Preventing Moderate Acute Malnutrition (MAM) Through Nutrition-Sensitive Interventions

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1. Independent consultant

“Where complementary nutrition prevention and treatment interventions are in place, attempts can usefully be made to forge links both to widen opportunities for identification of children with severe acute malnutrition SAM, to provide continuity of care and rehabilitation for children and ultimately, to forge links which address the underlying health determinants of acute malnutrition and thereby, prevent its occurrence.”

CMAM Forum Technical Brief:
December 2014
Acknowledgements

We would like to thank the following individuals for their very helpful comments and input during the development of this brief: Jonathan Annis (USAID/WASHplus, CARE USA), Abigail Beeson (CARE Cambodia), Erin Boyd (Tufts University- Friedman School of Nutrition Science and Policy), Jeanette Bailey (IRC-New York), Rebecca Brown (CMAM Forum), Susan Fuller (Save the Children UK), Maureen Gallagher (ACF–USA), Michelle Jimenez (Independent Consultant), Julien Morel (ACF–France), Francis M. Ngure (The World Bank Water and Sanitation Programme (WSP), Audrey Papucci (ACF–France), Maryanne Stone-Jimenez (Independent Consultant), and Patrick Webb (Tufts University).

This technical brief was produced with funding from ECHO. The final content is the responsibility of the authors and does not formally represent the position of the CMAM Forum in relation to issues discussed.

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Abbreviations

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<tr>
<th>Abbreviation</th>
<th>Description</th>
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<tr>
<td>ACF</td>
<td>Action Contra La Faim / Action Against Hunger</td>
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<td>BMI</td>
<td>Body Mass Index</td>
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<td>CAR</td>
<td>Conflict-Affected Residents</td>
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<td>CCT</td>
<td>Conditional Cash Transfer</td>
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<td>CLTS</td>
<td>Community Led Total Sanitation</td>
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<td>CMAM</td>
<td>Community-based Management of Acute Malnutrition</td>
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<tr>
<td>DDS</td>
<td>Dietary Diversity Scores</td>
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<td>DHS</td>
<td>Demographic Health Surveys</td>
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<td>ECD</td>
<td>Early Childhood Development</td>
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<td>EED</td>
<td>Environmental Enteric Dysfunction</td>
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<td>ENN</td>
<td>Emergency Nutrition Network</td>
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<td>EU</td>
<td>European Commission</td>
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<td>EWS</td>
<td>Early Warning Systems</td>
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<td>F-Diagram</td>
<td>The Faecal-Oral Transmission Diagram</td>
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<tr>
<td>FANTA</td>
<td>Food and Nutrition Technical Assistance project</td>
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<td>FAO</td>
<td>The United Nations Food and Agriculture Organisation</td>
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<td>FTF</td>
<td>U.S. Government Feed the Future initiative</td>
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<td>GAM</td>
<td>Global Acute Malnutrition</td>
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<td>GFD</td>
<td>General Food Distribution</td>
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<td>HDDS</td>
<td>Household Dietary Diversity Score</td>
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<td>HFIAS</td>
<td>Household Food Insecurity Access Scale</td>
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<tr>
<td>HHS</td>
<td>Household Hunger Scale</td>
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<tr>
<td>HWT</td>
<td>Household-level Water Treatment</td>
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<td>HWWS</td>
<td>Hand Washing with Soap</td>
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<tr>
<td>IDP</td>
<td>Internally Displaced Persons</td>
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<tr>
<td>Acronym</td>
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<tr>
<td>IDDS</td>
<td>Individual Dietary Diversity Score</td>
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<td>IPC</td>
<td>Integrated Food Security Phase Classification</td>
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<td>IYCF</td>
<td>Infant and Young Child Feeding</td>
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<td>MAD</td>
<td>Minimum Acceptable Diet</td>
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<td>MAM</td>
<td>Moderate Acute Malnutrition</td>
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<td>MICS</td>
<td>Multiple Indicator Cluster Surveys</td>
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<td>MDG4</td>
<td>Millennium Development Goal 4</td>
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<td>MND</td>
<td>Micronutrient Deficiencies</td>
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<td>MUAC</td>
<td>Mid-Upper Arm Circumference</td>
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<td>NNS</td>
<td>National Nutrition Strategies</td>
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<td>OD</td>
<td>Open Defecation</td>
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<td>ORT</td>
<td>Oral Rehydration Therapy</td>
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<td>PLW</td>
<td>Pregnant and Lactating Women</td>
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<td>POU</td>
<td>Point of Use</td>
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<td>SAM</td>
<td>Severe Acute Malnutrition</td>
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<td>SSN</td>
<td>Social Safety Nets</td>
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<td>SLEAC</td>
<td>Simplified LQAS Evaluation of Access and Coverage (SLEAC)</td>
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<td>SQUEAC</td>
<td>Semi-Quantitative Evaluation of Access &amp; Coverage</td>
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<td>TB</td>
<td>Tuberculosis</td>
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<td>UCT</td>
<td>Unconditional Cash Transfer</td>
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<td>UNICEF</td>
<td>United Nations Children’s Fund</td>
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<td>USAID</td>
<td>United States Agency for International Development</td>
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<td>USG</td>
<td>United States Government</td>
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<td>VBV</td>
<td>Value Based Voucher</td>
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<td>WASH</td>
<td>Water, Sanitation and Hygiene</td>
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<tr>
<td>WDDS</td>
<td>Women's Dietary Diversity Score</td>
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<tr>
<td>WFA</td>
<td>Weight-for-Age</td>
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<td>WFH</td>
<td>Weight-for-Height</td>
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<td>WFP</td>
<td>World Food Programme</td>
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<td>WHO</td>
<td>World Health Organisation</td>
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<td>WHZ</td>
<td>Weight-for-Height Z-score</td>
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<td>WSP</td>
<td>The World Bank Water and Sanitation Programme</td>
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1 Background

This technical brief examines current evidence, knowledge and practice relating to the prevention of moderate acute malnutrition (MAM) through nutrition-sensitive interventions in various sectors. This brief was developed based on a review of many types of evidence including ‘grey’ research, published research, systematic literature reviews, ongoing impact evaluations and other plausible research systematically collected.

Moderate Acute Malnutrition

The 2008 Maternal and Child Nutrition Lancet series recognises the importance of addressing acute malnutrition for meeting the Millennium Development Goal 4 of reducing child mortality. The 2013 Lancet Series also emphasises the management of MAM as critical for scale-up and suggests “further evidence is needed for prevention and management strategies for MAM in population settings.”

MAM, also referred to as wasting, is recent rapid weight loss or a failure to gain weight that results from illness, lack of appropriate foods, or other underlying causes. MAM affects a greater number of children and is associated with more nutrition-related deaths than severe acute malnutrition (SAM). Children with MAM are not only at three times greater risk of death and 4.5 times more likely to die from diarrhoea than well-nourished children but also face greater risk of morbidity from infectious diseases and delayed physical and cognitive development. There is a widespread misconception that MAM is a problem that only occurs in emergencies despite being very common in development contexts. MAM tends to peak during seasonal hunger, disease outbreaks, or during food security ‘shocks’ (e.g. economic or climatic crises) and stresses including humanitarian crises.

MAM should not be neglected as, untreated, it can deteriorate to SAM and possible death. Furthermore, evidence is emerging that repeated episodes of MAM can have a significant impact on stunting, for example, a recent study demonstrates how wasting is associated with stunting in early childhood and that prevention of wasting could potentially increase height in children. However further research is needed. Additionally, there is limited research on children who recover from MAM, particularly with respect to growth, mortality, and risk of further episodes of malnutrition. Therefore, unless acute malnutrition is addressed in all contexts, efforts to reduce stunting in the critical 1000-day ‘window of opportunity’ will be undermined.

1.1.1 Addressing the Underlying Causes of Malnutrition through Nutrition-Sensitive Interventions

Nutrition-sensitive interventions incorporate explicit nutrition goals and actions with a clearly defined plan about how to implement these actions to improve nutritional impact within other sectors. A review of potentially nutrition-sensitive interventions in various sectors (agriculture, social safety nets, early child development (ECD), etc.) confirms that programmes in these sectors are successful at addressing several underlying determinants of nutrition, although evidence of nutritional impact is limited. Strategies are needed to prevent MAM, to reduce MAM prevalence and relapse by integrating nutritional goals and objectives through multiple sectors while measuring for nutritional impact. Box 1 summarises the definition of nutrition-sensitive interventions.

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1 Evidence demonstrates that during the 1,000-day period – from the start of a woman’s pregnancy until her child’s second birthday – offers a unique window of opportunity to meet a child’s nutritional, growth and development requirements, to shape healthier and more prosperous futures. (Source: United Nations Children Fund (UNICEF). Key Facts and Figures on Nutrition. 2013.)
Box 1: Summary Definition of Nutrition-Sensitive Interventions

- **Explicit Nutrition Goal**: incorporates an explicit nutrition goal/objective into other sectorial policies, strategies and programs. This goal/objective is sometimes secondary and it should not detract from the sector’s own goals.

- **Nutrition Actions and Interventions**: Has nutrition intervention, activities and actions.

- **Addresses Underlying Determinants of Malnutrition**: such as environmental or socioeconomic factors (e.g. household food security, environment, health services, Water, Sanitation and Hygiene (WASH), care and feeding practices)

- **Measureable Nutrition Indicators**: Defines measurable nutrition outcome and impact indicators that demonstrate measurable results from the intervention.

- **Minimises Negative Nutritional Consequences**: Minimises the unintended negative nutritional consequences of interventions and policies on the poor, especially women and young children. Also tracks and mitigates potential harms.


Nutrition-sensitive interventions and programmes improve nutritional outcomes and impact by addressing many of the underlying and basic causes of malnutrition. These causes include: poor food and nutrition security—barriers to the access and consumption of quality, diverse foods, poor or inadequate hygiene and sanitation practices, poor access to clean, safe water and sanitation facilities, inadequate infant and young child feeding and caring practices, low utilisation of health services and infections such as diarrhoea.3,12,13,14 There are three main underlying causes of malnutrition identified in the UNICEF conceptual framework for malnutrition.15 1) **Household Food Insecurity**: lack of availability or access to food; 2) **Unhealthy household environment and inadequate health services**: poor health caused by poor WASH conditions and inadequate health services; and 3), **Inadequate care and feeding practices**: for children this includes poor maternal and child-caring practices, including inadequate breastfeeding and complementary feeding.

One of the greatest challenges is the lack of evidence, consensus and programmatic guidance on how to prevent MAM through addressing these underlying causes with nutrition-sensitive interventions. There is only limited understanding of the underlying causes of MAM and how to prevent them. Recently, a MAM Decision Tool16 was developed and published under the Inter-Agency Standing Committee’s Global Nutrition Cluster, MAM Task Force, updated in 2014, however there are still no globally agreed-upon guidelines for the prevention and management of MAM. There is, however, a growing interest and consensus that a diverse range of strategies to prevent MAM (as well as stunting) should be identified and developed. This technical brief examines the existing evidence and practical guidance available for nutrition interventions within other sectors that are likely to prevent several underlying causes of acute malnutrition and attempts to identify key gaps and areas for further investigation for preventing MAM through nutrition-sensitive interventions (see Figure 1).
Compared to the prevention of stunting and underweight, relatively few studies have looked at the prevention of acute malnutrition and amongst these studies it has been difficult to demonstrate the impact of interventions specifically on preventing MAM. A recent longitudinal study demonstrates that persistent wasting appears to be more acute and reversible than stunting, making prevention of wasting even more important. However, the review of the literature on wasting fails to identify factors that are not also directly related to stunting (e.g. seasonality, infections, growth retardation), making it difficult to identify effective interventions to prevent wasting. Given the alarming levels of acute malnutrition, more research is necessary to identify the causal pathways which can be addressed by nutrition-sensitive interventions and the possible links with stunting.

According to the most recent Lancet Series for Maternal and Child Nutrition, nutrition-sensitive interventions and programmes in agriculture, social protection (safety nets) and ECD have enormous potential to enhance the scale and effectiveness of nutrition-specific interventions. Despite the fact that scaling up the management (treatment) of acute malnutrition lies mostly within existing health structures and systems, prevention of malnutrition depends largely on a multi-sectorial approach. This requires coordinated, concurrent action and adequate involvement of other sectors including agriculture.

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1. Treatment of Severe Acute Malnutrition (SAM) refers to the specific actions of administering drugs and therapeutic diets. Management of SAM is a process that includes diagnosis based on: medical history and physical, clinical, and anthropometric assessments, triage, treatment planning (decision and consent), treatment, monitoring of treatment progress, preventing relapse and referral.
and food security, WASH and health sectors. This brief examines nutrition-sensitive interventions for the prevention of MAM in the following sectors:

- Agriculture and Food Security (including social protection (safety nets)
- Water, Sanitation and Hygiene
- Early Childhood Development
- Women’s Empowerment

1.2 Preventing both Short-Term and Long-Term Malnutrition

Nutrition interventions need to address both short-term wasting (moderate acute malnutrition) as well as the longer-term effects of chronic malnutrition (stunting). Acute malnutrition, or ‘wasting’ results from recent rapid weight loss or a failure to gain weight from inadequate nutrition over a short period of time, whereas ‘stunting’ or ‘chronic malnutrition’ results from a longer-term response to a sustained poor dietary intake or repeated illnesses that slows linear growth. In many resource-poor settings where infectious diseases are common and intake of nutritious food is limited, wasted children often fail to ‘catch-up’ their growth, slowing their linear growth over the short-term potentially resulting in stunting. However, given adequate nutrition and no further infections, catch-up growth may occur. Repeated episodes of MAM can eventually lead to stunting and affect the overall nutritional status of the next generation of babies. ‘Intergenerational growth failure’ is a cycle of poor nutrition that perpetuates itself across generations. Children who are wasted as a result of temporary inadequate food, poor health and care may become stunted over time with irreversible effects, becoming stunted adolescents, and then becoming the next generation of malnourished mothers. Adolescent pregnancy heightens the risk of low birth weight and the difficulty of breaking the cycle. Growth faltering earlier in life leaves women permanently at risk of obstetric complications and of delivering low birth weight babies.

Nutrition interventions therefore need to address both immediate, short-term nutritional needs of families, while building longer-term resilience to malnutrition. Short-term solutions for addressing acute malnutrition such as treatment through therapeutic foods with specialised nutritional products need to be integrated with longer-term prevention interventions integrated within health and the different sectors mentioned above, in order to reduce the incidence of malnutrition in a sustainable manner. This requires an understanding of MAM prevalence and its associated risk factors in different sectors, in order to plan targeted, integrated interventions.

1.3 Targeting Population Groups and Interventions

Clearly identifying and defining target population groups is essential. Evidence demonstrates that prevention interventions have a greater impact on reducing the prevalence of malnutrition for vulnerable populations rather than treatment interventions for individuals once they have become malnourished. It is important to target the most vulnerable and most at risk of malnutrition to maximise nutritional impact. A critical window for the prevention of malnutrition is the ‘1,000-day development window of opportunity’ from the start of a woman’s pregnancy to 24 months of age. This is the time when

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ii The term ‘catch-up’ has been used for the accelerated growth of children who have suffered from restricted intrauterine growth based on either maternal nutritional factors or morbidity such as hypertensive disease. Source: Associated Factors for Accelerated Growth in Childhood: A Systematic Review. Chrestani, MA, Santos, S, Horta, BL, Dumith, SC de Oliveira Dode. Maternal Child Health Journal 2013; 17:512-519.

iii Poor weight gain in infants and toddlers with a fall across 2 or more centile lines.
growth and development are the most rapid and infants and young children are most vulnerable to malnutrition, therefore potentially becoming stunted, resulting in cognitive and behavioural defects and lower adult productivity. Early nutrition interventions can prevent the consequences of adversity in childhood development, “adequate nutrition during pregnancy and the first 2 years of life is necessary for normal brain development, which lays the foundation for future cognitive and social ability, school success, and productivity.” The following are the targeted population groups where the greatest impact of nutritional interventions has been demonstrated in preventing acute malnutrition.

<table>
<thead>
<tr>
<th>Targeted Population</th>
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<tr>
<td><strong>Children</strong></td>
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<tr>
<td>Children 0-6 months of age</td>
<td>Malnourished infants less than 6 months are typically not admitted for treatment of MAM but need prevention interventions targeting them and which target their mothers in order to address / prevent both MAM and SAM acute malnutrition (see the two CMAM Technical Briefs Management of MAM and also Nutrition-specific Interventions). Current evidence suggests that wasting is more common in children 0–5 months of age and decreases with age. A recent longitudinal study of wasting reveals that the prevalence of wasting is highest in the first 1–3 months of age (15%) and decreases thereafter.</td>
</tr>
<tr>
<td>Children under 2 (Children 6-23 months of age)</td>
<td>Prevention of MAM is prioritised for this age group for many reasons. Prevalence of acute malnutrition and mortality are both higher in this group and their condition is more likely to deteriorate rapidly. Typically, growth faltering is noticeable from around about six months of age while complementary foods are introduced often in inadequate quantity and quality (nutritionally inadequate) and less hygienic, potentially leading to EED and diarrhoea: wasting occurs more commonly during this weaning period. Infants and young children also have higher nutrient requirements, a greater infection burden, and are more vulnerable to developing stunting and cognitive deficiencies. In addition, poor hygiene practices can lead to diarrhoea and other infections.</td>
</tr>
<tr>
<td>Children under 5 (6-59 months of age)</td>
<td>The standard target groups for all nutrition interventions are children under 5 years of age (6-59 months of age) (including those malnourished and those discharged from treatment of SAM). Children under 5 years of age are at increased risk of mortality associated with acute malnutrition, micronutrient deficiencies and stunting.</td>
</tr>
<tr>
<td>Children Recovered from MAM</td>
<td>Children who have recovered from MAM should be considered at high risk. Experience and observation has also shown that after recovery from MAM, children are at an elevated risk of relapsing back into MAM or SAM and of death.</td>
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<tr>
<th>Pregnant and Lactating Women</th>
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<tr>
<td>Pregnant and Lactating Women (PLW)</td>
<td>PLW women with infants less than 6 months of age and malnourished PLW should be targeted including vulnerable PLW living with HIV or other chronic illnesses such as tuberculosis.</td>
</tr>
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</table>

MAM prevention interventions should seek to improve nutrition throughout the lifecycle, focusing on women, infants and young children in the poorest and most vulnerable households. Vulnerable households are households that cannot afford all basic necessities and that are susceptible to chronic food and nutrition insecurity, inadequate sanitation and inadequate care or access to healthcare and social protection. In different country contexts, the most vulnerable households may also include those households with caregivers/income earners suffering from infectious and chronic disease (e.g. those with HIV and AIDS, TB), orphans and vulnerable children and those affected by humanitarian crises.

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1. A focus on nutrition between pregnancy and age 2 is proven to yield a high return on investment. Leading economists, including Nobel laureates, have declared that five of the top ten most cost-effective solutions for development focus on improving nutrition. World Food Program, 2010.
Other special vulnerable populations include internally displaced persons (IDP), conflict-affected residents (CAR), refugees, and hard to reach populations including mobile population communities, including pastoralists and displaced populations.\(^i\)

Acute malnutrition (both MAM and SAM), although common across development contexts, is often exacerbated by crises, associated with critical events where food supplies are disrupted and/or disease outbreaks are experienced and, associated with a high risk of mortality. The following are temporary or ongoing situations that would require a combination of short and long-term prevention interventions to respond to MAM: seasonal hunger, chronic food insecurity, disease outbreaks, unpredictable climatic conditions (e.g. recurrent droughts and flooding), humanitarian emergencies and conflicts, insecurity, mass displacement, and non-emergency contexts especially where access to adequate health care and/or adequate sanitation is limited.\(^i\)

Some argue that the targeting criteria should continue to be economic rather than social, since targeting based on social criteria alone can undermine the potential existing safety net systems and cause the erosion of livelihoods in times of crisis.\(^{29}\) Others agree that targeting should be based on both poverty and malnutrition indicators, as social safety nets are a poverty reduction tool to target the poorest, and malnourished individuals are also the most vulnerable. **Box 2** below begins to define common criteria for prevention of MAM among vulnerable communities and households, however global consensus around these criteria is needed. **Figure 2** illustrates the key targeted population groups that can be targeted geographically for MAM prevention.

**Box 2: Targeting Vulnerable Population Groups for Preventing MAM: Illustrative Criteria**

- The following are commonly used criteria in targeting households vulnerable to undernutrition:
  - **Food insecure households**: Chronically food-insecure and malnourished households, who are trapped in the hunger cycle are the worst-hit by seasonal shocks.\(^{30}\)
  - **Very poor/ impoverished households**: Households living below the poverty line, (those people living on less than $1.25/day) are especially vulnerable.\(^{8}\) Evidence from the Sahel clearly shows that, in most contexts, levels of child malnutrition are higher in very poor households, who simply cannot afford the nutritious, diverse food necessary for children to grow and thrive.\(^{31}\) Very poor households should be targeted for social protection programmes and livelihood interventions to manage the assets they have available with which to purchase food.
  - **Insecure Households or Lack Social Protection**: Households that are chronically insecure and chronically malnourished must be targeted as a long-term priority within integrated humanitarian and development programmes, not just during periods of crisis.
  - **Households with inadequate childcare capacity**: Households that have children left in inadequate care as defined by the percentage of children 0–59 months old left alone or in the care of another child younger than 10 years of age for more than one hour at least once in the past week.\(^{32}\)
  - **Households with poor sanitation**: Households that do not have access to improved sanitation facility (e.g. latrines), defined as one that hygienically separates human excreta from human contact.\(^{iv}\)\(^{33}\)

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\(^i\) Mobile population communities include populations that are long distances from urban areas and sometimes are in isolation (including health staff).

\(^{ii}\) Displaced populations usually suffer difficult transport and communications and the inability to access services and include internally displaced persons (IDP) and refugees.

\(^{iii}\) USAID’s Feed the Future indicator: ‘Prevalence of Poverty: Percent of people living on less than $1.25/day.’

\(^{iv}\) An improved sanitation facility is defined as one that hygienically separates human excreta from human contact. Source: WHO and UNICEF definitions of improved drinking-water source on the JMP website, WHO, Geneva and UNICEF, New York, accessed on June 10, 2012.
2 Preventing MAM through Nutrition-Sensitive Agriculture and Food Security interventions

The 2013 Lancet Series on Maternal and Child Nutrition recommends aligning agriculture with nutrition goals to achieve "substantially improved outcomes globally."\textsuperscript{10} Both food production and consumption impact nutritional status through agriculture.\textsuperscript{34} Preventing the underlying causes of malnutrition requires addressing food and nutrition security (see Box 3 for the definition), including the quality and quantity of food, diets, dietary micronutrient deficiencies and food shortages.\textsuperscript{8} This requires increasing access, availability, utilisation, affordability, and consumption of diverse, safe, nutritious foods and diets, preventing mal-absorption and energy intensive chronic immune stimulation from Environmental Enteric Dysfunction (EED) and other enteric infections and increasing access to treatment of infectious diseases.\textsuperscript{35} Improving the quantity and quality of household food consumption and overall dietary intake through nutrition-sensitive agriculture is a longer-term solution for the prevention of MAM, although more evidence is needed on the direct impact. It is important to target the most vulnerable with nutrition-sensitive agriculture/food security interventions to prevent future shocks and assist families to become more resilient.\textsuperscript{35}
Box 3: Food and Nutrition Security Defined

**Food and nutrition security** exists when all people at all times have physical, social and economic access to food of sufficient quality in calories, which is consumed in sufficient quantity and quality in terms of variety, diversity, nutrient content and safety to meet their dietary needs and food preferences, and is supported by an environment of adequate sanitation, health services, education and care, allowing for a healthy and active life.\(^1\)


2.1 Seasonal Food Insecurity

‘Wasting’ or sudden weight loss often occurs during specific seasons or ‘seasonality’—when a known ‘shock’ such as peaks in food insecurity and/or epidemics of infectious diseases (e.g. diarrhoea, TB) occur (see Box 4 for a definition of seasonality). Wasting and other negative effects of seasonality, such as unpredictable harvests, affects household food intake, increases the likelihood of infections and disproportionately affects children and poor households, increasing pressure on the households’ asset base, often leading to variable food prices and potentially prolonged hunger gaps.\(^37\) Although seasonality is sometimes predictable and regular, it is often not and climate change and unpredictable shocks and stresses make precise timing, severity and impacts hard to predict, as they vary from year to year.\(^38\)

Box 4: Seasonality Defined

**Seasonality** refers to any regular pattern or variation that is correlated with the seasons. Adverse seasonality describes the potentially damaging consequences for human well-being of seasonal fluctuations in the weather and the full range of its associated impacts on lives and livelihoods.


Climate change, a long-term change in the earth’s climate, or of a region on earth\(^39\) (e.g. extended rainy/monsoon seasons, abnormal weather conditions) can further exacerbate wasting as it can have a direct impact on multiple underlying causes of undernutrition, including food production, food prices, food security, health, caring practices, water and sanitation.\(^38\) Vulnerability will likely further increase with climate change in the future, as adaptive capacity decreases.\(^40\) In addition, climate change and seasonal variations in temperature and rainfall (e.g. monsoon season) can increase disease incidence such as diarrhoea that can further exacerbate malnutrition.\(^38\)

Predictable seasonal variations in food availability increase the risk of wasting especially during the ‘agricultural lean’ or ‘hunger’ season/periods,\(^3\) during rainy seasons, and before a harvest (pre-harvest season), highlighting the need for timely nutrition-sensitive agriculture and food security prevention interventions.\(^41\) In addition, the reduced availability and poorer quality of food, and increased female participation in the agricultural labour market results in poorer infant and young child care and feeding practices.\(^37\) Seasonal weather conditions and climate change can also increase the burden of shocks on livelihoods that in return affects food and nutrition security.\(^42\) Livelihood interventions are distinct or combined strategies that individuals and households pursue to make a living and/or to cope with shocks.\(^43\) Evidence demonstrates that food security is determined less by households’ own levels of

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\(^1\) Based on FAO definition (1996, 2009)

\(^2\) Although no internationally recognised definition exists for ‘hunger season’ or ‘lean season’ there is a common understanding that it is a certain period of time of the year where people face challenges in terms of food insecurity.
food stock but instead by their success in securing casual wages.\textsuperscript{44} \textsuperscript{i} There needs to be more research on how to improve longer-term agricultural productivity so that households can better access quality food, earn casual wages and work towards earning adequate incomes to avoid the need for social protection safety nets.\textsuperscript{45}

Nutrition-sensitive agricultural and food security interventions to prevent MAM should be targeted during predictable seasonal food insecurity for vulnerable communities and families while building their longer-term resilience to recurring crises. This requires a dual-approach to simultaneously deliver short-term interventions (e.g. social protection schemes such as cash transfers) in parallel with those that are longer-term interventions (e.g. improving agricultural productivity or livelihood opportunities). Short-term interventions may include targeted food supplementation for women with low Body Mass Index (BMI) during pregnancy and breastfeeding, interventions to improve complementary feeding, home food fortification and seasonal social protection interventions.\textsuperscript{18} Similar to stunting, the evidence-base demonstrating the direct impact of short-term food security interventions on preventing wasting during periods of seasonal food insecurity is limited. The impact of such interventions needs to be measured more carefully in future research.

2.2 Early Warning Systems

Vulnerable poor communities often face seasonal food insecurity or famine, leading to severe food security emergencies. Early warning systems can provide real-time information and deploy systems to detect “hot spots” or outbreaks of especially critical, time-sensitive nutrition and food security indicators and report crises for rapid decision-making. Evidence demonstrates that famine early warning systems have a good track record of predicting food crises, but that they fail to trigger early action.\textsuperscript{38} Evidence also shows that it is more cost effective to respond early to crises, with one source estimating that the provision of effective agricultural support as a preventive measure is around one-tenth of the cost of providing food aid at a time of in response to famine.\textsuperscript{46} Findings from case studies in Kenya, Ethiopia, Mozambique, Bangladesh and Niger support early response — even if predicted crises do not actually materialise, since they consistently cost less than the costs of late response.\textsuperscript{47} Further action needs to be taken to use information generated to trigger early response where famine early warning systems are already in place.

2.3 Resilience

<table>
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<th>Box 5: Resilience Defined</th>
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<td><strong>Resilience</strong> has been defined by United States Agency for International Development (USAID) as “the ability of people, households, communities, countries, and systems to mitigate, adapt to, and recover from shocks and stresses in a manner that reduces chronic vulnerability and facilitates inclusive growth.”\textsuperscript{49}</td>
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Recurrent food crises and resulting hunger, have underscored the need to work on a long-term and systematic approach to building the resilience of vulnerable communities and populations.\textsuperscript{48} Persistent food insecurity is caused by the limited access to food among the poorest which leads to high acute malnutrition rates.\textsuperscript{48} Resilient households are able to meet their food security needs if they have access

\textsuperscript{i} Referring to food security of the urban poor here.

\textsuperscript{ii} Famine early warning systems (EWS) are continuous monitoring of weather, climate, agriculture production, prices, trade, and other factors, considered together with an understanding of local livelihoods to spotlight emerging problems. Source: USAID FEWS NET (the Famine Early Warning Systems Network) Available at: www.fews.net
to sufficient nutritious and diverse foods, live in a protected environment, have the ability to participate in the decisions that affect their lives and have income security. Resilient households can bounce back in times of ‘shock’ from food insecurity, diseases and economic stresses which in turn means that children from these households are less susceptible to wasting. A major barrier to resilience is the weak enabling environment and lack of success in implementing appropriate policies to mitigate the adverse effects of seasonal food insecurity for poor households. More research is needed in order to identify policies and programmes that can improve longer-term resilience to food insecurity. The resilience framework in Figure 3 illustrates the pathway to food security and adequate nutrition.

**Figure 3: Resilience Framework**

![Resilience Framework Diagram]


2.4 Social Protection (Safety Nets)

A well-functioning social protection welfare system serves as a vital safety net for vulnerable food and nutrition insecure children and families and offers access to an array of quality social benefits and services to promote well-being and protect them from harm. Many of the immediate and underlying causes of malnutrition can ultimately be attributed to a lack of a social safety net and limited access to social protection programmes, resulting in insufficient access to food, healthcare, inadequate maternal and childcare practices and poor WASH/nutrition services. Social protection programmes can address these underlying causes by ensuring that basic needs are met, for example by increasing access to food and a nutritious, diverse diet or access to income to purchase food, while protecting assets to prevent seasonal or unpredictable shocks to ensure a safety net in adversity and reduce both immediate and longer-term vulnerability. These programmes can also simultaneously support positive child development, leading to a healthy and productive adulthood. There are many types of social protection.

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1 For the purposes of this paper, the social welfare system is defined as the system of interventions’, programmes and benefits which are provided by governmental, civil society and community actors to ensure the well-being and protection of socially or economically disadvantaged individuals and families (including, and perhaps most importantly, children).
programmes that improve food and nutrition security, including: cash transfers, cash and food-for-work vouchers, social transfers, school meals, social services, or financial services/insurance to augment household resources and improve the household’s nutrition and overall well-being. There is a lack of evidence about which social protection schemes are the best to address acute malnutrition. There is also limited evidence on the positive impacts of cash transfers targeted to reduce acute malnutrition as opposed to those aimed at tackling stunting. Successful social protection programmes will improve nutrition and protect the poorest households’ and children from the poorest households from relapsing back into MAM or SAM after treatment. There are ongoing studies in progress that look at prevention of wasting through cash transfers including Save the Children’s study in Niger. Ideally, social protection programmes would also offer livelihoods and productive activities to ensure that these vulnerable households can sustain assets in the longer term.

2.4.1 Conditional and Unconditional Cash Transfers

In the 2008 *Lancet’s Series on Maternal and Child Undernutrition*, conditional cash transfer programmes accompanied by nutritional education are referred to as indirect interventions with sufficient evidence to implement in specific situational contexts to protect or improve access to food and basic services, especially health services. These interventions are also sometimes referred to as ‘social transfers’—“predictable transfers to households or individuals, both in-kind and cash, including public works programmes” and can be either conditional or unconditional, depending on whether recipients are required to engage in specific behaviours as a condition for access. Predictable cash transfers involve the provision of cash to targeted beneficiaries who cannot afford and therefore easily access foods that are readily available in the local markets and can prevent the sale of assets to protect the household against livelihood shocks and reduce long-term vulnerability. Programmes in Niger and Ethiopia demonstrate that predictable cash transfers during annual seasonal declines can prevent acute malnutrition on a limited basis but may need to be complemented by interventions such as disease prevention and micronutrient supplements, so as to better protect children’s nutritional status. There are several types of social protection cash transfers that are summarised in Table 2.

<table>
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<th>Table 2: Types of Social Protection</th>
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<td>Type of Social Protection</td>
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<tr>
<td><strong>Conditional Cash Transfers</strong></td>
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<tr>
<td>Conditional cash transfer</td>
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<tr>
<td>Conditional cash for work or “physical labour”</td>
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<td>Conditional food and nutrition transfers</td>
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1 When implementing conditional cash transfers to improve nutrition, it is important to have well developed targeting criteria. Furthermore, if there are conditions it is important that these relate to the targeted population to help self-select those most vulnerable households that are willing to meet the conditions in order to access the transfers. Households should be selected for participation according to well-defined measures of income or asset levels and nutritional status.
The cash transfer decision tree based on certain contexts displayed in Figure 4 can help to decide whether or not to introduce a cash transfer for the promotion of a particular nutrition intervention. It is important to select the “right” conditionality based on factors such as evidence about which nutrition interventions have the strongest link to desired outcomes in the particular context—factors such as geography, the burden of disease, and the degree of existing infrastructure and social services can shape the menu of suitable nutrition-related conditionality. Common conditions often include proof of attendance at growth monitoring and promotion sessions, micronutrient supplementation, all coupled with support groups or nutrition education.

**Child-oriented cash transfers**
Child-oriented cash transfers are transfers that are usually given to the caregiver but are ‘tied’ to the child for meeting a certain condition, such as sending them to school.

**Unconditional Cash Transfers**

| Unconditional cash transfer | Unconditional cash transfers are given to recipients without any requirements and can be used to prevent seasonal weight loss and wasting in an emergency context, to transfer food and other assets.52 |

**Figure 4: Decision Tree for Determining the Use of Nutrition-Related Conditionality**


Cash Transfers - Key Findings / Evidence-base

While there is growing strong evidence that cash transfers have a range of positive effects and are good value for money, the evidence base relating to their impact on nutritional status varies.\(^5\), \(^4\)

- A recent systematic review that looked at the effect of both conditional and unconditional cash transfers programmes on improving stunting rates indicated improvement in calories consumed and dietary diversity, but mixed impact on child nutritional status.\(^5\), \(^5\) There is some evidence that conditional cash transfers (via cash or voucher programmes) demonstrate an improvement of nutritional status—particularly for stunting, although the amount of change that can be achieved requires further research. "Research is planned on the impact of different types of food assistance (e.g. food aid, cash transfers and vouchers) on nutrition, as well as comparing cash with more traditional interventions to address moderate acute malnutrition (e.g. supplementary feeding programmes), but generating findings will take time."\(^5\) Furthermore, the Emergency Nutrition Network (ENN) is implementing a study to look at the costs per nutritional outcome, addressing moderate acute malnutrition, including cash transfers.\(^5\)

- **Scale-up of seasonal Social Protection Cash Transfer Programmes**:\(^3\) Targeted seasonal cash transfers prior to, and during harvest time, ensure very poor households are able to cover their basic and urgent needs, thus protecting their harvests, and avoiding having to sell at low rates.\(^5\)

- **Supplementary Feeding is an effective seasonal Social Protection Programme**: Nutritional supplementary feeding is another form of social protection that prevents and treats MAM among children under five as well as PLW. Food rations or specialised nutrition products are distributed to the targeted individuals with MAM or distributed on a blanket basis in specific contexts.\(^5\), \(^8\) Blanket supplementary feeding programmes are currently the standard intervention to prevent acute malnutrition in young children particularly where high MAM, food insecurity or high prevalence of chronic malnutrition and micronutrient deficiencies exist.\(^1\) Please see the CMAM Forum technical briefs: *Management of MAM: Current Knowledge and Practices* and *Preventing MAM through Nutrition-Specific Interventions* brief for more information.

- **Specialised foods or vouchers are better than cash**: Preliminary findings from one study suggest that the inclusion of a specialised nutritious product as part of the cash programme is more effective in addressing acute malnutrition than cash alone.\(^5\) In another study, although key findings indicated that cash sometimes allows for savings that help households smooth their food and non-food consumption, it highlighted that if the objective is to increase calories or dietary diversity, vouchers are the most cost-effective means of doing so, followed by cash, although food vouchers are the modality least preferred by beneficiaries.\(^5\)

- Several ongoing studies in Burkina Faso, Niger and other countries will provide further evidence about preventing acute malnutrition through cash only, cash and special foods or specialised food products only.\(^1\), \(^ii\) In addition, the ENN has implemented a study to look at the costs per nutritional outcome addressing MAM, including cash transfers, although the results are not yet available.\(^5\)

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\(^1\) Some of this research is ongoing, for example the MAM’Out (MAM’Out Project - Evaluation of Multiannual and Seasonal Cash Transfers to Prevent Acute Malnutrition) trial carried out by ACF in Burkina Faso aims to evaluate the effect of a seasonal and multi-annual cash transfer programme to prevent acute malnutrition in children under 24 months of age. (Source: Action Contre la Faim with collaborators: Centers for Disease Control and Prevention, Universiteit Gent and AgroParisTech, May 2013. Available at: http://clinicaltrials.gov/show/NCT01866124).

\(^ii\) The ENN is also carrying out a trial in Niger, to provide evidence on the effectiveness of unconditional cash transfers to prevent seasonal weight loss and acute malnutrition in an emergency context, to understand how the cash works in order to determine whether future programmes in a similar setting will also be effective, and to examine the cost efficiency of the intervention.
2.5 Dietary Quality and Diversity

Among poor communities, diets are often of poor quality and highly monotonous, preventing an adequate intake of micronutrients. Dietary diversity – defined as the number of different foods or food groups consumed over a given reference period – is a key indicator of a high-quality diet. Dietary diversity is a considerable factor influencing household food and nutrition security, as a lack of dietary diversity can lead to wasting and is significantly associated with morbidity. Wasting occurs more frequently in infants and young children as complementary foods are being introduced into their diets, and they are more susceptible to infectious diseases. Addressing both the quality and quantity of food including dietary diversity is necessary to prevent wasting over the longer-term. Diet quality can be improved through both agricultural food production and consumption of local, diverse, nutrient-dense foods. Agriculture has the potential to improve nutrition through the production of food for consumption, the selling of food for income and through changes of food prices or the quality of foods available. One of the strongest evidence-based agriculture-nutrition impact pathways is boosting household’s income through own food production to improve access to and consumption of quality foods to prevent food shortages. Diversification in agriculture and food systems can improve incomes while increasing the resilience of smallholder farmers.

Preventing MAM through food-based interventions requires measuring whether or not the targeted populations have access to a quality, diverse diet, not just food. Actual household food consumption is easily tracked by measurements of dietary diversity that can be measured many ways. Dietary diversity indicators can be powerful predictors of economics status and malnutrition (both stunting and wasting). Although dietary diversity scores (DDS) should not be used to detect wasting, they are good indicators of food deficits or poor utilisation of food that could lead to wasting. DDS’s to monitor the diversity of diets are used by the World Health Organisation (WHO), the United Nations Food and Agriculture Organisation (FAO) and the U.S. Government Feed the Future initiative. DDS capture detailed data on household food access and individual dietary intake including the number of food groups consumed over 24 hours. Some indices use minimum portions, while others are based on different time periods. The household dietary diversity score (HDDS) reflects the food access dimension of food security in terms of the number of different food groups consumed over a given reference period, and is useful since it reflects the economic ability of a household to access a variety of foods, diverse diet outcomes and improved nutritional status. Individual Dietary Diversity Score (IDDS) are often used as a proxy measure of the nutritional quality of an individual’s diet and as a measure for calorie and nutrient adequacy of the diet. The Women's Dietary Diversity Score (WDDS) is a simple food group diversity indicator that provides a proxy measure of the probability of micronutrient adequacy of women’s diets.

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1 Diet quality is when a diet provides adequate recommended levels of essential nutrients needed by the body in addition to energy and limited amount of saturated fat, added sugars, and sodium while ensuring consumption of balanced healthy fats.

2 For example, maternal wasting and fatigue resulting from increased maternal nutrient needs during pregnancy and lactation may limit their ability to supply infants’ with their diverse nutrient needs.

3 The World Health Assembly target is to reduce childhood wasting to less than 5% by 2025 and maintain it below that level.


5 A single 24-hour recall is usually adequate to quantify performance indicators of a program’s overall impact over time, when the indicators are calculated as group averages; that is, the average household dietary diversity of the target population.

6 12 food groups are used for the Household Dietary Diversity Score (HDDS); there is a 9 group variant for Women Dietary Diversity Scores (WDDS) and 7 food groups are used for Individual Dietary Diversity Score (IDDS) specifically for Infant and Young Child Feeding (IYCF). These are described in FANTA documents.

7 The U.S. Government Feed the Future initiative, the European Commission, and the World Bank use the Women’s Dietary Diversity Score.
2.6 Quality Agriculture Food Production and Practices
Sustainable food and nutrition security involves improving the quality and quantity of food through dietary diversity, improved agricultural practices and post-harvest handling management, among other things. Many variables affect the quality and quantity of food production, including: changes in agricultural production, food processing, types of crops, the amount of time spent in agriculture, and the allocation of resources within the household. Poor agricultural practices can increase the duration and severity of the hunger gap, reducing food stocks, increasing food insecurity that can lead to wasting. Sustainable agricultural practices can increase the production of food crops and/or livestock, improve the quality of food, and make nutritious food more accessible. The management of agriculture inputs such as natural resources (crops, land, soil, seeds and water) to improve agricultural productivity can increase resilience to shocks while adapting to climate change. Actions that optimise harvest, post-harvest handling, food storage and processing can help prevent wasting, although more evidence on impact is needed. Post-harvest handling management includes food post-harvest handling, processing and storage procedures that are critical to maintain food safety and quality. Improving post-harvest handling management not only increases food security (food access) but it can also reduce mycotoxin levels and exposure to other food contamination in the environment such as EED, which can affect diet quality, quantity, and diversity. Surpluses at the end of a growing season can be used to increase year-round nutrient intake. This type of intervention is particularly important during times of seasonal food insecurity and high prevalence of MAM. Preventing food losses and waste due to spillage and degradation during handling, storage and transportation between farm and distribution can also increase food security and prevent wasting.

3 Women’s Empowerment & Gender Equality
Addressing malnutrition requires mainstreaming gender issues throughout programming in agriculture, nutrition and health. Integrating women’s empowerment and gender equality is cross-cutting throughout all nutrition-sensitive and nutrition-specific interventions and should be central to the implementation of agricultural interventions aiming to improve nutritional status. Women’s empowerment has been linked to over 50% of reductions in all child stunting between 1970-1995. Recent evidence demonstrates that the condition of women and household wealth are related to both stunting and wasting. Women play a central role across cultures as both caregivers and providers, with responsibility for childcare and the management of household food supplies, affecting dietary choices and influencing household health. Changes in a woman’s time allocation can have adverse effects on maternal and child health and nutritional status. When a woman’s work-related energy expenditure exceeds their nutrient intakes through an increase in workload, dietary diversity and the nutritional and health status of their household can be compromised. This is particularly true during the harvest season when women have a double burden of increased agricultural workloads on the farm in addition to existing household responsibilities. This can have a negative impact on a woman’s ability to provide adequate caring and feeding practices for their young children, which can compromise the nutritional status of both the woman and her children. There is a need to identify appropriate interventions which can protect a woman’s ability to maintain care for her children or prioritise childcare during

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i Improved agricultural practices include: aquaculture, agroforestry, intercropping, cover crops, composting, livestock & poultry breeding, and small-scale fisheries to name a few.

ii Value-added food processing, preservation and storage can preserve and maintain nutrients and increase access to the consumption of nutritious foods.

iii Affected populations can learn about home food processing to preserve and maintain nutrients for their own consumption by transforming their unprocessed own produce or market-purchased foods into longer shelf-life food products, and includes: canning, crushing, drying, and milling foods. This will help improve their yields and storage of quality, diverse foods to promote resiliency to future shocks and stresses.
periods of increased workloads, in order to prevent wasting. Protecting childcare and feeding practices during specific periods when women have greater demands on their time could have a direct impact on acute nutritional status. Interventions should also be considered which improve women’s access to time and labour-saving technologies, equipment, practices and management techniques, which can increase, and protect, nutrient content and dietary diversity while increasing yields and overall incomes. Increasing women’s access to income can also improve the allocation of household resources and the feeding and care of young children.

4 Preventing Malnutrition through Water, Sanitation and Hygiene Interventions

WASH practices are linked to overall health and nutritional status. Improving WASH practices also protects children against communicable diseases such as measles. A poor health environment with inadequate access to clean water and unsafe sanitation and hygiene practices increases the risk of enteric diseases that indirectly cause acute malnutrition. The combination of access to a safe water supply, correct and consistent use of a hygienic sanitation facility and hand washing with soap at critical moments reduces the incidence of infant diarrhoea and may prevent the onset of environmental enteric dysfunction (EED) and are therefore directly associated with the prevention of moderate acute malnutrition. EED is a subclinical condition, characterised by chronic inflammation of the gut (abnormal gut function) hypothesised to be caused by an overload of the small intestines with faecal bacteria. Improving WASH practices is necessary to reduce diarrhoea in infants, allowing children to better digest food, absorb more nutrients, and lead healthier lives. Figure 5 depicts various WASH-nutrition causal impact pathways that will be discussed in detail in the following sections.

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1 ACF, EC, FAO, IYCN, Save the Children UK, WB

2 These technologies were adapted from the U.S. Government Feed the Future definitions in the Feed the Future Indicator Handbook. Definition Sheets as well as the Synthesis of Guiding Principles on Agriculture Programming for Nutrition.

3 These technologies were adapted from the U.S. Government Feed the Future definitions in the Feed the Future Indicator Handbook. Definition Sheets as well as the Synthesis of Guiding Principles on Agriculture Programming for Nutrition.

4 Critical moments include: 1. Before cooking and preparing weaning foods: 2. After using the toilet or safely disposing of children’s faeces. 3. Before eating or before feeding an infant.

5 See section below
4.1 Management of Diarrhoea

Diarrhoea is one of the most direct and well-studied pathways that link poor water, sanitation and hygiene to nutrition.\(^8^1\) Diarrhoea prevents children from achieving normal growth, as it can be both a cause and consequence of malnutrition. Acutely malnourished children can suffer more frequent and longer episodes of diarrhoea, reducing the body’s ability to fight infections as a vicious cycle of intestinal diseases contribute to acute malnutrition through decreased nutrient absorption.\(^8^1^\text{-}^8^4\) Repeated diarrheal episodes and short periods of acute malnutrition (i.e. infection phases) reduce children’s height and weight gains and prevent children from “catching-up” on their growth leading, to growth faltering and ultimately, stunting.\(^8^5\) In several studies, 5-20 percent of linear growth deficit (stunting) was attributable to diarrhoea.\(^8^6\) Conversely, acutely malnourished children without diarrheal infections quickly improve their nutritional status.\(^8^6\) Poor environmental conditions, lack of availability of safe, accessible drinking water, poor hygiene and sanitation practices (such as lack of hand washing with soap) are the principal causes of diarrhoea among children under five years of age that need to be addressed to prevent diarrhoea.\(^8^7^\text{-}^8^8\) Repeated diarrheal episodes often result in reduced food intake from a poor appetite or from the caregiver withholding food during the illness. Therefore, promoting responsive feeding can mitigate repeated episodes of diarrhoea, especially when the child is sick, ensuring that the mother does not stop breastfeeding during diarrhoea. Responsive feeding stimulates
the appetite through active feeding and positive child development. Diarrhoea should be treated using the WHO and UNICEF recommended therapeutic zinc treatment with oral rehydration therapy (ORT) and simple actions such as promotion of home-based diarrhoea management. 89, i

4.2 Environmental Enteric Dysfunction (EED)
Recent evidence suggests that the primary causal pathway from poor sanitation and hygiene to stunting is not diarrhoea as long believed, rather a sub-clinical condition known as environmental enteric dysfunction. 90 EED is characterized by the inflammation of the gut causing a loss of villous surface area, possibly associated with the presence of abnormal gut bacteria (microbes), which prevent proper absorption of nutrients. 92 Research indicates that EED is a major, if not primary, cause of child stunting; one study suggesting that EED may account for up to 40 percent of stunting throughout the developing world. 92 Another study concludes that “the failure of nutritional interventions in the developing world may be attributed to environmental enteropathy.” 91 Although the exact cause of EED is not clearly understood, evidence suggests that it results from repeated infant exposure to poor environmental health conditions, resulting in constant contact with, and ingestion of, faecal bacteria, including from chickens and other livestock. 90, 92 Over time, this constant exposure to faecal contamination and chronic immune stimulation caused by toxins and microbes decreases the intestines’ ability to absorb essential nutrients and creates a “leaky gut.” Reduced intestinal absorptive capacity, reduced barrier function and diversion of energy and nutrients from growth due to gut inflammation and subsequent immune stimulation, leads to malnutrition. 93 Please see the CMAM Forum Technical Brief “Environmental Enteric Dysfunction –an Overview, August 2014.”

Evidence demonstrates that poor conditions of WASH along with a poor diet are underlying causes of acute malnutrition and have been associated with reduced linear growth (stunting). 94 Recent findings reveal that therapeutic food alone is insufficient to achieve a sustained improvement in the absorption of nutrients, a condition necessary to achieve improved nutritional status and to prevent MAM in the long-term. 95 Although many acutely malnourished children gain weight when they are treated with therapeutic food, they remain at high risk for malnutrition and stunted growth due the chronic effects of EED and repeated diarrhoea. 95 A research study carried out by the Food and Nutrition Technical Assistance project (FANTA) /Washington University of St. Louis demonstrated that more than 30% of children in Malawi who recovered from MAM after treatment with therapeutic foods either relapsed or died within the following 12-months. 96 This suggests underlying causes such as environmental sanitation and hygiene need to be addressed to ensure successful management of MAM; otherwise individuals will still remain vulnerable.

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i  Main messages: 1. The OraselKIT® is an effective treatment for uncomplicated diarrhea in children; 2. The kit contains two sachets of ORS and 10 tablets of zinc; 3. Mix the ORS with boiled water and give ORS several times daily; 4. Mix one zinc tablet in a spoon with boiled water or breast milk and give once a day for the full 10 days; and ORS replaces liquids lost in diarrhea while zinc improves recovery and strength and helps prevent future diarrhea.

ii Environmental enteric dysfunction is also known as environmental enteropathy, and formerly known as tropical enteropathy.


iv Abnormal gut bacteria or microbes.

v Jan. 30, 2013 — A study of young twins in Malawi, in sub-Saharan Africa, found that bacteria living in the intestine are an underlying cause of a form of severe acute childhood malnutrition. The research, led by Washington University School of Medicine in St. Louis and reported Feb. 1 in the journal Science, shows how dysfunctional communities of gut microbes conspire with a poor diet to trigger malnutrition.
Figure 6 demonstrates the pathways of the environmental-related faecal-oral transmission of bacteria and other pathogens to an individual through poor sanitation, water supply and hygiene practices and how sanitation, clean water supply and hygiene practices can prevent oral-faecal transmission. This diagram is also known as the ‘F’ diagram (the Faecal-Oral Transmission Diagram), because the main faecal-oral transmission pathways begin with the letter “F”: faeces, fluid (water), fingers, flies, field/floors, food and face (mouth). The F diagram provides the conceptual framework to demonstrate the pathways by which faeces (both human and animal) transmit to individuals as well as the barriers to these pathways resulting from nutrition-sensitive WASH interventions—improved sanitation, clean water supply and hygiene.

**Figure 6: The Faecal-Oral Transmission Diagram (F-Diagram)**

Integrated nutrition-WASH interventions need to address both the hygienic conditions of the physical environment and personal hygiene behaviours’ and practices.

Both diarrhoea and EED are largely avoidable by preventing infants and young children from ingesting human and animal faeces through a combination of interventions that improve community and household sanitation and hygiene practices:

- **Promote improved hygiene behaviours and practices**: especially hand washing with soap at critical moments, safe faeces disposal (both animal and human faeces) for adults and infants and young children, and hygienic food preparation, handling, storage and food safety.

- **Promote a clean and sanitary physical environment for infants and young children**: Promote clean, safe and protective play and feeding spaces and sanitary physical environments for infants and young children. Ensure that the environment where children play and eat is free from contamination by human and animal faeces and animals in an enclosed structure to prevent contamination of the environment with animal faeces.
• **Improve Quality, Distance and Source of Drinking Water:** increasing access to an improved water source (protected wells or boreholes, piped water supply, rainwater harvesting systems) at a reasonable distance from the household for drinking and hand washing; promotion of, safe water storage, treatment of drinking water using at point of use (POU) and water treatment technologies (chlorination, ceramic water filters, boiling, solar disinfection).

• **Improve Sanitation Facilities:** including expanding household access and the correct and sustained use of an improved sanitation facility that separates human excreta from human contact.\

• **Reduce and ultimately Eliminate Open Defecation:** one possible approach is through community-led total sanitation (CLTS).

### 4.3 Promote Improved Hygiene Behaviours and Practices

Good hand washing practices with soap (including use of clean water, a washing agent such as soap and a drying phase) reduces disease transmission and is the most cost effective health intervention to prevent diarrhoea and associated undernutrition. Hands should be washed regularly with soap in clean water at all critical times, which include: preparing and eating food, feeding children, after going to the toilet or changing a baby and after handling raw food, food waste or chemicals. Currently, hand-washing interventions usually focus on mothers and other caregivers. Guidance needs to be updated to include washing infants’ hands since they often put their hands into their mouths. Furthermore, hygiene practices for food preparation and storage are also important in preventing faecal-oral transmission, and guidance should include how to properly wash and prepare vegetables without depleting their nutrients, how to store food safely, and how to maintain a clean home environment.

### 4.4 Clean and Sanitary Physical Environment

In most developing countries, the contamination of the domestic physical environment with animal and human faeces in poor households is pervasive. Both human and animal feet track the faeces into the domestic environment and the immediate play and feeding areas of infants and young, where children often play and crawl on the contaminated soil and surfaces and pick up objects from the ground. Faecal contamination of the children’s play and feeding environment is a constant health risk during the critical window of a child’s growth and development. Existing WASH interventions are generally not adequately designed to prevent faecal-oral transmission of bacteria and other pathogens for children. To prevent MAM in early childhood, future WASH interventions need to continue to focus on addressing EED by preventing the contamination of the field (soil) and foods with faeces. This requires assessing the physical environment, including the consideration of risk of young children coming into contact with faecal matter within their play and feeding environments. Dedicating clean play spaces would ideally allow for active play while at the same time greatly reducing children’s risk of exposure to faecal pathogens that can cause morbidity and stunted growth.

### 4.5 Improve Quality, Distance and Source of Drinking Water

Global evidence from 140 demographic health surveys (DHS) demonstrates a strong linkage between access to safe drinking water (and sanitation) and children’s health and nutrition outcomes.

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i An improved sanitation facility is defined as one that hygienically separates human excreta from human contact. The WHO/UNICEF Joint Monitoring Programme (JMP) classifies the following as ‘improved’ sanitation that is more likely to be hygienic: a connection to a sewerage system, septic tanks, pour-flush toilets, ventilated improved pit latrines and pit latrines with a concrete slab. Source: WHO and UNICEF definitions of improved drinking-water source on the JMP website, WHO, Geneva and UNICEF, New York.

ii Hygienic practices for food preparation and storage also include separating cooked food from raw food to reduce the risk of cross-contamination. The food should also be protected from other sources of contamination such as soil, insects, rodents and other animals.
the distance from, and the quality of, the household’s drinking water source are important factors affecting reduction in diarrhoea prevalence and improved nutritional status. Although communities may have access to water, the available quantity and quality may be insufficient to meet basic needs. Access to improved drinking water sources that are less than one kilometre away has been demonstrated to result in better hygiene, including increased hand washing. This is especially true when households have access to an improved water source on the premises of their homes. Recent evidence from Tanzania demonstrates that the distance to a water source uniquely predicts being underweight. However, more evidence is needed to look into the prevalence of wasting and the distance between household and water source. Recent evidence from Iraq demonstrates that the source of drinking water affects nutritional status and the chances of developing acute malnutrition. Another study from Niger concluded that efforts to prevent acute malnutrition should include improving the community water supply sources. Point-of-use household-level water treatments (chlorination, ceramic water filters, boiling, solar disinfection) are immediate solutions to promote safer drinking water in households using unprotected sources (mainly surface water), though graduation to more sustainable community water sources is recommended. Finally, safe storage of drinking water in the home is important. In Tanzania, enteric pathogens were found in stored drinking water and on caregivers’ hands.

4.6 Improved Sanitation Facilities

Improving access to sanitation facilities improves the health of families and communities. Many studies have looked at the impact of improved sanitation on diarrhoeal incidence, including a recent Cochrane review. Evidence demonstrates that lack of access to improved sanitation facilities, especially latrines, leads to contaminated drinking water and leaves communities and individuals vulnerable to infections and diseases including diarrhoea, repeated periods of acute malnutrition and mortality. Evidence also suggests that poor environmental sanitation retards growth and affects the mother–child behaviour patterns that are critical to better development. Improved access to and correct use of an improved sanitary facility such as a latrine has been found to decrease diarrheal deaths by up to 30%. The World Health Organisation and United Nations Children's Fund Joint Monitoring Programme for Water Supply and Sanitation (JMP) has set global criteria, standards and definitions for levels of improved sanitation (see Table 3). There is strong evidence to support the view that sustainable coverage of improved sanitation reduces exposure to faecal pathogens and stops most of the faecal–oral transmission infections by limiting ground and water contamination by human faeces. Additionally, a positive relationship has been identified between improved sanitation infrastructure and early childhood health outcomes. Recent evidence demonstrates that individual health benefits from the use of sanitation facilities is realised only after a high level of sanitation coverage is achieved for the community as a whole.

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1 Basic access (between 100 and 1,000 meters or 5 to 30 minutes total collection time) or intermediate access (water delivered through one tap on plot – or within 100 m or 5 minutes total collection time).
Table 3: Levels of Improved Sanitation

<table>
<thead>
<tr>
<th>Level</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Open Defecation</td>
<td><strong>Open Defecation</strong>: Defecation in Fields, forests, bushes, bodies of water or other open spaces, or disposal of human faeces with solid waste.</td>
</tr>
<tr>
<td>Unimproved</td>
<td><strong>Unimproved Sanitation Facilities</strong>: Facilities that do not ensure hygienic separation of human excreta from human contact. Unimproved facilities include pit latrines without a slab or platform, hanging latrines and bucket latrines.</td>
</tr>
<tr>
<td>Shared</td>
<td><strong>Shared Sanitation Facilities</strong>: Shared Sanitation facilities of another acceptable type shared between two or more households. Shared facilities include public toilets</td>
</tr>
<tr>
<td>Improved</td>
<td><strong>An improved sanitation facility includes</strong>:</td>
</tr>
<tr>
<td></td>
<td>• A <strong>flush toilet</strong> uses a cistern or holding tank for flushing water, and a water seal (which is a U-shaped pipe below the seat or squatting pan) that prevents the passage of flies and odours. A pour flush toilet uses a water seal, but unlike a flush toilet, a pour flush toilet uses water poured by hand for flushing (no cistern is used).</td>
</tr>
<tr>
<td></td>
<td>• A <strong>piped sewer system</strong> is a system of sewer pipes, also called sewerage, that is designed to collect human excreta (faeces and urine) and wastewater and remove them from the household environment. Sewerage systems consist of facilities for collection, pumping, treating and disposing of human excreta and wastewater.</td>
</tr>
<tr>
<td></td>
<td>• A <strong>septic tank</strong> is an excreta collection device consisting of a water-tight settling tank which is normally located underground, away from the house or toilet. The treated effluent of a septic tank usually seeps into the ground through a leaching pit. It can also be discharged into a sewerage system.</td>
</tr>
<tr>
<td></td>
<td>• A <strong>flush/pour flush</strong> to pit latrine refers to a system that flushes excreta to a hole in the ground or leaching pit (protected, covered).</td>
</tr>
<tr>
<td></td>
<td>• A <strong>vented improved pit latrine</strong> (VIP) is a dry pit latrine ventilated by a pipe that extends above the latrine roof. The open end of the vent pipe is covered with gauze mesh or fly-proof netting and the inside of the superstructure is kept dark.</td>
</tr>
<tr>
<td></td>
<td>• A <strong>pit latrine</strong> with slab is a dry pit latrine that uses a hole in the ground to collect the excreta and a squatting slab or platform that is firmly supported on all sides, easy to clean and raised above the surrounding ground level to prevent surface water from entering the pit. The platform has a squatting hole, or is fitted with a seat.</td>
</tr>
<tr>
<td></td>
<td>• A <strong>composting toilet</strong> is a dry toilet into which carbon-rich material are added to the excreta and special conditions maintained to produce inoffensive compost. A composting latrine may or may not have a urine separation device.</td>
</tr>
</tbody>
</table>


4.7 Reduction and Elimination of Open Defecation

There is growing evidence that open defecation and ingestion of faeces causes diarrhoea, and that exposing infants to unsafe or contaminated drinking water, even in small amounts, nearly doubles their risk of diarrhoea.\textsuperscript{121} Evidence demonstrates positive health benefits for children living in households that have stopped defecating in the open including, effectively breaking down the faecal-oral transmission cycle of disease, thereby improving health. Spears’ work (2013) demonstrates that open defecation rates are an important predictor of height in developing countries, revealing the direct benefits of eliminating open defecation.\textsuperscript{114, 122, 1} Moreover, encouraging use of latrines and reducing or eliminating open defecation has been found to be more effective in curbing the rate of child diarrhoea than improving the water supply alone.\textsuperscript{114} The CLTS behaviour change approach mobilises communities to completely eliminate open defecation. This approach facilitates communities to conduct

\textsuperscript{1} Including both households that moved to a fixed-point defecation or to improved sanitation.
their own assessment and analysis of defecation practices in their community, in turn stimulating action to become ‘open defecation free’. The primary barrier to faecal-oral transmission is the safe disposal of all faeces, including children’s faeces, in latrines or other appropriate places, preventing faeces from entering the domestic environment, and hand-washing with soap after faecal contact. To date, safe disposal of children’s stools has received relatively little attention in sanitation programmes. This area remains a knowledge gap for both academics and practitioners.81

5 Preventing Moderate Acute Malnutrition through Optimising Early Childhood Development and Positive Caregiving

Combined ECD and nutrition interventions show promising synergistic effects on child development—and in some cases nutrition, but more evidence is needed to test these programmes at scale.90 Child development refers to the “ordered emergence of interdependent skills of motor, cognitive language, and social-emotional functioning.”124 ECD is the term used to describe a variety of interventions provided to children under eight years of age and their families that ultimately aims to promote children’s holistic development including the physical and mental skills they will use for the rest of their lives.4 Evidence demonstrates a high return rate for the investment in ECD for both governments and families.125 Childhood is the period where growth and psychosocial development are supported by food intake, and poor nutrition in early life can impair a child’s ability to learn and, consequently, to earn a living.126 Growth failure in early life, from both acute malnutrition and stunting has profound adverse consequences over the life course on human, social, and economic capital.127

Children face specific vulnerabilities that differ from those of adults or which can have more serious consequences, such as increased vulnerability to malnutrition, disease and abuse.126 There are a few emerging areas within ECD interventions that demonstrate promising results in improving nutritional status, including a focus on WASH and EED and positive caregiving practices. Addressing ECD to prevent MAM requires addressing both the caregivers’ behaviour and the child’s interaction with the environment, potentially decreasing the risk of EED and improving caregiving. These programmatic approaches for nutrition and ECD are well-developed.129 Recent evidence suggests, “malnutrition may be the major mediator on the causal pathway between unhygienic environments and child development.”26 However, in the two recent Lancet Child Development series there is notably no reference to any potential effect of hygienic and sanitary conditions of the physical environment on child development.130, 131

5.1 Positive Care and Feeding Practices

The Lancet Child Development series identifies inadequate cognitive stimulation, stunting, iodine deficiency, and iron-deficiency anaemia as key risks that prevent children from achieving their developmental potential.130, 131 Positive caregiving is one of the most important factors in healthy psychological development, contributing to a child’s resilience and ability to “bounce back” during times of crisis, and in determining success later in life.133 Child development through positive caregiving can be measured through key developmental milestones including: movement - hand and finger skills; language -cognitive and social/emotional development. This requires a focus on improving caregiver practices at the maternal, household and community levels. Many MAM rehabilitation facilities not only allow, but also require the mother to stay with the child for educational purposes and to improve

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1 Unsurprisingly, children who live in households that dispose of faeces safely are taller, on average, than children who do not.

ii Early Childhood Development is also sometimes referred to as: Early Childhood Care and Development (ECCD) and Early Childhood Care and Education (ECCE).
caring practices. Part of the rehabilitation should focus not just on feeding, but on the responsive nature of feeding and working with the mother or caregiver to engage with infants and young children while they are eating. Positive care and feeding practices can improve child stimulation and have synergistic effects, in improving nutrition and development outcomes.

Mothers or caregivers can be counselled on positive caregiving through ‘timed and targeted nutrition counselling’\(^1\) and providing information both to those who practice the recommended behaviours and those who influence adoption of behaviours (e.g. fathers, grandmothers). Nutrition education and behaviour change communication (BCC) should be incorporated into all nutrition-sensitive and nutrition-specific interventions, targeting PLW and children under 2 years.\(^{134-136}\) Please see the CMAM Forum Technical Brief: *Management of Moderate Acute Malnutrition (MAM): Current Knowledge and Practices* for more information.

6  
**Surveillance, Monitoring and Evaluation**

6.1  
**Surveillance**

Stakeholders can easily identify the progress or deterioration of a given nutrition situation, through surveillance of the monthly admissions to services for acute malnutrition, although data on nutritional risk factors, and impact of interventions on nutritional status are more difficult to obtain. Concerted efforts and investment are needed in order to develop quality monitoring and *early warning systems (EWS)* to provide real-time information and measure/track the performance of key impact and outcome indicators, which can in turn be used to inform interventions in different sectors, including agriculture, food security and social welfare systems. Strategies include:

- **Early Detection**: Promotion of the early detection and diagnosis of cases of MAM can reduce the numbers that deteriorate into a severe condition. Measuring wasting enables health and nutrition workers rapidly to assess whether a child is malnourished and to assess the overall nutrition situation of a community. The proportion of wasted children in an area may vary by the season, due to annual periods of food insecurity or seasonal illness.

- **Early Warning Systems**: The set-up of EWS to monitor and detect “hot spots” and/or outbreaks of especially critical, time-sensitive MAM problems for rapid, real-time decision-making. Routine, seasonal analysis of nutrition and nutrition-sensitive indicators (see table 11 for indicators) can help inform early action.\(^{38}\)

- **Promote Early Response and Action**: Ensure that early response and action is prompted through EWS, especially when levels of Global Acute Malnutrition (GAM) and wasting reach their peak (see tables 9 and 10 for thresholds). Early responses to crises are more cost effective than responding after crises and early responses promotes longer-term resilience. Policy makers and managers need to ensure that they trigger early action where famine EWS are in place.

6.2  
**Indicators**

For monitoring the performance of programmes to tackle MAM in any context, Sphere indicators are still the main markers used for recovery, default, death and coverage. The following indicators are nutrition-sensitive indicators that can be used to both monitor the MAM situation in relation to MAM prevalence, to prevent MAM and to measure programme impact.

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\(^1\) ‘Timed and targeted nutrition counseling’ was promoted by World Vision in an ‘operations research’ project with Alive and Thrive in Ethiopia. Timed and targeted counseling involves delivering health messages when behaviors can best be put into practice (timed counseling) and targeting messages to those who practice the behaviors and those who influence behaviors, e.g., women with newborns and their mother-in-laws are given information about breastfeeding and mothers and fathers of 6-month-old babies are given information on complementary feeding.
6.2.1 Impact Indicators

The nutritional status of a population is one of the basic indicators, together with mortality rates, to assess the severity of malnutrition. Both acute and chronic malnutrition are generally recorded for children under 5 years of age, however others find underweight and wasting to be better predictors of mortality than stunting. One of the major challenges is the fact that ongoing growth monitoring through nutrition programmes - and therefore most of the studies related to malnutrition in children under five years of age - use WFA. WFA measures underweight, and does not distinguish between MAM and stunting. In addition, since MAM is often associated with emergency contexts it is often not measured in development settings. Both wasting and stunting require regular nutritional screening, monitoring and tracking to plan appropriate targeted nutrition interventions. Both the common measurements of wasting or weight-for-height (WFH) for children and Body Mass Index (BMI) for lactating women can measure nutritional impact of programmes through the reduction of MAM. Changes in wasting prevalence are rapid to observe and can be captured within a small time period (e.g. less than one year). The mid-upper arm circumference (MUAC) can be used for rapid screening for children 6-59 months of age for admittance into a therapeutic feeding programme and is recommended by WHO, followed up by measurement of Weight for height Z-Score (WHZ).

Frequent screening of nutritional status through MUAC and measurement of nutritional status through WHZ is needed to capture relatively short-term impacts of malnutrition and is a critical impact indicator for moderate acute malnutrition (see Table 4 for standardized acute malnutrition thresholds). While prevalence of wasting responds to fluctuating environmental factors or seasonality there is limited evidence of sudden and acute starvation. Wasting is a key trigger for action and should be used during seasonal analysis to inform existing EWS. Furthermore, there is a need to address the high rates of defaulting from MAM management programmes. This is partly because some of the SAM cases come from districts that have not initiated CMAM, making follow-up difficult once clients go back to their districts of origin.

<table>
<thead>
<tr>
<th>Phase 1 Minimal</th>
<th>Phase 2 Stressed</th>
<th>Phase 3 Crisis</th>
<th>Phase 4 Emergency</th>
<th>Phase 3 Famine</th>
</tr>
</thead>
<tbody>
<tr>
<td>More than four in five households are able to meet essential food and non-food needs without engaging in atypical, unsustainable strategies to access food and income, including any reliance on humanitarian assistance</td>
<td>Even with any humanitarian assistance at least one in five HH in the area have the following or worse: Minimally adequate food consumption but are unable to afford some essential non-food expenditures without engaging in irreversible coping strategies.</td>
<td>Even with any humanitarian assistance at least one in five HH in the area have the following or worse: Food consumption gaps with high or above usual acute malnutrition OR Are marginally able to meet minimum food needs only with accelerated depletion of livelihood assets that will lead to food consumption gaps.</td>
<td>Even with any humanitarian assistance at least one in five HH in the area have the following or worse: Large food consumption gaps resulting in very high acute malnutrition and excess mortality OR Extreme loss of livelihood assets that will lead to food consumption gaps in the short term.</td>
<td>Even with any humanitarian assistance at least one in five HH in the area have an extreme lack of food and other basic needs where starvation, death, and destitution are evident. (Evidence for all three criteria of food consumption, wasting, and CDR is required to classify Famine.)</td>
</tr>
</tbody>
</table>
The GAM rate is the most important impact indicator to gather information about pre-crisis vulnerability or historical prevalence information of affected populations. However, it should be remembered that GAM is a late indicator of crisis, and the frequency of reporting is a challenge. For the decision-making process, GAM prevalence is considered critical and above the seasonal norm threshold when prevalence is above 15%, serious when between 10-14%, poor when between 5-9% and acceptable below 5% (see Table 5). GAM can be measured through anthropometric measurements from household surveys such as DHS or Multiple Indicator Cluster Surveys (MICS), clinic measurements, admissions, and anthropometric surveys. Trend analysis, including an understanding of seasonality of GAM in the emergency affected population, is also critical in classifying the GAM prevalence.

<table>
<thead>
<tr>
<th>Nutritional Status</th>
<th>Acute Malnutrition:</th>
<th>Acute Malnutrition:</th>
<th>Acute Malnutrition:</th>
<th>Acute Malnutrition:</th>
<th>Acute Malnutrition:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>&lt;5% BMI &lt;18.5</td>
<td>5–10% BMI &lt;18.5</td>
<td>10–15% OR &gt; usual and increasing BMI &lt;18.5</td>
<td>15–30% OR &gt; usual and increasing BMI &lt;18.5</td>
<td>&gt;30% BMI &lt;18.5</td>
</tr>
<tr>
<td></td>
<td>Prevalence: &lt;10%</td>
<td>10–20%</td>
<td>20–40%, 1.5 x greater than reference</td>
<td>20–40%, 1.5 x greater than reference</td>
<td>far&gt; 40%</td>
</tr>
</tbody>
</table>


### 6.2.2 Outcome Indicators

Measuring dietary diversity can help predict wasting and stunting and is a proxy for quality of diet. Improved access to diverse and quality foods can be measured through the minimum acceptable diet. A few measures are suggested for assessing stages of crisis and experiences of household food insecurity in relation to acute malnutrition. The Household Food Insecurity Access Scale (HFIAS) measures the level of household food access and detects changes in the food insecurity situation of a population over time from the FANTA project and the Household Hunger Scale (HHS) measures hunger at the household level while the Integrated Food Security Phase Classification (IPC) tool can be used to assess acute malnutrition and the level of crisis in order to plan an appropriate response.

In order to assess the practices and caring capacity of caregivers, the following indicators can be used: infant and young child feeding (IYCF) practices, including exclusive breastfeeding and complementary foods, and child development growth and motor milestones, which can easily be assessed by parents and paraprofessionals at an early age to identify gross-motor milestones. Indicators for WASH interventions are outlined in Section 4 above are proxy indicators only and do not directly measure impact on nutritional status, although monitoring coverage of a package of WASH interventions can help to give an idea of their likely role in, and impact on, the GAM rate. Table 6 below highlights a number of indicators for monitoring progress and impact of multi-sectorial nutrition-sensitive interventions on preventing undernutrition.
<table>
<thead>
<tr>
<th>Indicator Name</th>
<th>Indicator</th>
<th>Data Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>Impact Indicators</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Global Acute Malnutrition</strong></td>
<td><strong>Percentage (%) change in GAM rate</strong>&lt;sup&gt;1&lt;/sup&gt;</td>
<td>DHS, MICS and other household or national surveys.</td>
</tr>
<tr>
<td>Wasting</td>
<td><strong>Percentage (%) change in prevalence of wasted children under 5 years of age; Prevalence of low weight-for-height (wasting).</strong> Percentage (%) of children 0-59 months moderately malnourished.</td>
<td>DHS</td>
</tr>
<tr>
<td>Agriculture and Food Security</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Share of calories from non-staple foods (%)</td>
<td>A simple dietary diversity indicator that is well correlated with stunting, wasting and low Body Mass Index. Can be calculated from FAO food balance sheets, with staple foods consisting of cereals and root crops, or from other, more disaggregated data sources.&lt;sup&gt;141&lt;/sup&gt;</td>
<td></td>
</tr>
<tr>
<td>Minimum Acceptable Diet (MAD)</td>
<td><strong>Dietary Diversity: Percentage (%) of children 6-23 months of age receiving a minimum acceptable diet (measures improved access to diverse and quality foods).</strong></td>
<td>DHS, MICS and other national surveys.</td>
</tr>
<tr>
<td>Diversity</td>
<td><strong>Dietary Diversity: Minimum Dietary Diversity for children 6-23 months: Proportion of children 6–23 months of age who receive foods from 4 or more food groups.</strong></td>
<td>DHS, MICS and other national surveys.</td>
</tr>
<tr>
<td>Minimum Meal Frequency</td>
<td><strong>Percentage of children aged 6-23 months who received solid, semi-solid, or soft foods (and milk feeds for non-breastfeeding children) the minimum number of times or more during the previous day, according to breastfeeding status</strong></td>
<td>DHS, MICS and other national surveys.</td>
</tr>
<tr>
<td>Household or Individual Dietary Diversity Score (IDDS/HDDS)</td>
<td><strong>Dietary diversity is the sum of the number of different foods or food groups consumed by an individual or household over a specific time period. This indicator is a proxy for quality of diet and is highly correlated with adequate caloric and protein intake, quality of protein consumption, and household income.&lt;sup&gt;140&lt;/sup&gt;</strong></td>
<td>Dietary Diversity: Household or Individual Dietary Diversity Score</td>
</tr>
<tr>
<td>Household Food Insecurity Access Scale (HFIAS)</td>
<td><strong>Prevalence of household food insecurity (access component)</strong></td>
<td>Household Food Insecurity Access Scale</td>
</tr>
<tr>
<td>Early Childhood Development and Care Capacity &amp; Practices</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Child Development Growth &amp; Motor milestones</td>
<td><strong>Child development motor milestones in young children can easily be assessed by parents and paraprofessionals at an early age to identify gross-motor milestones.&lt;sup&gt;142&lt;/sup&gt;</strong></td>
<td>WHO</td>
</tr>
</tbody>
</table>

<sup>1</sup> In an emergency situation, the weight and height of children between 6 and 59 months are measured and the results are used as a proxy indicator for the general health of the entire population.
| **Attendance in early childhood education** | Percentage of children 36–59 months old that are attending an early childhood education programme. | MICS, DHS and other national surveys |
| **Learning materials at home: playthings** | Percentage of children 0–59 months old with two or more of the following playthings at home: household objects or objects found outside (sticks, rocks, animals, shells, leaves etc.), homemade toys or toys that came from a store. | DHS, MICS and other national surveys |
| **Learning materials at home: children’s books** | Percentage of children 0–59 months old that have three or more children's books at home. | DHS, MICS and other national surveys |
| **Children left in inadequate care** | Percentage of children 0–59 months old left alone or in the care of another child younger than 10 years of age for more than one hour at least once in the past week. | DHS, MICS and other national surveys |
| **Exclusive Breastfeeding** | Percentage (%) change in prevalence of exclusive breastfeeding under 0–5 months of age increased in target regions. | DHS, MICS and other national surveys |
| **Complementary Foods** | Introduction of Complementary Foods (timing, type of foods, amount). | DHS, MICS and other national surveys |
| **Infant and Young Child Feeding Practices** | Percentage (%) change in prevalence of appropriate infant and young child feeding practices for children under 2 (Children 6–23 months). | DHS, MICS and other national surveys |
| **Water, Sanitation and Hygiene (WASH)** | | |
| **Improved Drinking-Water Source & Quality** | Number of household members using improved sources of drinking water. Percentage (%) of households with access to improved drinking water source/systems. | DHS, Drinking-Water and Sanitation for Household surveys, other national surveys |
| **Access to Water** | Proportion of households using <15 litres/person/day (%) Percentage (%) of households using an improved water source less than 30 min round trip from their home. | DHS, Drinking-Water and Sanitation for Household surveys, other national surveys |
| **Improved Sanitation Facilities** | Number of household members using improved sanitation facilities. | DHS, Drinking-Water and Sanitation for Household surveys, other national surveys |
| **Hand Washing** | Percentage (%) of households with soap and water at a hand washing station commonly used by family members. Number (#) of households with reported access to both soap and water at a hand-washing station commonly used by family members. | DHS, Drinking-Water and Sanitation for Household surveys, other national surveys |
| **Sanitary disposal of children’s faeces** | Number of children under the age of 3 years whose (last) stools were disposed of safely. | DHS, Drinking-Water and Sanitation for Household surveys, other national surveys |
| **Open Defecation Free** | Number of communities certified as “open defecation free” | National surveys |
| **Diarrhoea Prevalence** | Prevalence of Diarrhoea: Percentage (%) of children under age five who had diarrhoea in the two weeks preceding the survey, as defined by DHS. | DHS |

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1 Sanitary disposal of children’s faeces includes: child using toilet/latrine, putting faeces into the toilet or latrine, burying faeces.
6.3 Monitoring and Evaluation Tools

There are a number of monitoring and evaluation tools and guidance available to assist with the prevention of MAM. The Action Contre La Faim (ACF) uses the multi-sectoral seasonal calendar tool\(^1\) to conduct rapid multi-sectoral analyses in order to better understand nutrition insecurity and the seasonal fluctuations of incidence of SAM in a given area of operation. The Integrated Food Security Phase Classification\(^i\) \(^{ii}\) \(^{iii}\) tool is used as the analytical framework for situational and response analysis (see Table 4 for acute malnutrition thresholds during different phases). This is a system which has been set up and coordinated by key UN agencies to monitor the incidence and prevalence of under-fives affected by acute malnutrition as well as treatment coverage (carried out on a country-by-country basis, with data published annually). There is also the recent development of comprehensive and innovative coverage monitoring tools, including the Semi-Quantitative Evaluation of Access & Coverage (SQUEAC) and the Simplified LQAS Evaluation of Access and Coverage (SLEAC) by Valid International, FANTA and their partners, which have provided the means by which to monitor programme coverage practically and easily. The MAM Decision Tool\(^16\) guides practitioners in the identification of the most feasible MAM prevention strategy, including target population groups, and incorporates a range of situational factors into the decision-making process in a given context.

7 Way Forward and Conclusions

The specific pathways to preventing acute malnutrition are not well known, and more research and evidence is needed. The short and long-term effects of nutrition-sensitive interventions to prevent MAM have not been extensively studied, and the findings thus far are not substantial. Some studies show significant results in reduction of wasting when addressing underlying conditions such as poor WASH conditions, inadequate food security and social protection and poor caring practices.

Preventing MAM through nutrition-sensitive interventions should focus on the high-impact ‘window of opportunity’: pregnant women and children under 2 years of age, especially among food and nutrition insecure households and those which lack adequate sanitation, care or social protection. A multi-sectorial approach is needed, which addresses the sanitary environment ensures a clean water supply, and good hygiene, a diverse diet as well as the social determinants of nutritional status.

Nutrition-sensitive interventions can also serve as delivery platforms for nutrition-specific interventions (see the CMAM Forum Technical Brief: Preventing Moderate Acute Malnutrition through Nutrition-specific Interventions), potentially increasing their scale, coverage, and effectiveness in preventing

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\(^1\) By using the calendar, ACF will develop its seasonal thinking for strategic programming. Users will gain a seasonal perspective on all factors contributing to the risk of undernutrition. The tool allows users to build a clearer picture of the main characteristics of each season: the seasonal variation of undernutrition; identified risks — climate-related and other (e.g. malaria); caretaker and livelihood activities; staple food price fluctuations; access to water etc. The calendar will also identify cultural events that may increase household level cash needs. The tool has been rolled out across the ACF network and feedback is good: it is easy to use at both community and macro level, enabling comprehensive information collection in a short time. Furthermore, it is easy to triangulate through information collection at different levels from the community to the national level. Application of the tool facilitates coordination between sectors (health, WASH, FSL(Food Security and Livelihoods)) and it is essential for planning seasonally-sensitive interventions, enabling stakeholders to identify the times of year in which particular risks are heightened and so plan accordingly.

\(^i\) The IPC includes also >15% GAM but this is very difficult to measure accurately in urban areas because it requires high levels of data disaggregation e.g. within slums.

\(^ii\) IPC Version 2.0 distinguishes between two conditions of food insecurity – acute and chronic. For the IPC, acute food insecurity is a snapshot of the current or projected severity of the situation, regardless of the causes, context or duration. Chronic food insecurity is the prevalence of persistent food insecurity – for example, levels of food insecurity that continue even in the absence of hazards/shocks or high frequency of years with acute food insecurity.
acute malnutrition. There is a need for integrated programming and improved linkages between ‘direct’ nutrition-specific interventions and ‘indirect’ nutrition-sensitive interventions to ensure that the maximum impact is achieved from the considerable investments made by both government and partners.

Scaling up prevention strategies within the different sectors is challenging and requires sustained commitment as an integral part of sectorial planning and programme design. In the face of constant change due to factors such as seasonality, climate change, crisis and shocks, practitioners must have the flexibility to implement concurrent short-term interventions which address immediate needs and longer term interventions to promote resilience. This will entail the need to:

- Clearly define MAM prevention strategies through evidence-based interventions in each sector (e.g. agriculture and food security, WASH, social protection and ECD).
- Integrate clear strategic plans for prevention of MAM through nutrition-sensitive interventions within existing CMAM strategies and multi-sectorial National Nutrition Strategies with scale-up plans (with geographical and coverage targets, costing, support needs, training strategy, etc.).
- Integrate the prevention of MAM through nutrition-sensitive interventions through existing pre and in-service training in each sector (e.g. agriculture and food security, WASH, social protection and ECD).

Additional key findings which arose from this review and which should be considered when planning and designing nutrition-sensitive interventions to prevent acute malnutrition are summarised below:

- Foster consensus on criteria for targeting vulnerable individuals, households and communities.
- Ensure that seasonal food insecurity and other changes associated with seasonality, such as an increase in infections or inadequate caring practices, are taken into consideration in order to reduce seasonal peaks in wasting. A combination of short-and long-term interventions to prevent MAM can help build longer-term resilience whilst also responding to needs arising due to the local seasonal context. In particular, there is a need to:
  - Monitor short-term and seasonal food security shocks and hotspots.
  - Help establish early warning systems to ensure the early detection and diagnosis of acute malnutrition to inform and prompt appropriate early action.
  - Increase the availability of evidence about seasonal food insecurity and its relationship with MAM. More evidence is also needed about short-term and longer-term interventions to prevent predictable seasonal peaks of MAM.
  - Promote targeted seasonal social protection interventions to help prevent MAM, especially for nutrition and food insecure households.
  - Promote hunger season prevention interventions, including initiatives to promote food market development, and support employment during the hunger season.

- While there is limited evidence of impact relating specifically to acute malnutrition, longer-term interventions should be promoted, which ensure adequate food and nutrition security and longer-term resilience vulnerable communities. These interventions should aim to reinforce short-term interventions that address the immediate impacts of seasonal shocks and include post-harvest management strategies, increasing access to a diverse diet and promoting dietary diversity and production of a variety of nutritious foods.

- Strategies to promote the empowerment of women and gender equality should be mainstreamed into all nutrition-sensitive programmes and activities. This includes increasing equitable access to agricultural inputs including extension services, productive resources and assets to increase market access for women and optimising the productive capacity of land, protecting women’s ability to maintain good quality care for their children and increasing incomes.

- WASH interventions can play a significant role in the prevention of acute malnutrition, although clear evidence is still needed. Nonetheless, WASH interventions should form a key component of
strategies to prevent acute malnutrition and undernutrition more generally. Key interventions include:

- Promotion of a clean and sanitary environment for infants and young children and addressing faecal-oral transmission pathways, especially exploratory ingestion of soil and chicken faeces in infants and young children (birth–18 months old), due to the very high bacterial load of these substances.
- Promotion of improved sanitation, hygiene behaviours and practices.
- Improved management of diarrhoea.
- Increased household access to, and the correct and sustained use of, improved sanitation facilities.
- Improved drinking-water source and quality, including an adequate water supply, improving household access to a nearby, improved water source (wells, piped water supply, ceramic water filters), safe water storage and treatment of drinking water with sustainable, accessible point-of-use water treatment technologies.
- Reduction and ultimate elimination of open defecation.

- There are also several interventions in the area of ECD which demonstrate promising results in terms of improving nutritional status and preventing both acute malnutrition and stunting. These should be considered within strategies to prevent acute malnutrition and include those that address both the caregivers’ behaviour and the child’s interactions with the environment, decreasing risk of infection and fostering positive caregiver-child interactions. Examples include:
  - Counselling through nutrition education and behaviour change communication to adopt positive care and feeding behaviours and practices,
  - Promoting of the consumption of quality, nutrient-dense, diverse diets and complementary foods,
  - Identifying and promoting time and labour saving technologies to help to reduce women’s workloads.
  - Where appropriate, promoting the establishment of community/family-centred and/or subsidised childcare-services.

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1 Percentage (%) of households using a improved water source less than 30 min round trip from their home.
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Annex 1: Definitions and Concepts

**Asset**
An asset is an item of property including land, capital, or a share in ownership.

**Catch-up Growth**
The term ‘catch-up’ has been used for the accelerated growth of children who have suffered from restricted intrauterine growth based on either maternal nutritional factors or morbidity such as hypertensive disease.

**Chronic Food Insecurity**
Chronic food insecurity is long-term or persistent when people are unable to meet their minimum food requirements over a sustained period of time and results from extended periods of poverty, lack of assets and inadequate access to productive or financial resources and can be overcome with typical long term development measures also used to address poverty, such as education or access to productive resources, such as credit. They may also need more direct access to food to enable them to raise their productive capacity.

**Climate Change**
Climate change refers to a change in the state of the climate that can be identified (e.g., by using statistical tests) by changes in the mean and/or the variability of its properties, and that persists for an extended period, typically decades or longer. Climate change may be due to natural internal processes or external forces such as modulations of the solar cycles, volcanic eruptions and persistent anthropogenic changes in the composition of the atmosphere or in land use. Note that the Frame-work Convention on Climate Change (UNFCCC), in its Article 1, defines climate change as: ‘a change of climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability observed over comparable time periods’. The UNFCCC thus makes a distinction between climate change attributable to human activities altering the atmospheric composition, and climate variability attributable to natural causes.

**Dietary Diversity**
Variety of food in food groups to ensure adequate intake of essential nutrients and to promote good health.

**Disposal of Children’s Faeces**
Disposal of children’s faeces is how the faeces of all children under three years of age in the household were disposed of when they most recently passed stool. The safe disposal of children’s faeces is of particular importance because children’s faeces are the most likely cause of faecal contamination to the immediate household environment. The preferred disposal method, which is likely to ensure protection

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v N, Rachel. Bringing Agriculture to the Table: How Agriculture and Food Can Play a Role in Preventing Chronic Disease. The Chicago Council on Global Affairs. 2011

of the household environment from faecal contamination, is putting or rinsing stools into a sanitation facility.

“Faecal-oral” transmitted diseases (they can perhaps be water-borne or water-washed) either Low infective dose: cholera, typhoid, or High infective dose: diarrhoeas due to amoeba and bacteria, ascariasisiosis, gastroenteritis, hepatitis, paratyphoid, Enterovirus and hookworm.¹

Food Aid ii
Food aid is providing food and related assistance to tackle hunger, either in emergency situations or to help with longer-term hunger alleviation and achieve food security.

Food Consumption iii, iv
Food consumption is expressed in kilocalories (kcal) per capita per day is a key variable used for measuring and evaluating the evolution of the global and regional food situation.

Fixed-Point Defecation is defecation into a pit or other containment structure, regardless of the quality of the structure or whether it is hygienically maintained (i.e. includes access to both improved and unimproved facilities).

Gender Equity v is the process of being fair to women and men. To ensure fairness, measures must often be available to compensate for historical and social disadvantages that prevent women and men from otherwise operating on a level playing field. Equity leads to equality.

Gender Equality vi concerns women and men, and it involves working with men and boys, women and girls to bring about changes in attitudes, behaviours, roles and responsibilities at home, in the workplace, and in the community. Genuine equality means more than parity in numbers or laws on the books; it means expanding freedoms and improving overall quality of life so that equality is achieved without sacrificing gains for males or females. Gender Equality vii is a broad concept and a goal for development. It is achieved when men and women have equal rights, freedoms, conditions, and opportunities for realising their full potential and for contributing to and benefiting from economic, social, cultural, and political development. It means society values men and women equally for their similarities and differences and the diverse roles they play. It signifies the outcomes that result from gender equity strategies and processes. Gender equality viii concerns fundamental social transformation, working with men and boys, women and girls, to bring about changes in attitudes, behaviours, roles and responsibilities at home, in the workplace, and in the community. Genuine equality means expanding freedoms and improving overall quality of life so that equality is achieved without sacrificing gains for males or females.


ii Bringing Agriculture to the Table: How Agriculture and Food Can Play a Role in Preventing Chronic Disease. Rachel Nugent, PhD, Chair. The Chicago Council on Global Affairs. 2011.

iii Food Aid
Food aid is providing food and related assistance to tackle hunger, either in emergency situations or to help with longer-term hunger alleviation and achieve food security.

iv Food consumption per person is the amount of food, in terms of quantity, of each commodity and it's derived products for each individual in the total population. Figures are shown for food items. FAO Statistics Division, http://www.fao.org/faostat/foodsecurity/FSSDMetadata_en.htm.


viii USAID Gender Term Definitions. Automated Directives System Chapter 205.
Household
A small group of persons who share the same living accommodation, who pool some, or all, of their income and wealth and who consume certain types of goods and services collectively, mainly housing and food.

Hunger is an outcome of food insecurity, where dietary intake, at population level, falls below minimum requirements (typically averaged as 2,100 kcal per person per day).

Hygiene
Hygiene is any intervention that promotes adoption of, or increased practice of, hand washing with soap after defecation and disposal of child faeces, prior to preparing and handling food and before eating (group discussions, media campaigns, leaflets, songs, pictorial stories, dramas etc.).

Improved Drinking Water Source
An improved drinking-water source is defined as one that, by nature of its construction or through active intervention, is protected from outside contamination, in particular from contamination with faecal matter. “Improved” sources of drinking-water include:
- Piped water into dwelling, also called a household connection, is defined as a water service pipe connected with in-house plumbing to one or more taps (e.g. in the kitchen and bathroom).
- Piped water to yard/plot, also called a yard connection, is defined as a piped water connection to a tap placed in the yard or plot outside the house.
- Public tap or standpipe is a public water point from which people can collect water. A standpipe is also known as a public fountain or public tap. Public standpipes can have one or more taps and are typically made of brickwork, masonry or concrete.
- Tubewell or borehole is a deep hole that has been driven, bored or drilled, with the purpose of reaching groundwater supplies. Boreholes/tubewells are constructed with casing, or pipes, which prevent the small diameter hole from caving in and protects the water source from infiltration by run-off water. Water is delivered from a tubewell or borehole through a pump, which may be powered by human, animal, wind, electric, diesel or solar means. Boreholes/tubewells are usually protected by a platform around the well, which leads spilled water away from the borehole and prevents infiltration of run-off water at the well head.
- Protected dug well is a dug well that is protected from runoff water by a well lining.

Improved Sanitation
The UN’s Millennium Development Goal (MDG) sanitation target calls for ‘improved sanitation’. The WHO/UNICEF Joint Monitoring Programme (JMP) includes the following as improved sanitation: connection to a public sewer and/or septic system, pour-flush latrine, access to a pit latrine and ventilation improved pit latrine. An improved sanitation facility includes:
- A flush toilet uses a cistern or holding tank for flushing water, and a water seal (which is a U-shaped pipe below the seat or squatting pan) that prevents the passage of flies and odours. A pour flush toilet uses a water seal, but unlike a flush toilet, a pour flush toilet uses water poured by hand for flushing (no cistern is used).
- A piped sewer system is a system of sewer pipes, also called sewerage, that is designed to collect human excreta (faeces and urine) and wastewater and remove them from the household.

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i The Agricultural Household – Concepts and Definitions, FAO. Available at:  


environment. Sewerage systems consist of facilities for collection, pumping, treating and disposing of human excreta and wastewater.

- **A septic tank** is an excreta collection device consisting of a water-tight settling tank which is normally located underground, away from the house or toilet. The treated effluent of a septic tank usually seeps into the ground through a leaching pit. It can also be discharged into a sewerage system.

- **A flush/pour flush to pit latrine** refers to a system that flushes excreta to a hole in the ground or leaching pit (protected, covered).

- **A ventilated improved pit latrine (VIP)** is a dry pit latrine ventilated by a pipe that extends above the latrine roof. The open end of the vent pipe is covered with gauze mesh or fly-proof netting and the inside of the superstructure is kept dark.

- **A pit latrine with slab** is a dry pit latrine that uses a hole in the ground to collect the excreta and a squatting slab or platform that is firmly supported on all sides, easy to clean and raised above the surrounding ground level to prevent surface water from entering the pit. The platform has a squatting hole, or is fitted with a seat.

- **A composting toilet** is a dry toilet into which carbon-rich material (vegetable wastes, straw, grass, sawdust, ash) are added to the excreta and special conditions maintained to produce inoffensive compost. A composting latrine may or may not have a urine separation device.

- **Special case.** A response of “flush/pour flush to unknown place/not sure/DK where” is taken to indicate that the household sanitation facility is improved, as respondents might not know if their toilet is connected to a sewer or septic tank.

**Livelihood Assets:**

Livelihood assets; assets that allow individuals and households to meet basic needs. Six assets/capitals: financial; physical; political; human; social; and natural.

**Management of Severe Acute Malnutrition (SAM)**

Management of SAM is process that includes diagnosis based on medical history and physical, clinical, and anthropometric assessments; triage; treatment planning (decision and consent); treatment; monitoring of treatment progress; preventing relapse; and referral.

**Positive Behaviours:** Executive functions help children develop skills of teamwork, leadership, decision-making, working toward goals, critical thinking, adaptability, and being aware of our own emotions as well as those of others. For society, the outcome is more stable communities, reductions in crime, and greater social cohesion.

**Primary Caregiver**

The primary caregiver is the person who knows the most about how and what the child is fed. Usually, but not always, this will be the child’s mother.

**Seasonal Food Security**

The concept of seasonal food security falls between chronic and transitory food insecurity. It is similar to chronic food insecurity as it is usually predictable and follows a sequence of known events. However, as seasonal food insecurity is of limited duration it can also be seen as recurrent, transitory food insecurity. It occurs when there is a cyclical pattern of inadequate availability and access to food. This

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i World Vision

ii Building the Brain’s ‘Air Traffic Control’ System: How Early Experiences Shape the Development of Executive Function” and the Working Paper series from the Center on the Developing Child at Harvard University. [www.developingchild.harvard.edu/resources/](http://www.developingchild.harvard.edu/resources/)

iii Adopted from U.S. Government Food for Peace (FFP) Standard Indicators Handbook. (Baseline-Final Indicators) December 2011

is associated with seasonal fluctuations in the climate, cropping patterns, work opportunities (labour demand) and disease.

**Supplementary Feeding**
Targeted supplementary feeding is generally a nutrition-specific intervention used to prevent wasting in humanitarian emergency situations through the provision of food rations or specialised food for targeted populations that cannot easily access food. Many donors support food aid products for those with either moderate or severe levels of malnutrition to boost caloric intake or meet the nutritional needs of targeted vulnerable groups. Targeted population groups include mild and moderately malnourished children, pregnant and lactating women and other nutritionally vulnerable groups. Supplementary feeding can also prevent moderately malnourished individuals from becoming severely malnourished. Supplementary feeding, however fails to meet the nutritional needs of all recipients through large-scale feeding programmes. For example, children 6–59 months of age with MAM need to receive nutrient-dense foods to meet their extra needs for weight and height gain and functional recovery. However, the evidence base for nutrient needs to address MAM is more limited. A recent food aid quality review by researchers from Tufts University outlines ways to make nutritional enhancements for supplementary foods that will improve the impact of U.S. food aid. In addition, more operations research needs to be conducted to recommend approaches for counselling households to use locally available foods and the impact on wasting.

**Treatment of Severe Acute Malnutrition (SAM)**
Treatment of Severe Acute Malnutrition (SAM) refers to the specific actions of administering drugs and therapeutic diets.

**Vulnerable Populations**
Vulnerable populations are people that are at risk of food insecurity because of their physiological status, socioeconomic status, or physical security; also people whose ability to cope have been temporarily overcome by a shock.

**Water Supply**
Water quantity or supply is any intervention to provide a new or improved water supply or improved distribution (installation of a new hand pump or household connection), or both.

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6. Briend and Prinzo 2009
