-income countries) positively affects WHZ/WLZ (MD 0.10; six studies). While the studies were of low quality, the review concludes that multiple micronutrient fortification may improve WHZ/WLZ (Das et al. 2019). A systematic review and meta-analysis of large-scale fortification of complementary foods (mostly cereals and excluding formula, milk, and milk-based formula) in any country found no effect on wasting for children 6–23 months (four studies) based on moderate quality evidence (Csölle et al. 2022). A systematic review and meta-analysis of large-scale zinc fortification with and without multiple micronutrients found no effect on WHZ (seven studies) or MUAC (six studies) (Tsang et al. 2021).

Home fortification: Home fortification with micronutrient powders may not improve child growth. A systematic review of home fortification using multiple micronutrient powder in low- and middle-income countries (LMICs) did not find an effect on child wasting prevalence or WHZ (Salam et al. 2013).

Food and Water Utilization

GAP Priority: Increase the Implementation of Joint Nutrition and WASH Programs and Increase the Coverage of Handwashing Facilities and WASH Services (Safe Water and Sanitation)

Support to improve access to and adoption of improved WASH behaviors: WASH interventions may have a positive effect on wasting, but the quality of evidence tends to be low and the results are mixed. WASH interventions may be more likely to impact wasting if: a) practitioners combine multiple WASH interventions, b) they are combined with nutrition interventions, and c) they are implemented when children are under two.

Three studies (two systematic reviews and meta-analyses, one systematic review) looked at the effect of WASH interventions (single or combined) on wasting. A Cochrane review and meta-analysis found no effect on WHZ among children under five (seven studies); however, the interventions were relatively short and none of the studies were of high quality (Dangour et al. 2013). One systematic review and meta-analysis found no effect from WASH interventions only on WHZ for children under five (11 studies; low to moderate quality evidence), but three that combined nutrition and WASH interventions had a small positive effect on WHZ for children under five (MD 0.04) (Bekele, Rawstorne, and Rahman 2020). One systematic review focused on the impact of WASH on acute malnutrition³ (including severe acute malnutrition with edema) and disaggregated findings by type of WASH interventions. The reviewed studies ranged in quality. No association between the intervention type and wasting was found for water access (five studies) or food hygiene (two studies) interventions. A positive association was shown from at least one study for water quality (2 of 15 studies), water storage (1 of 4 studies), hygiene

³ Review included studies that assessed rates of wasting, severe acute malnutrition, moderate acute malnutrition WHZ, and/or MUAC and summarized across these studies.

(3 of 6 studies), hand washing (1 of 9 studies), and safe disposal of feces interventions (3 of 14 studies), as well as combined packages (4 of 6 studies). The authors concluded that WASH interventions have a greater effect on acute malnutrition when delivered as a package of interventions among children under two. They also suggest community-level sanitation interventions may be more effective than household-level sanitation interventions (Patlán-Hernández et al. 2022).

Support to improve sanitation behaviors: Sanitation interventions may have a positive impact on wasting; however, evidence is mixed and generally of low quality.

One systematic review and one systematic review and meta-analysis examined sanitation interventions. The systematic review found a positive effect on WHZ among children 0–35 months (MD 0.19; 1 of 1 study) from a pit latrine study in Bangladesh (Morita, Godfrey, and George 2016). The systematic review and meta-analysis did not find an effect on WHZ (seven studies) using evidence that was very low quality on average (Freeman et al. 2017).

GAP Priority: Align Nutrition and Social Protection Policies, Strategies, and Programs to Leverage Social Protection Systems to More Effectively Contribute to Nutrition Results for Vulnerable Adolescent Girls and Women

Support to improve women’s empowerment: Women’s empowerment interventions may have a positive effect on wasting, but evidence is very limited.

One review and one primary study assessed the effectiveness of women’s empowerment interventions on wasting. A systematic review on nutrition-sensitive agriculture found that a 1.9 percentage point reduction in wasting prevalence among children under five was attributable to the women’s empowerment component (out of a total reduction of 7.5 percentage points) of an enhanced homestead food production project in Burkina Faso (Sharma et al. 2021). A cluster-randomized trial in India tested nutrition-sensitive agriculture with and without women’s empowerment interventions, and none had an effect on WHZ among children 6–23 months (Kadiyala et al. 2021).

Multi-Sectoral Pathways in USAID Investments

We reviewed 10 evaluations (four summarized results from multiple activities) of USAID-funded multi-sectoral nutrition interventions. These were primarily activities funded by the Bureau for Humanitarian Assistance. The activities assessed wasting outcomes and included at least one intervention type that falls into one of the GAP priorities presented above.

Half of the evaluations of USAID-funded multi-sectoral nutrition interventions showed positive results on wasting. However, results were mixed and the evidence is weak because most evaluations were performance evaluations (and thus not able to attribute changes in wasting to the activity).

Five evaluations showed positive wasting results—four performance evaluations and one impact evaluation. Four performance evaluations of nine multi-sectoral nutrition and food security activities reported that the activities contributed to a positive effect on wasting among children under five. The evaluations found about a 3 to 5 percentage point reduction in wasting prevalence. Activities varied significantly in design (e.g., nutrition SBC, WASH, income generation, and agricultural production interventions) and were implemented in Niger, Ethiopia, and Bangladesh (Persha, Magistro, and Baro 2018; EVELYN 2018; Langworthy 2015; TANGO 2015). Yaajeende in Senegal took a food systems approach to improve nutrition by promoting sustainable food and nutrition interventions through strong local governance and a responsive private sector. Interventions included support for livestock and horticulture production, nutrition education, and hygiene and food security governance. The impact evaluation of Yaajeende found a 20.8 percentage point reduction in wasting prevalence for children in less poor households, although there was no significant effect for the overall treatment group and the evaluators note this result should be taken with caution. The evaluation did not find a clear reason for

the differences in outcomes between subgroups. The evaluation also found an increase in prevalence of minimum acceptable diet (Persha and Haugan 2018).

Five evaluations—four performance evaluations of seven multi-sectoral nutrition and food security activities and one impact evaluation—did not find an association between the activity and wasting prevalence. The activities varied in design (e.g., infant and young child feeding [IYCF], nutrition SBC, WASH, cash and food transfers, agricultural production, and market development) and were implemented in Uganda, Cambodia, Honduras, Ghana, and Malawi (Advanced Marketing Systems 2017; Save the Children 2019; Almanzar and Maximo 2016; USAID/Ghana Evaluate for Health Project 2019; IMPEL 2020). It is possible these changes were not seen due to methodological constraints (e.g., using population-based rather than program participant-based samples, or being underpowered to detect small changes in wasting) and low wasting prevalence in a few countries.

Factors Influencing Implementation

A Maximizing the Quality of Scaling Up Nutrition Plus report presents design and implementation constraints for wasting prevention programs across the food and health systems (2018). The main constraints were—

- Poor understanding among stakeholders of what wasting prevention strategies should be and what the most effective prevention packages are.
- Lack of leadership and coordination on wasting prevention, as focus remains on treatment.
- Wasting is often not assessed as an outcome in research and evaluation.
- Poor quality implementation of interventions, including SBC and other interventions.
- Limited evidence on what works to prevent wasting in different contexts, particularly non-emergency contexts (MQSUN+ 2018).

We did not find information on implementation factors related to the discussed intervention types when implemented to reduce wasting specifically. The implementation constraints are likely the same as when those interventions are implemented with the intent of improving other nutritional outcomes.

Conclusions and Recommendations

The overall evidence base for the effectiveness of food systems approaches for wasting prevention is limited and mixed. When effects were observed, interventions tended to reduce wasting prevalence by a few percentage points. However, this effect size is to be expected and beneficial as wasting prevalence is typically low. In addition, this effect size is similar to what USAID Advancing Nutrition found in a literature review on blanket supplementary feeding. The limited evidence base is in part due to methodological difficulties and limitations, so evidence should be interpreted cautiously and a lack of evidence does not mean an intervention is not effective. Wasting and its drivers are complex and it is difficult to disentangle the effects of different types of interventions on wasting prevention.

We found the most evidence related to WASH, nutrition-sensitive agriculture, and large-scale food fortification. This evidence varied in quality. We found limited evidence related to livestock vaccination and insurance, income generation, home fortification, and women's empowerment interventions. We did not find evidence on wasting prevention that assessed other GAP priority interventions on their own, such as interventions to improve food availability and affordability outside of nutrition-sensitive agriculture and livelihoods and resilience interventions. The evaluations of the USAID-funded nutrition and food security activities included some of these interventions, but they did not seek to evaluate their individual contribution to wasting reduction. We found little cost-efficiency data and no evidence on cost-effectiveness.

The current evidence base suggests that the following interventions may help reduce wasting:

- Aim nutrition-sensitive agriculture interventions toward increasing production of micronutrient-rich foods along with either energy or protein dense foods, and ideally, implement them for longer periods of time (e.g., at least four years).
- Use large-scale food fortification with multiple micronutrients rather than home fortification.
- Use multiple WASH interventions combined with nutrition interventions targeted to children under two.

Practitioners can use this evidence when designing food systems interventions, however this evidence does not imply that these interventions should be used in isolation to prevent wasting.

Areas for Further Research

The evidence base across the board needs to be strengthened to understand which food systems interventions can help prevent wasting in different contexts. Preventing wasting requires a comprehensive approach, so the focus when building the evidence base should be on testing combined packages of food systems (and health systems interventions when appropriate). To strengthen the evidence base, in general, food systems studies should assess both dietary patterns and nutritional status, assess cost-effectiveness, collect data on other factors that might affect the interventions impact on wasting, and follow children post-intervention to assess relapse (Bassey et al. 2022; Ickes, Craig, and Heidkamp 2022; Girard et al. 2012). In addition, studies should consider assessing wasting more frequently using wasting incidence rather than wasting prevalence (Ickes, Craig, and Heidkamp 2022), as “incidence rate is a more complete assessment of the wasting burden than prevalence of low WLZ at a single point in time” (Dewey et al. 2021, 31S–32S).

Food availability and affordability are important drivers of wasting and interventions to address them outside nutrition-sensitive agriculture are significant evidence gaps. High-quality studies should assess the effectiveness of understudied interventions (and/or combinations) that aim to improve food availability and affordability, including interventions that address food prices, food market environments, and post-harvest processing and storage. Practitioners should test these interventions in contexts where the key food system drivers of wasting are known so they can tailor interventions to address them.

In contexts where key food system drivers of wasting are not known, donors should invest in basic research on food system drivers of wasting to identify which factors their implementing partners should address to help reduce wasting.

To further build the existing evidence base, we suggest—

- Conducting large-scale, high-quality studies that assess the comparative effectiveness and cost-effectiveness of nutrition-sensitive agricultural packages (including types of crops and animal source food and intervention intensity and/or duration).
- Conducting high-quality studies that assess the comparative effectiveness of combined WASH interventions (at household- and community-levels) and cost-effectiveness.

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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 (integrated community case management, community-based management of acute malnutrition, integrated management of childhood illness, growth monitoring and promotion [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, and using alternative screening approaches?
6. What metrics/indicators are appropriate for monitoring and evaluating wasting prevention in the context of USAID programming?

Annex 2. Summary of Studies Reviewed

Table 1. Summary of Studies Reviewed: Food Supply

Approach	Description	Outcome
Reviews		
Nutrition-sensitive agriculture (crop and/or animal source food)	Systematic review on effect of agricultural interventions on child nutritional status (biofortification, home gardens, small-scale fisheries and aquaculture, dairy development, and animal husbandry and poultry development) (Masset et al. 2012)	Wasting prevalence (under five): ↓ 3 percentage points (2 [1 dairy production, 1 OFSP] of 7 studies; quality not provided)
	Systematic review of nutrition-sensitive agriculture on undernutrition; nearly all included home gardening, poultry, nutrition education and behavior change, women's empowerment, OFSP, marketing, hygiene, and agricultural production and diversification (Sharma et al. 2021)	Wasting prevalence (under five): ↓ 3 percentage points (1 [same OFSP study as previous row] of 15 studies; low quality evidence)
	Review of nutrition-sensitive social protection programs in the food system; nutrition-sensitive agriculture interventions with asset transfer included home gardens, livestock transfers, value chain, or market-based interventions (Olney et al. 2021)	Wasting prevalence (under five): positive effect in 2 of 5 studies (effect sizes not given) (1 livestock; 1 home gardens; evidence quality not rated)
	Systematic review of nutrition-sensitive interventions in South Asia including seed and plant provision and training for homestead production with or without livestock, and livestock or aquaculture provision and training (Bird et al. 2019)	Wasting prevalence (under five): ↓ 15 percentage points (1 of 2 studies; high quality evidence)
Home food production/ gardening (crop and/or animal source foods)	Systematic review and meta-analysis of home food production (i.e., provision of seedlings and/or training in crop production on land attached to or near home primarily for home consumption, training in and/or distribution of chicks for home raising and consumption with or without behavior change intervention) (Basse et al. 2020)	WHZ (under five): ↑ MD 0.05 (5 studies; low quality evidence); greater effects in Asia than in Africa Cost of intervention documented in 2 studies: \$23.20 USD per year per garden in Bangladesh (including project costs,

Approach	Description	Outcome
		<p>women's opportunity cost, and seedling cost) \$220 USD for 22 months per garden and \$239 for a garden + fish pond + training per household in Cambodia</p>
	<p>Systematic review and meta-analysis of household food production interventions, including fruit, vegetable, OFSP, tuber, livestock, and fish production (Girard et al. 2012)</p>	<p>Wasting (under five): no effect from pooled estimates (5 studies; very low-quality evidence)</p> <p>3 studies showed reduced wasting (effect sizes not given) (1 livestock, 1 OFSP, 1 integrated model)</p>
<p>Small livestock and fish</p>	<p>Systematic narrative review of small livestock and aquaculture production interventions (Blackmore, Lesorogol, and Iannotti 2018)</p>	<p>WHZ (under five): ↑ MD 0.47 (1 of 4 studies; moderate quality)</p>
<p>Primary Studies</p>		
<p>Newcastle vaccination for chickens</p>	<p>Two-arm randomized control trial (RCT) to determine if Newcastle vaccination in Kenya would increase flock size (it did) and if vaccination affected children's animal source food consumption and growth outcomes (Otiang et al. 2022)</p>	<p>WHZ (under five): no effect</p>
<p>Livestock insurance</p>	<p>Impact of a cash transfer program and an index-based insurance product on pastoralist households in Kenya, including MUAC (Jensen, Barrett, and Mude 2017)</p>	<p>MUAC (under five): no effect</p>

Table 2. Summary of Studies Reviewed: Food Environment

Approach	Description	Outcome
Reviews		
Income generation	Cochrane systematic review of community-level interventions to improving access to food, including income generation (e.g., small business development, cash-for-work, agriculture interventions) and outcomes on wasting (Durao et al. 2020)	Wasting prevalence (ages not specified): no effect (2 studies; moderate-quality evidence)
Food fortification	Cochrane review and meta-analysis of impact of multiple micronutrient fortification (vehicles included staples, dairy products, non-dairy beverages, biscuits, spreads, and salt) on the general population in any country (Das et al. 2019)	WHZ/WLZ (age not specified): ↑ MD 0.10 (6 studies; low quality evidence)
	Systematic review and meta-analysis of provision of zinc-fortified foods (with or without multiple micronutrient supplementation) compared to non-fortified food in LMICs (Tsang et al. 2021)	WHZ (age not specified): no effect (7 studies; quality not specified) MUAC (age not specified): no effect (6 studies; quality not specified)
	Systematic review and meta-analysis of effect of consumption of large-scale fortification of complementary foods (excluding formula, milk, and milk-based formula) in any country (Csölle et al. 2022)	WHZ/WLZ (6–23 months): no effect (4 studies; moderate quality evidence)

	Systematic review of home fortification with micronutrient powders in LMICs (Salam et al. 2013)	Wasting (age not specified): no effect (1 study; moderate quality evidence) WHZ (age not specified): no effect (1 study; moderate quality evidence)

Table 3. Summary of Studies Reviewed: Food and Water Utilization

Approach	Description	Outcome
Reviews		
WASH	Cochrane review and meta-analysis of effect of WASH interventions, including water quality, sanitation, and hygiene (or combination) (Dangour et al. 2013)	WHZ (under five): no effect (7 studies [hygiene, sanitation, and/or water quality]; low to moderate quality evidence)
	Systematic review and meta-analysis on effect of interventions with at least one WASH component (water quality, water supply, sanitation, and/or handwashing) or combined with nutrition (Bekele, Rawstorne, and Rahman 2020)	WHZ (under five): no effect for WASH only (11 studies; low-moderate quality evidence) ↑ MD 0.04 for WASH and nutrition (3 studies)
	Systematic review of effect of WASH interventions, including water quality, water supply, sanitation, hygiene, and environmental hygiene (Patlan-Hernandez et al. 2022)	Acute malnutrition (under five): (effect sizes not given) (low to high quality evidence) Water access: no effect (5 studies) Water quality: positive association (2 of 15 studies) Water storage: positive association (1 of 4 studies) Food hygiene: no effect (2 studies) Hygiene: positive association (3 of 6 studies)

Approach	Description	Outcome
Reviews		
		<p>Handwashing: positive association (1 of 9 studies)</p> <p>Safe disposal of feces: positive association (3 of 14 studies)</p> <p>Combined packages: positive association (4 of 6 studies)</p>
Sanitation	<p>Systematic review on the effectiveness of interventions targeting unsafe child feces disposal in reducing this behavior and improving child health in LMICs (Morita, Godfrey, and George 2016)</p>	<p>WHZ (0–35 months): ↑ MD 0.19 (1 study; evidence quality not rated)</p>
	<p>Systematic review and meta-analysis of the impact of sanitation on diarrhea, soil-transmitted helminth infections, trachoma, schistosomiasis, and nutritional status assessed using anthropometry (Freeman et al. 2017)</p>	<p>WHZ (age not specified): no effect (7 studies; very low-quality evidence on average)</p>
Women’s empowerment pathway in nutrition-sensitive agriculture	<p>Systematic review of nutrition-sensitive agriculture on undernutrition; nearly all included home gardening, poultry, nutrition education and behavior change, women’s empowerment, OFSP, marketing, hygiene, and agricultural production and diversification (Sharma et al. 2021)</p>	<p>Wasting prevalence (under five): ↓ 1.9 percentage points attributable to women’s empowerment (1 study; medium quality evidence)</p>
	<p>Cluster-randomized trial in India of nutrition-sensitive agriculture with and without women’s empowerment (four arms were nutrition-sensitive agriculture videos; nutrition-sensitive agriculture and</p>	<p>WHZ (6–23 months): no effect</p>

Approach	Description	Outcome
Reviews		
	nutrition-specific videos; or nutrition-sensitive agriculture videos and a nutrition-specific participatory learning and action cycle meetings and videos) (Kadiyala et al. 2021)	

Table 4. Summary of Studies Reviewed: USAID Evaluations

Activity	Description	Outcome
Three development food assistance projects (DFAPs) in Niger	Pre-post performance evaluation (no comparison group) of three five-year DFAPs in Niger. Key interventions include promotion of positive behavior change in nutrition, health, hygiene, sanitation, and agriculture; involvement of women in project activities as participants and beneficiaries; and interventions to diversify livelihoods through livestock, savings and lending, and literacy activities (Persha, Magistro, and Baro 2018)	Wasting prevalence (under five): ↓ 3.4 to 5.9 percentage points
4 DFAPs in Ethiopia	Pre-post mixed methods performance evaluation (no comparison group) in four DFAPs. Projects varied, but tried to reduce food security and improve resilience, including capacity strengthening, food transfers, WASH, etc. (EVELYN 2018)	Wasting prevalence (under five): ↓ 3.7 to 13.4 percentage points
Nobo Jibon in Bangladesh	Pre-post quantitative performance evaluation (no comparison group) of the five-year program. Strategic objectives on improving	Wasting prevalence (under five): ↓ 5.2 percentage points (↓ 32%)

Activity	Description	Outcome
	maternal and child health and nutrition, market-based production and income generation, and disaster risk reduction (Langworthy et al. 2015)	
Strengthening Household Ability to Respond to Development Opportunities (SHOUHARDO) II in Bangladesh	Pre-post quantitative performance evaluation (no comparison group) of the five-year program. Strategic objectives on availability and access to nutritious foods, improved use of health and nutrition services, women’s empowerment, and disaster risk reduction (TANGO 2015)	Wasting prevalence (under five): ↓ 3.5 percentage point (↓ 22%)
Growth, Health, and Governance Project in Uganda	Pre-post quantitative performance evaluation (no comparison group) of the five-year program. Project addressed three objectives: 1) Economic growth—agriculture, livestock, and other income generating activities through market systems and entrepreneurship; 2) Improved nutrition—nutritional well-being of mothers and their children under five years of age and safe water, sanitation, and hygiene; and 3) Good governance—strengthening group formation and local governance, strengthen capacity for conflict mitigation, and improve youth capacity to engage with government (Advanced Marketing Systems 2017)	Wasting prevalence (under five): no effect

Activity	Description	Outcome
NOURISH in Cambodia	Pre-post quantitative performance evaluation (no comparison group). Main activities were social and behavior change communication, community-led-total sanitation, and conditional cash transfers (NOURISH 2019)	Wasting prevalence (under five): no effect
ACCESO in Honduras	Impact evaluation (difference-in-difference) of the four-year project. Project included agricultural and value-add technical assistance, market linkages, rural financial services, reducing policy barriers, environmental and natural resource management, improving utilization, and consumption of food (Almanzar and Torero 2016)	WHZ (under five): no effect
Yaajeende in Senegal	Impact evaluation (difference-in-difference) of six-year project. Took a food systems approach, including supporting improved agricultural production, private sector network development, and building strong institutions (Persha and Haugan 2018)	Wasting prevalence (under five): no overall treatment effect; ↓ 20.8 percentage point for better off households
Four activities in Ghana	Mixed method pre-post performance evaluation (no comparison group) of Resiliency in Northern Ghana; Strengthening Partnerships, Innovations, and Results in Nutrition Globally; Livelihood Empowerment Against Poverty; and WASH 4 Health in Northern Ghana. Interventions ranged across these, including IYCF, nutrition education, village	Wasting prevalence (under five): no effect

Activity	Description	Outcome
	savings and loan associations, farmer field schools, WASH, cash transfers, anemia prevention (USAID Ghana Evaluate for Health Project 2019)	
United in Building and Advancing Life Expectations in Malawi	Mixed methods pre-post performance evaluation (no comparison group) of the five-year activity in Malawi. Interventions aimed to increase household incomes (including through agricultural income), providing blanket supplementary feeding ration, strengthening nutrition policy, and strengthening local structures (IMPEL 2020)	Wasting prevalence (under five): no effect



USAID ADVANCING NUTRITION

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