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Persistent Global Acute Malnutrition

A discussion paper on the scope of the problem, its drivers, and recommendations for policy, practice, and research

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Acronyms

- ACF** Action Contre La Faim (NGO)
- CMAM** Community Management of Acute Malnutrition
- FEWSNET** Famine Early Warning Systems Network
- GAM** Global acute malnutrition
- INGO** International Non-governmental Organization
- IPC** Integrated Phase Classification
- IYCF** Infant and young child feeding
- M&E** Monitoring and evaluation
- MAM** Moderate acute malnutrition
- MUAC** Mid-upper arm circumference
- NCA** Nutrition causal analysis
- NCF** Nutrition Conceptual Framework (UNICEF)
- NGO** Non-governmental organization
- RCT** Randomized controlled trials
- SAM** Severe acute malnutrition
- SH/S** Sitting height/standing height ratio
- SMART** Standardized Monitoring and Assessment of Relief and Transitions
- UN** United Nations
- UNHCR** United Nations High Commissioner for Refugees
- UNICEF** United Nations International Children's Emergency Fund
- WHO** World Health Organization
- WHZ** Weight-for-height z-score

Executive Summary

In many protracted emergencies, the prevalence rates of global acute malnutrition (GAM) regularly exceed the emergency threshold of > 15% of children with acute malnutrition (< -2 weight-for-height z-scores (WHZ) or with nutritional edema), despite ongoing humanitarian interventions. The widespread scale and long-lasting nature of “persistent GAM” means that it is a policy and programming priority.

Drawing on a literature review and a series of key informant interviews, this paper describes the scale and duration of the persistent GAM problem, the perceived causal pathways, the methodological challenges in identifying trends and understanding drivers, and the implications for current practice and policies as well as for future research.

Our interviewees identified 25 countries as places where persistent GAM is widely recognized as an issue. The most frequently referenced were Somalia, Ethiopia, and South Sudan. The Sahel belt and Horn of Africa were the two most consistently highlighted regions. South Asia, including India, Pakistan, and Bangladesh, was also mentioned, indicating this problem is not limited to humanitarian contexts but is also evident in more stable development settings despite wider global improvements in stunting and under-five mortality. Using available survey data, four case studies are presented (see Annex 2), where the prevalence of GAM generally remains above 15%: Chad, Bangladesh, South Sudan, and Niger.

Informants generally agreed that an understanding of the drivers of GAM must inform the design of interventions that address it. The UNICEF conceptual framework—“causes of malnutrition and death”—remains the most well-known and widely adopted conceptual framework and has been reproduced many times. Informants noted that in a protracted crisis, the drivers of persistent GAM are often unclear, in part because the three underlying causes—food, care, and health—all potentially play a role, so there may be no single reason accounting for persistent GAM.

However, a “food-first” focus still tends to dominate thinking and practice in preventing malnutrition in acute emergencies despite the recognized importance of public health in controlling disease and increasing awareness of care for children and women. However, evidence in protracted persistent GAM settings indicates that food security may not be the main driver.

The UNICEF framework provides a starting point for understanding malnutrition causality, but it needs to be elaborated on to understand the basic causes that apply in protracted emergency contexts, including potentially protracted war, conflict, and insecurity; marginalization; inequalities and poverty; governance of natural resources; and migration and displacement. In addition, four cross-cutting themes emerged from the interviews, ones that are not explicit in the UNICEF framework but are felt to be crucial in understanding persistent GAM, including: gender; livelihood systems; the history of vulnerability and long-term trends driving acute malnutrition; and seasonal fluctuations in acute malnutrition.

There are a number of methodological challenges in studying persistent GAM. First, there is limited availability of reliable and comparable data on acute malnutrition, across time and populations. Second, the switch from anthropometric reference data to WHO growth standards in 2006 had implications for comparability over time. Another potential challenge is the slight differences in body shape that have been observed among children over two years of age from different populations, which associates longer-limbed types with pastoralist populations in hotter, semi-arid environments.

Various approaches are used for analyzing the drivers of malnutrition, ranging from household surveys to qualitative approaches and mixed methods. While surveys can be used for testing correlations and regression analysis, a general lack of capacity and resources tends to limit this approach

in practice. Both localized surveys and qualitative methods suffer in that results are not generalizable.

Recent methodological advances include a new participatory and response-oriented methodology known as Link-NCA, which has now been applied in more than 30 settings. Identified strengths of this approach are that it can bring together stakeholders, raise awareness, and build consensus. However, the issue of response analysis and uptake of findings remains a challenge not only for Link-NCA but also for all methodologies.

Addressing persistent GAM presents particular challenges for operational agencies, in part as a result of structural issues within the humanitarian system (focus on treatment of severe acute malnutrition, “siloes” sectors, short-term funding cycles that do not include nutrition causal analysis (NCA) or prioritize prevalence data).

The paper offers some potential strategies for moving forward. First, treatment and prevention should go hand in hand at all stages of an emergency; second, nutrition-sensitive programs based on partnership, localization, and more participatory ways of working should be adopted as common practice; third, the root causes of persistent GAM linked with the wider political economy and protracted crisis should be more seriously analyzed; fourth, a learning culture linked to research uptake and response analysis should be promoted.

This last point is linked to a proposed research agenda to strengthen the evidence base in order to guide programs and policies. Important research gaps highlighted in this review relate to further analysis of wasting trends and, linked with this analysis, the relationship between wasting, stunting, and mortality. A major area for future research is further investigations of specific pathways associated with wasting, including the role of environmental enteropathy pathogens, the microbiota, and the role of pre-existing nutritional status on child wasting.

1. Introduction

In many contexts frequently affected by humanitarian emergencies or experiencing protracted crises, the prevalence of global acute malnutrition (GAM) among infants and young children remains stubbornly high over an extended period. Practitioners and donors have characterized this issue as “persistent GAM,” which is defined here as contexts where the emergency threshold of above 15% GAM is repeatedly exceeded over several years or even decades. Other common terminology reported by some interviewees for the same concept was “chronic wasting,” “chronic undernutrition,” or “endemic wasting,” not to be confused with chronic malnutrition, otherwise known as stunting.

In some contexts like South Sudan and Niger, elevated prevalence rates have been reported repeatedly over more than two decades despite the presence of international non-government organizations (INGOs) and ongoing humanitarian programs during this time. However, persistent GAM is not only a humanitarian problem but also a development one. In contexts such as Pakistan and Bangladesh, wasting is becoming an increasing and persistent problem, while stunting and under-five mortality tends to be improving. Part of the difficulty, as laid out here but also in a recent World Bank report, is insufficient evidence on effective programs to prevent wasting, primarily due to a limited focus on and understanding of the pathways or drivers¹ leading to the incidence of wasting (Shekar et al., 2016). The problem of persistent GAM is particularly challenging given that there often appears to be a limited or, in some cases, nonexistent association between many of the indicators of an emergency, such as food insecurity, on the one hand and indicators of child GAM on the other.

Severe wasting² is associated with a ninefold increased risk of mortality, while moderate wasting

is associated with a threefold increased risk of mortality, increased risk of infections, and impaired physical and cognitive development. However, children who are malnourished are likely to have an even greater risk of dying where levels of morbidity and mortality are already high (Pelletier et al., 1993), which is why persistent GAM in protracted or post-emergency contexts is of particular concern. Given the association of GAM with mortality, morbidity, impaired development, and stunting, this report aims to better understand the scope and scale of the problem and why it has continued to persist despite global improvements in stunting and under-five mortality.

The original impetus for this report comes from a combination of work carried out by the authors, including earlier reviews of nutrition and mortality indicators (Young and Jaspars, 2009), research in the Sila Region of Chad (Marshak, Young, Bontrager, and Boyd, 2016; Marshak, Young, and Radday, 2016), and the growing research on the role of environmental enteropathy (Crane et al., 2015) and the microbiome (Kane et al., 2015). In Sila, the authors found that despite some evidence of recovery from crises, the prevalence of acute malnutrition in the group not receiving the multisectoral intervention significantly increased over the same time period (2012–2015) from 16 to 21% (Marshak, Young, and Radday, 2016). In addition, the authors found no correlation between child weight-for-height z-scores (WHZ) and food insecurity indicators, but instead found a significant association with livelihood strategies, village cattle ownership, access to potable water, and hygiene practices (Marshak, Young, Bontrager, and Boyd, 2016). The findings from Chad coupled with the authors’ experience in other contexts led to the question, “How persistent is wasting in protracted crises despite investment in humanitarian and

¹ From now on we will use the term “drivers” of GAM in recognition that there are many factors that contribute to this phenomenon, and how they relate to each other and interact as part of causal pathways may be as—or more—important than the individual drivers themselves. Others, including the IPC for Acute Malnutrition, have adopted the term drivers rather than causes.

² Severe wasting is classified as below -3 z-scores of the weight-for-height standards, while moderate wasting corresponds to -3 to < -2 weight-for-height z-scores (WHZ).

recovery programs aimed at tackling child acute malnutrition?" In addition, there has been a growing debate on the microbiological and physiological factors, including the role of zoonosis, that might be driving wasting (Azzarri et al., 2015; Headey et al., 2016).

The focus of this paper is the problem of persistent GAM in contexts related to humanitarian emergencies, particularly those that are protracted over many years, or in the period post emergency when the wider situation appears to be improving. The report aims to answer the following questions through a brief review of the literature and key informant interviews:

1. How widespread is the issue of persistent GAM?
2. What are the perceived drivers of GAM in these contexts?
3. What are the methodological constraints in analyzing persistent GAM and its drivers?
4. What are the implications for current practice and policy?
5. What are the implications for research?

Below, we briefly describe the methodology for this research. Then, each subsequent section corresponds to the above questions, followed by a short conclusion. In addition, four case studies to illustrate the problem of persistent GAM are presented in Annex 2. Some preliminary recommendations are suggested at the end of sections 4 and 5.

Methodology

In order to address the questions highlighted above, the researchers used a combination of approaches. First, interviews were carried out with key informants: technical specialists working for INGOs, United Nations (UN) organizations and donors, as well as academics and donors. The same interview protocol was followed with each person interviewed. The authors drew up an initial interview list based on their experience in the nutrition field. A snowball approach was then adopted as interviewees suggested additional informants. A total of 25 interviews were conducted from June to November 2017.

Second, a literature review was completed including the additional readings suggested by key informants. Third, four case studies were developed for exploring further the problem of persistent GAM in specific contexts. The case studies were selected to represent the countries most consistently mentioned in the interviews, but also regions with sufficient data available to establish a trend in GAM were chosen (see section 3 for a discussion of the constraints associated with establishing such a trend). These case studies are found in Annex 2 and include the following countries and regions:

1. Kanem Region, Chad
2. Cox's Bazar, Bangladesh
3. Northern Bahr-el-Ghazal, South Sudan
4. Maradi and Zinder Districts, Niger

It is worth noting the limitations to this approach. This report is neither a systematic review nor a random survey of expert views. The interviews are limited to relatively senior and experienced members of the international community, and missing are the voices of professionals from emergency-affected countries working for government or national non-governmental organizations (NGOs). Thus, while the authors aimed to get a cross-section of views reflecting the international community, the selection of interviewees is not exhaustive, as interviews were concluded when the list ended and not when a saturation of responses was reached.

Our approach of drawing on key informant interviews was due to the general lack of published data on persistent GAM. Most information and discussion on this topic is within the grey literature, technical websites (Link-NCA (nutrition causal analysis), Integrated Phase Classification (IPC) for Acute Malnutrition), or not in the public domain (Harmonised Framework and other reporting tools). Thus, this report cannot be described as a systematic review of the literature, but rather a set of self-identified and suggested readings that highlight the points made by the key informants.

This report also does not establish the statistical evidence for persistent GAM. While the case studies specifically draw on nutrition surveys and Standardized Monitoring and Assessment of Relief and Transitions (SMART) data to show how wasting has not declined in certain contexts, there are also significant limitations with the data itself (see section 3 for more detail). However, ultimately the authors view this report as a starting point for informing the dialogue and for further investment in identifying the problem of persistent GAM and possible solutions.

1. Defining the problem: Scale and scope of persistent GAM

In this section, we look at how widespread the issue of persistent GAM is, reflect on the scale of the problem and general trends, and summarize to what degree the problem is acknowledged and is being addressed by the humanitarian community.

Despite years of intervention, there is a growing body of evidence that the prevalence of wasting in some contexts is not declining. This evidence is drawn from the vast numbers of nutrition surveys carried out by NGOs in the context of emergencies to estimate the prevalence of GAM. A review of around 900 of such surveys from 2000 to 2006 conducted in the arid and semiarid areas of the Greater Horn of Africa found that between 2000 and 2006, the adjusted (for country, livelihood, and season) yearly average prevalence of wasting never fell below 15% in Kenya, Sudan, and Eritrea (Chotard et al., 2010). Out of the seven years of available data, the prevalence in the Afar and Somali Regions of Ethiopia only once fell below 15%, in 2014.³

Using available SMART data and nutrition reports, we further illustrate this point in Annex 2 through the use of four case studies focusing on contexts frequently affected by humanitarian disasters and showing persistent wasting over the past decade. In all four contexts (Chad, Bangladesh, South Sudan, and Niger), the prevalence of GAM generally remains above the 15% mark, only occasionally dipping, despite significant humanitarian interventions (see Annex 2 and Figure 1). For example, in the Kanem Region of Chad, a prevalence of GAM of above 15% has been recorded in 15 out of the last 17 nutrition surveys from 1992 through 2015,

sometimes irrespective of improvements in other indicators such as food security, and in the absence of a recorded hazard (Annex 2, Case Study 1).

All 25 respondents acknowledged the problem of persistent GAM, pointing out that they are frequently intervening in the same exact places year after year:

“Go back to the same woredas [in Ethiopia] every year to address emergency levels of malnutrition.” [Nutrition advisor (19)]

“Feels like we never pull out.” [Donor (20)]

“No matter the zone we will always have 10 to 15% of acute malnutrition, but then a crisis would increase it.” [Nutrition advisor speaking on Niger (22)]

“In spite of intervention, projects, over many years, even decades, malnutrition persists.” [INGO food security advisor speaking about Kanem, Chad (6)]

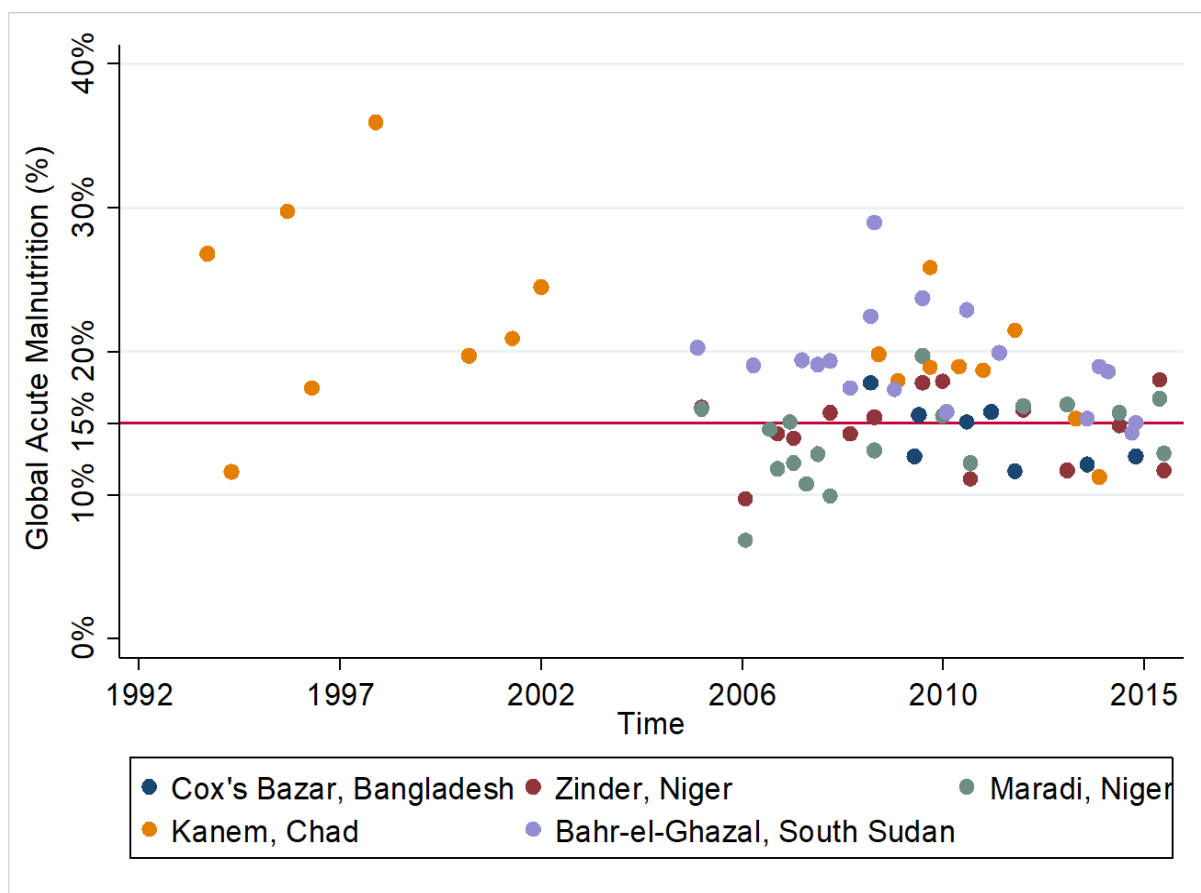
“We also recognize that there is a struggle in parts of Somalia where we think we are being reasonably successful, but you are still seeing some alarming GAM throughout the year.” [Donor (20)]

“Don’t really see a drop in GAM even though intervening for years.” [Nutrition advisor (19)]

“In the North in the IDP [internally displaced person] camps [we] ensure proper access to

³ Chotard et al. (2010) also looked at Somalia, regions other than Afar and Somali in Ethiopia, and Uganda. For these three countries, the variability was far greater, ranging from 6–21% in Somalia, 9–12% in Ethiopia, and 4–16% in Uganda.

Figure 1. GAM prevalence for case studies.



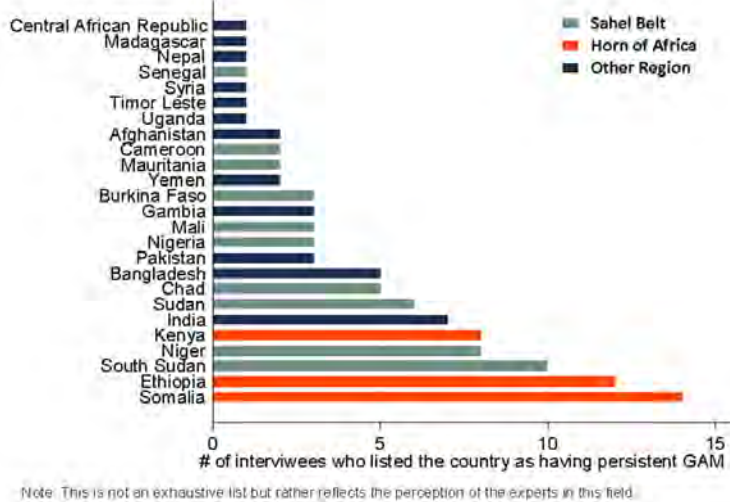
services was happening—lots of investment—but very static GAM rates, no improvement.” [Nutrition advisor speaking about Somalia (24)]

“Even in a good year, we still have high levels [of malnutrition] in Mauritania, Mali, Niger, and Senegal.” [Food security and livelihoods advisor (12)]

“Whole group of countries where GAM is persistently high...South Sudan, Sudan, South and Central Somalia, Sahelian West Africa.” [Food security expert (3)]

Key informants highlighted certain countries and regions within those countries more frequently than others. Of the 25 people interviewed, Somalia and Ethiopia were mentioned by almost all individuals, followed by South Sudan, Niger, Kenya, India, Sudan, Chad, and Bangladesh (see Figure 2 for a distribution of the frequency of key informants identifying particular places). As is apparent from the frequency count, the two regions most consistently highlighted were the Sahel Belt and Horn of Africa, with South Asia (encompassing India, Pakistan, and Bangladesh) not far behind.

Figure 2. Places identified as having persistent GAM by key informants.



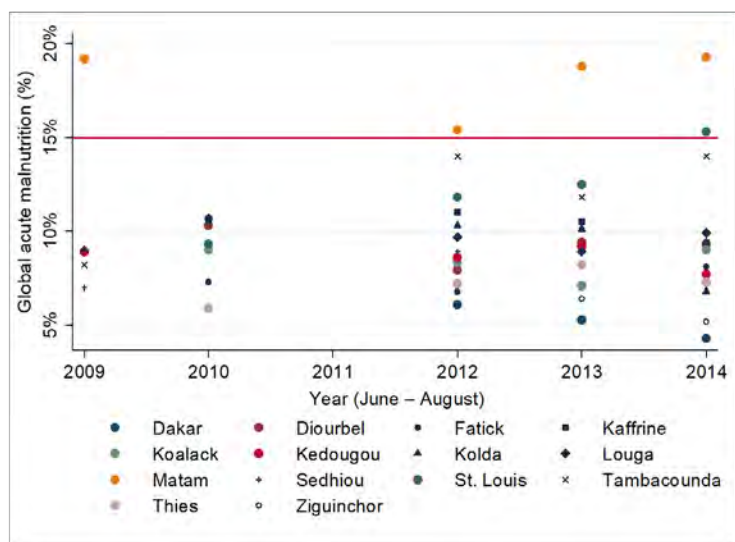
Not all areas within a country were reported to be affected by persistent GAM. For example, this variability is particularly visible in the context of Senegal. Using SMART data from 2009 through 2014 (collected during the hunger gap between June and August), only one region—Matam—shows a persistent above-emergency level of GAM (see Figure 3). From the interviews, individuals specifically highlighted Bolosso Sorie, Afar, and Somali Region in Ethiopia; Kanem Region in Chad; Bay and Bakool in Somalia; and Wajir, Turkana and West Pokot in Kenya.

Seasonal variation in acute malnutrition was also an important consideration in countries identified in the Sahel Belt and Horn of Africa, and in displaced settings: “Striking seasonal trend in Sudan. Even in the camps, you see this seasonal trend” [Nutrition advisor (19)]. However, respondents were keen to point out that “even in the harvest season you can find high rates” [Donor (17)]. For example, in the Kanem Region in Chad, the prevalence of GAM remains above the emergency threshold of 15% for most of the year, even in the harvest season (see Case Study 1 in Annex 2). The *fluctuation* in wasting by season might be one area where the humanitarian

and development community is making progress. One key informant noted that “while we still had above-emergency thresholds [in Niger], the duration was shorter. It is still 16%, but did not last as long” [Nutrition advisor (22)]. Research from Gambia shows a similar trend: while there is no change in the prevalence of wasting, there was a decline in the variability of malnutrition over time (Nabwera et al., 2017). The role of seasonality is explored more in section 2.

Respondents also pointed out that the issue of persistent GAM was not only a rural problem. “Particularly in India, Bangladesh, and Nigeria, we actually find the problem can be worse in urban areas” [Donor (17)]. Research from an urban area of Bangladesh found significant seasonal differences in child wasting despite the urban setting (Hillbruner and Egan, 2008). The problem was also observed with displaced populations. One key informant responded that we are “seeing [the problem of persistent GAM] in some of the refugee camps in Ethiopia and parts of South Sudan in displaced populations” [Donor (20)]. Case Study 2 on a camp setting Cox’s Bazar Region in Bangladesh illustrates this point, with little evidence of declining GAM prevalence over the five years of available data

Figure 3. GAM prevalence by region and year in Senegal.



(see Figure 1 above and the case study in Annex 2). However, another key informant who had been looking into the question of persistent GAM in refugee settings pointed out that perhaps the initial assumption of a static population is incorrect. The respondent suggested we need to better understand where those populations are coming from, when influxes have occurred, and when there has been an exodus from the camp in search of temporary work [Nutritionist/donor (11)]. A recent United Nations High Commissioner for Refugees (UNHCR) report found that because of large population movements in and out of camps, a lack of change in a specific indicator, such as anemia or GAM, is not necessarily due to a lack of impact from the intervention, but rather an incorrect interpretation of the data (Tondeur et al., 2016).

Many of the countries and regions highlighted as having persistent GAM by respondents (and the focus of this report) are places that experience frequent disasters or are categorized as complex and protracted emergencies. However, the limited available academic literature and key informant interviews also stressed that persistent GAM is not exclusively a humanitarian problem and is found in more stable development contexts as well: in “non-

humanitarian contexts you are seeing high wasting, even though other things are not a problem” [Donor (20)]. A recent study in Gambia analyzed the effect of 36 years of intensive health interventions on several nutrition indicators and found no change in the prevalence of wasting (hovering around 11% < -2 z-scores) despite four decades of sustained investments in healthcare- and nutrition-related infrastructure in the study villages (Nabwera et al., 2017). The quality of these interventions was described as “unparalleled across rural Africa (Nabwera et al., 2017, e213). More worrying still, in some non-emergency contexts, the limited available evidence base suggests that wasting appears to be *increasing*. Using data from the National Nutrition Survey, Bhutta et al. (2013) found that despite a groundswell of momentum for nutrition in Pakistan, the prevalence of wasting increased from 9% in 1977 to 15% in 2011. This point underscores that emergency levels of GAM are not necessarily due to the shocks themselves but could be associated with more underlying drivers of persistent GAM. Even the selected case studies (see Annex 2) consistently illustrate that GAM levels can remain high both before and after an emergency, and frequently show little correlation with trends in food insecurity or cereal prices.

The problem of high and in some cases increasing prevalence of wasting in countries that are otherwise experiencing economic growth are a particular issue in India, Bangladesh, and Pakistan:

“In Bangladesh and India...we are seeing lower but stable prevalence levels, both from our data and research utilizing national surveys. In some countries—Pakistan—GAM is actually increasing... What that does not explain is why you are seeing particularly high levels in South Asia even though that region has lower poverty and higher education.” [Academic (18)]

The experience of “persistent GAM” in more stable and development contexts underlines another important relationship highlighted by respondents. In some contexts—development and humanitarian—wasting is remaining static or increasing despite significant improvements in other sectors. For example, in the Gambia study described above, the population under study during the same period increased their wealth and housing conditions, decreased the incidence of most diseases (especially diarrhea), decreased mortality, increased birth spacing, decreased family size, and increased school enrollment (Nabwera et al., 2017). In a study in the Sikasso Region in Mali, the authors report a paradoxical situation where improvement in agricultural production is accompanied by continued high levels of GAM (Dury and Bocoum, 2012). This discrepancy between improvements in assumed drivers of wasting and the prevalence of wasting was reported by several respondents:

“Classic case is India—every indicator you can think of, proportion of deaths from diarrhea, surveillance system on communicable diseases, maternal deaths in childbirth, all these indicators of development are going in one direction—a good direction, but GAM is stuck at 12 to 15% and has been stuck for 20 years.” [Epidemiologist (14)]

“We continue to see these high GAM rates even when other indicators, such as health, some WASH, and even morbidity, improve.” [Donor (17)]

“We have all year high rates of GAM but if we look at household and individual dietary diversity, we can see there is improvement during certain periods of

the year. Also, seasonally food security improves, while GAM remains high.” [Nutrition advisors speaking on Niger (4 and 5)]

“Everything has improved, except for malnutrition. Pockets of malnutrition where we do not know what to do.” [Nutrition advisor speaking on Ethiopia (23)]

While in this report we define “persistent GAM” as a regular occurrence of a prevalence of GAM above 15%, one key informant pointed out that the problem of persistent GAM is even more pervasive if we drop just below this arbitrary cutoff point: “You have most African countries struggling with [persistent GAM]. If you look at Nigeria, it is massive. Indonesia has massive levels of undernutrition; people do not pay attention to it because it is below 10%” [Nutrition advisor (22)].

The issue of persistent GAM was acknowledged by all individuals interviewed, whether they were practitioners, academics, or donors. Several key informants noted ongoing discussions within their organizations to better define and address the problem of persistent GAM. One donor reported that they had held a workshop with key experts in 2016 in order to identify what is known about preventing wasting and where there are gaps in the evidence base [Donor (20)]. Similarly, another key informant had been exploring trends in malnutrition over time and identifying where there are persistent levels of GAM (as well as other nutrition indicators) [Nutritionist (11)]. Based on preliminary findings, a workshop focused on Ethiopia was held in 2016 in order to enable stakeholders to discuss this issue. In addition, one of the respondents reported ongoing research for several country case studies (many of which are mentioned in this report) looking at wasting as one of the main primary outcomes. Further implications for programming and policy are reviewed in section 4.

2. What are the perceived drivers of GAM in these contexts?

There is widespread agreement internationally in the literature and in agency guidelines and policies as to the importance of understanding the drivers of acute malnutrition⁴ (see Box 1). The majority of our interviewees also felt strongly that analysis of the drivers of persistent GAM is a priority.

The most well-known and widely adopted conceptual framework that aims to explain malnutrition causality is the UNICEF “causes of malnutrition and death” (UNICEF, 1990). It has survived nearly three decades, and is both multi-scalar (distinguishing three levels of causality—

Box 1. Why we talk about “drivers” of malnutrition rather than “causes” of malnutrition

It is important to note that while the terms “driver” and “cause” are both used in the body of this report and throughout the quotes, frequently these terms are improperly applied, not just in reports and in conversation, but in the field of nutrition more broadly. In most instances, these terms signify association, or the more statistical term: correlation, meaning that as one variable changes in one direction, so does another. However, this correlation does not imply a causal link—that one variable directly affects another, as the two variables may be independently associated with a third confounding variable.

In order to show and prove true causation, in addition to association, the data have to also show temporality (that the cause precedes the effect) and non-spuriousness (meaning a third variable

does not explain the relationship between the effect and cause variables). Only “a perfectly conducted RCT [randomized controlled trial] provides an unbiased probability statement of causality between the intervention and the impact indicator - BUT requires further evidence to be biologically and conceptually plausible” (Victora et al., 2004). Hence the importance of understanding the causal pathway—its logical sequence and potential steps (social, behavioral, biological, etc.) that may also need to be measured. Measurement of intermediary steps potentially enhances the plausibility of RCT findings (Victora et al., 2004). Cross-sectional studies can only hint at causation by highlighting correlation.

⁴ Including: UNICEF, 1990; WFP, 2000. Food and nutrition handbook. WFP, Rome; Save the Children, 2004. Emergency nutrition assessment guidelines for field workers, Save the Children, London; Blössner, M., and M. de Onis. 2005. Malnutrition: Quantifying the health impact at national and local levels. WHO, Geneva; The Sphere Project. 2011. Humanitarian charter and minimum standards in humanitarian response. 2004 and 2011 editions. The Sphere Project, Geneva; The IPC for Acute Malnutrition classification and analysis framework, developed by the IPC Nutrition Working Group, operating under the direction of FAO. See <http://www.ipcinfo.org/ipcinfo-technical-development/ipc-nutrition-phase-classification/en/>; The famous 2008 *Lancet* article by Black et al. presents a framework of the relations between poverty, food insecurity, and other underlying and immediate causes of maternal and child undernutrition and its short-term and long-term consequences. They list the development of methods to assess nutritional status and its determinants as a research priority (Black et al., 2008).

immediate, underlying, and basic causes) and interdisciplinary (encompassing biological, social, and economic causes of nutrition problems). See Figure 4 in Annex 1. Since its inception, the framework has been reproduced with small modifications many times; for example, as part of the 2008 *Lancet* series on maternal and child malnutrition (see Figure 5 in Annex 1). While this update highlighted the short- and long-term consequences of maternal and child malnutrition, the updated framework removed the potential interactions between underlying factors, undermining some of the complexity highlighted in the original framework.

The UNICEF nutrition conceptual framework (NCF) succeeded in capturing the convolution of malnutrition causality, with multiple pathways, causal factors, and interactions, while at the same time reflecting the multisectoral nature of the problem and strategies needed to address it. Not a lot has changed since, and this framework remains the starting point for identifying, prioritizing, and addressing the priority causes. UNICEF's intention then was for the framework to be used to develop a more concise local model and help in "asking relevant questions in development of such models" (UNICEF, 1990, 23).

Perceptions of the drivers of persistent GAM

In the acute phase of an emergency, the causes of acute malnutrition are usually obvious, and relate to the hardships and suffering that accompany the shock or shocks: lack of food, water, shelter, sanitation, and increased risk of disease and death, as well as acute malnutrition. This knowledge has given rise to the well-established priorities for emergency response. While the immediate direct effects of a disaster or humanitarian crisis are obvious and can be controlled, it is far less clear how to address the drivers of malnutrition beyond the acute phase [Nutritionist (1)].

Several respondents believe the causes of persistent GAM are unclear and acknowledged that we are generally unable to properly explain persistent GAM trends [INGO food security advisor (6), Nutritionist (1), INGO nutritionist (9)], although there are usually a lot of assumptions [INGO nutritionist (9)]. Most telling were statements from experienced professionals that "the more I read, the more unsure I get" [Food security expert (3)], meaning there is no adequate explanation for this particular nutrition problem. Even nutrition scientists at the top of their field do not have the answers [Nutritionist (1)], and referred to the experience in the Gambia, where over the past 30 years the prevalence of wasting has persisted above 10%, while stunting has decreased, despite unprecedented levels of nutrition and health interventions and with no known plausible explanation for this persistent GAM (Nabwera et al., 2017).

Several interviewees stated that they thought all three underlying causes—food, care, and health⁵—play a role [INGO nutritionist (13), INGO nutritionist (9), INGO food security advisor (6), Nutrition expert (8)], so possibly there is no single main reason there is persistent malnutrition. However, how these underlying causes are interrelated, or situated in relation to each other in a causal pathway, will differ according to context:

"In all of these contexts, it's pretty clear that the primary driver most of the time is some combination of caring practices, and health- and disease-related issues, but not the mechanism or the pathway that links to undernutrition, which is different. Diseases always linked to undernutrition, but why there are diseases and how and why they are they linked differs in every context." [INGO nutrition advisors (4 and 5)]

"Care practices will be of the same significance in different contexts. But what contributes to the barriers for care practices differs by contexts." [Nutrition advisor (22)]

So rather than reviewing each of the individual components of the framework, we turn instead to

⁵ UNICEF (1990) grouped the underlying causes of malnutrition into three main clusters: basic health services and a healthy environment; household food security; and maternal and child care.

exploring some of the common questions or themes that came up in the interviews or literature in relation to the drivers and pathways leading to persistent GAM.

Immediate causes: Food intake and/or disease?

In the past, scholars looking at the impact of malnutrition suggested that food intake was more important than disease, although views have changed with increasing recognition and understanding of the role of disease and biological utilization. For example, research in Keneba, Gambia showed that despite reductions in diarrhea incidence and duration of attacks over 15 years, nutritional status did not improve, which led researchers to suggest that these children were malnourished primarily because of a lack of food rather than because of high rates of diarrhea (Poskitt et al., 1999). In a published response to this work, Bagott argued that although acute diarrheal disease may not contribute significantly towards poor growth, the underlying enteropathy does (Bagott, 1999).

The UNICEF framework explicitly recognizes that malnutrition must be caused by inadequate food intake and/or disease, or the unspecified interaction between the two. As Weaver (1999)⁶ points out, we can be more explicit about this interaction and say that nutrition is linked to “insufficient intake, defective digestion or absorption, increased metabolic demands, or excessive losses (largely from the gastrointestinal tract).” With increasing understanding of how disease and environmental enteropathy contributes to malnutrition, it is time that these factors are made more explicit in any conceptual framework of drivers of malnutrition and related strategies and policies.

Since the earlier work that suggested lack of food might be more important than diarrhea, the pendulum of opinion has swung towards the importance of disease and environmental enteropathy.

Underlying causes: Food

Famine and famine response are fundamentally linked to alleviating hunger, malnutrition, and death through the distribution of food to the starving. This food-first focus (Pelletier, Deneke et al., 1995) was challenged following the epic famines of the 1980s across the Sahel, after which relief agencies expanded their famine response strategies to include health, water, sanitation, and shelter in addition to food distribution. While the importance of addressing both food and health crises has long been recognized, acute malnutrition is nevertheless still strongly associated with situations of food insecurity. For example, many of the highest levels of GAM have been recorded in famine/food insecurity-related emergencies (Borrel and Salama, 1999; Young et al., 2004). Hence, the food-malnutrition nexus still tends to dominate much of the literature and thinking of emergency practitioners, policy makers, and scholars.

In relation to persistent GAM, the explanation is not as clear. Several interviewees noted recent examples of persistent GAM that appeared NOT to be linked to household food insecurity, or where the level of food insecurity indicated some cause for concern, but was not at a level that would explain the concurrent extremely high levels of GAM [Somalia, Afghanistan food security expert (3), Kenya UN nutritionist (10), Niger INGO nutrition advisors (4 and 5)]. As one expert remarked, “Over time food security may play less of a role than is commonly held” [Food security expert (3)]. Similarly, in Niger, in a “non-exceptional year” food security was not a driver [Food security expert (3)]. The evidence for this conclusion was that, seasonally in Niger, food security can be shown to improve (as indicated by household and individual dietary diversity), yet prevalence of GAM remains high [INGO nutrition advisors (4 and 5)]. See Case Study 4 on the Zinder Region and Maradi Region of Niger in Annex 2.

Some interviewees voiced surprise that food security has recently been shown to be not that important [Food security expert (3), Food security advisor (6)] and emphasized the known links between

⁶ L. T. Weaver has a commentary accompanying the Poskitt et al. (1999) article.

climate shocks, availability and access to food, and undernutrition, particularly in Sahelian countries, but less so in southern Africa. Some suggested more regional analysis would be helpful [Food security advisor (6)] to uncover other evidence of the importance of food versus health or care.

Underlying causes: Care

The concept of care for children and women speaks directly to UNICEF's mandate and the international conventions that underpin it.⁷ The development of this concept of care as an underlying cause was slower compared to the food and health clusters of causes (as the latter were already associated with specific sectors and disciplines). Care on the other hand was a relatively new concept in the 1990s, yet to be fully articulated and incorporated into emergency programs (Longhurst and Tomkins, 1995).

The past decade has seen considerably more progress, with several of our interviewees emphasizing the role of care as an important but not always a widely understood driver of GAM [INGO nutritionist (13), UN nutritionist (7), INGO nutrition advisors (4 and 5)]. In the Zinder and Maradi Regions of Niger as well as in Kanem, Chad case studies (see Annex 2), the Link-NCA found that care practices were indirectly associated with malnutrition, with little correlation to changing food insecurity. Care is strongly linked to gender, issues of protection and empowerment of women, maternal nutrition, women's workload, and women's limited access to services (not only health, but also education, childcare facilities, microfinance):

"In Niger, women's empowerment is one of the major causes [of persistent GAM], protection linked to undernutrition, religion, and cultural factors are big drivers [of GAM]." [INGO nutrition advisors (4 and 5)]

"Mothers heavy workload and limited access to services, so having enough time to spend time with the child who has lost their appetite. This is really the biggest reason." [UN nutritionist (7)]

"Most of the Link-NCAs come out with huge issues related to gender and workload of women, but there are no [quantitative] measurement tools to examine this—so no clear evidence. It is obvious that this is an important driver—BUT we are stuck in how to measure and then address this." [Nutritionist (16)]

Access to education is considered a component of care, and in some cases was found to be a priority of women (see Niger and Chad case studies in Annex 2).

Underlying causes: Health

The health cluster is concerned with access to and utilization of health centers, and the wider public health environment, which is linked to water, sanitation, crowding, and other factors contributing to infectious disease. Access to services has already been identified as an important potential driver, linked to care of children above. Access to health was implicated as one of the variables associated with malnutrition in the Kanem, Chad and Northern Bahr-el-Ghazel case studies (see Annex 2). The role of access to health services in child malnutrition in the literature is shown to be highly contextual (Auon et al., 2015). The utilization of health services has also been correlated to caretaker perceptions of what constitutes an illness requiring health services. A study in southern Malawi found that a mother would take her child to a health center if he/she had diarrhea or fever but did not recognize malnutrition as the underlying cause (Flax et al., 2016). In Chad, for example, access to health was associated with distance and quality but also with household perceptions about the utility of the health center versus a traditional healer [INGO nutrition advisors (4 and 5)].

Basic causes

Several interviewees considered the basic causes of GAM as the root causes of persistent GAM, as they impact all three underlying causes [Food security advisor (6), Nutrition expert (8), INGO nutritionist (9), Nutritionist (11)]. Unfortunately, there is not room here to elaborate on an analysis

⁷ Convention of the Rights of the Child and the Convention on the Elimination of all Forms of Discrimination against Women.

of basic causes, but this perhaps is one of the major gaps in our collective understanding of the issue of persistent GAM.

From the interviews, we are able to identify four overlapping perspectives on the basic causes of persistent GAM, which are all socially and politically constructed:

- 1. Protracted war, conflict, and insecurity** linked with social and political marginalization, and distorted power relations, which contributes to extreme vulnerabilities [Nutrition expert (8)]. Conflict and insecurity are frequently linked with blocked roads, looting, raiding, disrupted livelihoods, security risks, and protection threats, including intimidation and violence that can affect people directly or indirectly, forces people to flee, and drives a high level of displacement. Mobility is often restricted, thus limiting livelihoods and opportunities for return and recovery. In turn, protracted conflict and insecurity result in a difficult context in which to negotiate access and implement programs [INGO nutritionist (9)].
- 2. Inequalities and poverty** linked with the political and economic marginalization of certain regions or groups. For example, in the more remote semi-arid pastoral regions of Kenya, Sudan, and Ethiopia, communities suffer a comparative lack of basic health and education services. This lack is also often associated with a high level of inequality and poverty, both of which are major factors contributing to increasing vulnerabilities in the face of shocks:

“Every nutrition causal analysis [NCA] has women’s limited time and poverty as an issue. And every single NCA will come up with that, but no single program has addressed it.” [Nutritionist (24)]

“[There is] a lot of marginalization in Somalia. So even if they [the marginalized group] can walk to the health center they would not be allowed inside. They can stand right outside of it but would not be let in because they are considered unholy.” [Nutritionist (24)]

- 3. Governance of natural resources, particularly in the context of demographic and climate pressures.** The management of natural resources includes land use and land tenure, and the sustainable management of agricultural, forestry, pastoralist and other natural resources vital for livelihoods and other factors influencing land use.
- 4. Migration and displacement** generate twin pressures, first on the households, and especially on women left behind who often have lost a main provider, and second on the rapidly growing urban peripheries that are home to many migrants, displaced, and dropouts from rural livelihoods.

Cross-cutting themes

Frequently, respondents mentioned themes that are cross-cutting, ones that are not explicit in the UNICEF framework. These include: the previous history of vulnerability and drivers of malnutrition; long-term trends; impact of seasonal climatic patterns on drivers of malnutrition; gender; and livelihoods or source of food and income.

History of vulnerability and long-term trends driving acute malnutrition

The fact that GAM is persistent over years, if not decades, merits consideration of the long-term trends in acute malnutrition and how drivers of malnutrition potentially change over time, something that is rarely considered.

Seasonality

It is well known and widely accepted that the prevalence of GAM is worst during the rainy season or prior to harvest and best during the months following the harvest (Longhurst, 1979; Teokul et al., 1986; Hillbruner and Egan, 2008). The implicit assumptions are that the most difficult periods are linked to the “lean season” or “hunger gap,” i.e., food insecurity, or alternatively to an increase in the transmission of waterborne disease associated with the rainy season. A study of the urban poor in Burkina Faso found that intakes of energy and micronutrients were significantly lower during the

lean season than during the post-harvest season (Becquey, Delpuech et al., 2012). Hillbruner and Egan (2008) demonstrated significant seasonal patterns of both undernutrition and food security indicators in Bangladesh, with households consistently worse off during the monsoon season, compared to the post-harvest season. However, in subsequent modeling of nutritional status and growth velocity, none of the seasonally varying explanatory variables (including dietary diversity) were significant. Research done by Maxwell and Burns in South Sudan (2008) using nutrition survey data from 1999–2006 identified two peaks of malnutrition, one in April/May following the end of the dry season and another in July/July corresponding with the peak of the hunger season (Maxwell and Burns, 2008).

A recent survey providing a nutrition analysis in Niger (see Case Study 4 in Annex 2 for more detail) found pronounced seasonal variation in the prevalence of child wasting among agropastoral and agricultural livelihood zones in Maradi and Zinder, with an increase in wasting during the agricultural pre-harvest “lean season” from July to September, as compared to the post-harvest season (McDonald, 2017). A nutrition and food security surveillance specialist [Food security expert (3)] concluded from this finding that seasonality was more pronounced than anticipated and that surveys during the lean season are of limited use for early warning. The implication is that we urgently need to better understand seasonality of persistent GAM and its underlying causes. We also need to recognize that cross-sectional surveys give us no clue about these seasonal dynamics, as they take a snapshot in time and therefore risk missing these short-term (within-year) trends altogether.

In the same region, seasonality effects are not necessarily uniform. Different groups may experience more or less pronounced seasonal peaks or improvements in nutritional status. In Niger, the variation was more pronounced in the agropastoral zone (farming and livestock) compared to the agricultural zone (mainly farming, and no livestock) (McDonald, 2017).

Alternatively, the timing of the seasonal peak in acute malnutrition may differ in the same region. For

example, pastoralists do not experience the same livelihood stresses as farming communities in the same areas. Their year is shaped by their annual livestock migrations and not the agricultural calendar (Loutan and Lamotte, 1984). Their peak seasonal stresses are at the time of the end of the hot dry season and at beginning of the first rains (pasture is limited, livestock are in poor condition, new grass is not yet available, and the first rains wash livestock fecal contaminants around permanent water sources into the wells). This period may also coincide with a seasonal peak in acute malnutrition in these communities.

There are three final points to note about seasonality. First, Chotard et al. (2010) found that seasonal fluctuations in wasting were greater among pastoralists during years of drought and helpfully concluded that “knowing the typical seasonal fluctuation should be useful both for assessing the severity of malnutrition at one time and for predicting early how far malnutrition rates are likely to rise with the onset of leaner times” (page S220). Second, seasonality is likely to have a greater impact on a population affected by chronically high levels of malnutrition (persistent GAM), and therefore it should be considered more carefully when designing programs (Hillbruner and Egan, 2008). Lastly, seasonal effects on nutritional status may also be mitigated or ameliorated by other factors. For example, more recent evidence indicates an indirect climate effect on growth (stunting) in Nepal among households that depended on their own food production. This effect was mediated by changes in agricultural production and hygiene (Mulmi et al., 2016).

Gender

Gender is obviously a cross-cutting theme in the nutrition framework and is not limited to issues in the care cluster. Both household food security and access to healthcare reflect or involve gender differences or typical gender roles. Several respondents argued that the situation of women, lack of women’s empowerment, women’s workload, and lack of protection were among the major causes [INGO nutrition advisors (4 and 5)]. Yet on the other hand, another nutritionist pointed out that “blaming the mother” (in relation to their poor

feeding, hygiene, or health practices and knowledge) is a widespread and general discourse [Nutritionist, (16)].

Gender not only cuts across the underlying causes of malnutrition, it also cuts across scales of analysis, from household to basic causes. Nutrition expert (8) explained that many reports emphasize household-level drivers, such as caring behaviors, and conclude GAM is a result of cultural practices, caring, and hygiene behaviors. However, these completely ignore wider issues linked with vulnerability, such as access to land and employment, inequalities in ownership, and vulnerabilities within communities. Nutrition expert (8) argues that household-level caring practices are unlikely on their own to lead to very high rates of GAM and need to be considered in the context of the wider basic causes of malnutrition. It may be misleading to identify a lack of care as a driver of malnutrition in a protracted crisis without first looking at the determinants of those behaviors [Nutrition expert (8)].

Livelihoods

Household capacities, access to resources, and vulnerabilities are directly linked to the household's livelihoods, and thus, like gender, livelihoods impact all three clusters of underlying causes, and are themselves directly impacted by basic causes, risks, and shocks.

The other dimension of livelihoods that is missing from the UNICEF conceptual framework is a consideration of local perspectives and priorities, which is at the heart of sustainable livelihoods. People's livelihoods also reflect their decision-making regarding resource allocation. A study in the aftermath of a food crisis in rural Niger revealed the mismatch of views between external interventions focused on saving individual children's lives, and local priorities aimed at spreading risk and the preservation of long-term livelihoods (Hampshire, Casiday et al., 2009). While there was an ethos and practice of equal investment in children, there were marked intra-household differences in child growth, driven in part by all-pervasive poverty (Hampshire, Casiday et al., 2009).

In conclusion to this section, the UNICEF conceptual framework provides a plausible, yet on its own insufficient, explanation of causality. For example, seasonality, gender, and livelihoods are three cross-cutting issues that are not explicit in the UNICEF framework yet, since the 1990s have been shown to be more interesting and potentially helpful in addressing the drivers of malnutrition than much of the original model is! Second, most efforts to understand the drivers have tended to focus at the household level, with less attention to a comprehensive analysis of the underlying causes. An adequate elucidation of basic causes in protracted crises is also distinctly lacking.

Some argue that the domination of the UNICEF framework has unintentionally generated a false level of confidence that we have sufficient understanding of the causes of malnutrition and how they operate [Food security expert (3)]. In turn, this complacency potentially discourages efforts to dig deeper or better understand cross-cutting elements, like gender, livelihoods, and seasonality, or inter-linkages and pathways that show one underlying cause driving another. It is generally assumed we know what the underlying causes are (as specified in the framework), which then limits data collection to these elements:

"In the end you are just looking at the nutrition causal framework. [Donor (20)]"

"What I worry about at times is 'what we know relates to what we do.' When we are not doing something, we are not tracking it." [Donor (20)]"

It could be argued that because the UNICEF framework is so deeply engrained and embedded in the nutrition psyche, it is becoming increasingly difficult to promote qualifications to the theory and concepts, especially when the emphasis is always on the development of a locally specific nutrition analysis. While a strength of the framework is its simplicity, this can be limiting and enforces a rigidity on the analysis that at times can be unhelpful.

The cross-cutting themes discussed above are fundamentally important and easily as substantial and interesting as any part of the UNICEF Nutrition Conceptual Framework. It is time for a change.

What is clear is that malnutrition causal pathways are complex, unlike the short linear pathway between agent and infectious disease. Despite this complexity, there remains the Holy Grail for many donors and practitioners—the pursuit of the single driver of acute malnutrition and associated magic bullet. While this pursuit is not to be ignored, it is unlikely to ever yield the successes that might be generated from a more comprehensive approach to improving nutrition based on an understanding of social, economic, and political drivers of malnutrition in a given context.

The way the UNICEF framework has been applied, especially the focus on the individual and household level, as well as the proposed technical solutions (treat severe acute malnutrition (SAM), dig a borehole, provide 15 liters of water per person per household, provide seeds and tools, etc.) has depoliticized nutrition analysis, and led us away from understanding the social construction of malnutrition and its social, economic, and political determinants.

3. Methodological challenges in identifying trends in and drivers of GAM

Challenges in identifying trends in GAM

Part of the challenge of identifying whether the problem of persistent GAM even exists is the lack of data on wasting, and its comparability across time and populations. In this section, we highlight the challenges that are raised by key informants and that are explored in the literature.

Comparability across time

Since the 1980s, there has been a large improvement in the standardization and comparability of malnutrition prevalence data, starting with the guidelines provided by World Health Organization (WHO) in 1983 (WHO, 1983) and followed by the solidification of the current SMART design (SMART, 2006) with the 1995 Médecins Sans Frontières (MSF) Nutrition Guidelines (MSF, 1995). And while greater standardization has led to a proliferation of surveys and nutrition data, significant challenges remain. For example, while SMART surveys allow for greater standardization, the methodology was not widely used until the mid-2000s. The lack of historic data utilizing the same methodology hampers being able to see long-term trends. Furthermore, because the SMART methodology was specifically developed for emergency settings, in relatively stable periods SMART surveys are less likely to be carried out, leading to substantial gaps in the data.

Another concern for comparability across time is the switch from the National Center for Health Statistics (NCHS) reference data to WHO growth standards in 2006. Specifically, important differences were

observed in the WHZ cutoffs used for defining acute malnutrition between the two growth standards (Seal and Kerac, 2007). The WHO standards result in higher-prevalence estimates of SAM by 3%, with no difference in the prevalence of moderate acute malnutrition (MAM).

The variation in the timing of data collection can also hamper comparability. Besides gaps in annual data mentioned above, acute malnutrition is highly seasonal in many of the contexts discussed here. Thus, data collected during the harvest period cannot be compared against data collected in the rainy season if the aim is to establish long-term trends.

Nor can we assume that the population itself is static. As discussed earlier, especially in camp settings, one cannot necessarily presuppose that it is the same population (Tondeur et al., 2016): “You assume you are measuring the same people each time, so you should be seeing some gradual movement. Perhaps we are not capturing the same people” [Donor (20)].

Finally, there is the issue of how the data are reported and what geographical region they are supposed to be representative of. National-level data or data aggregated to the national level can mask hot spots of malnutrition (see the Senegal example in section 1). Conversely, surveys of smaller areas, such as SMART surveys, can mask regional trends. Thus, in order to truly be able to establish a trend in wasting, one needs consistent data on a yearly basis, capturing seasonal variation, on the

same geographic area and population over time. While a tall order, it is not inconsistent with the data demands of measuring nutrition indicators for both the World Health Assembly and Sustainable Development Goals. Many of the NGOs that have ongoing programs already collect a large amount of data for the purpose of monitoring and evaluation (M&E). However, without considerations for long-term comparability, they are missing an opportunity for more “historical analysis of GAM rates and other indicators, so our analysis is a bit limited, very much into monitoring individual projects, and a lack of attention to trends” [Food security advisor (6)].

Comparability across populations

One issue that came up several times in the interviews was that physiological differences produce artificial differences in malnutrition rates, specifically referring to the role of body shape and variations in the sitting/standing height ratio of different groups. One key respondent noted that persistent GAM “is partly an artifact of measurement and all down to body shape (long-limbed versus short-limbed phenotypes, note different trunk to leg length ratio)” [Epidemiologist (14)]. Comparisons between mid-upper arm circumference (MUAC) and WHZ for different populations underline this issue. One respondent noted there “are differences in the prevalence of GAM depending on whether MUAC or WHZ is used. For example, in South Sudan, where there is persistent GAM based on WHZ you don’t see the same persistently high levels of GAM based on MUAC measurements” [Independent nutritionist (11)].

An analysis among Somali and Afar pastoralists shows that the prevalence of GAM by MUAC is less than the prevalence by WHZ (1 versus 9% respectively for children between 24 and 59 months), while in agrarian societies it was similar (both very low < 3%) (Myatt et al., 2009). Because the adult phenotype establishes itself quite early, after two years of age the role of genetic physiological differences would be picked up in the anthropometry data of under-fives. The difference for children under the age of 24 months is likely less stark given established growth curves.

The WHO guidelines on identifying children with SAM using anthropometry do not address the possibility that physiological differences produce different malnutrition estimates in children and specifically highlight the similarity between prevalence estimates using MUAC and WHZ (WHO and UNICEF, 2009). As one interviewee highlighted, the WHO growth standards, more generally, imply that what is true for the six countries for which child anthropometry data were collected would apply universally. Perhaps that assumption itself needs to be tested [Nutritionist (1)]. Among adults it is well established that body shape (as measured by the sitting height/standing height ratio (SH/S)) influences measures of anthropometric status of adults as measured by body mass index. For example, shorter limbs and a longer body imply heavier weight for a given height. This body shape difference can be corrected using the Cormic index (Collins, Duffield et al., 2000). The slightly different SH/S measures (0.5698 and 0.5585) among children aged 2 to 5 years found by Myatt et al. (2009) do raise questions as to whether the impact of these slight body shape differences among children account for differences in weight-for-height GAM estimates. Note differences between weight-for-height and MUAC estimates among older children are to be expected, as arm circumference increases with age, so fewer older children are likely to fall below the fixed cutoff, unlike the age-adjusted weight-for-height cutoff. There is no clear guidance on how to correct for this in the literature that we could find.

Methodological challenges in understanding drivers of GAM in contexts where GAM is persistent

Compared with efforts to estimate GAM prevalence, there is less experience of investigating drivers of GAM. However, there is growing recognition of persistent GAM and increased efforts to develop and apply approaches to analyze causes, or rather the drivers, of malnutrition. Table 1 in Annex 1 briefly summarizes the different approaches to the analysis of the drivers of acute malnutrition, with examples broadly grouped into quantitative surveys, qualitative approaches, and mixed methods.

Cross-sectional (for example, SMART) surveys are the most common nutrition data collection tool in emergencies, yet they have not been widely used to analyze statistical associations. Generally, given the extent of SMART surveys, there are relatively few examples of more in-depth statistical analysis:

“While the GAM trends are available, there is generally a lack of comparable data on underlying causes to allow statistical correlations between available indicators on drivers and GAM to be calculated.” [INGO food security advisor (6)]

The SMART methodology is standardized and so does not account for possible differences in variability between and within villages across different contexts. Hence, if it is being used to establish associations, a different and more contextually specific sampling strategy should be used.

There are also serious limitations with the statistical analysis of surveys, which is often very limited, including simple descriptive statistics, overlaying different indicators and nutritional status data, and reviewing visually where the two sets of data overlap without actually confirming any statistical associations. This simple analysis might be useful as a first step in developing hypotheses and for stakeholders to review trends, as done with the IPC Acute Malnutrition Framework analysis, but it does not allow the confirmation or validation of specific pathways and factors. It also allows for “assumptions” to play a larger role in identifying drivers because if you are not testing or validating a relationship, it is potentially easier to impose preconceived notions onto the data:

“The evidence base is only in relation to your study, and you do not acknowledge other drivers because they are not part of your study.” [Donor (20)]

Even where associations are found, these are not necessarily causal, and their relationship to GAM cannot be deduced from the association alone. For example, Pelletier (1994) argues that the relationship might not necessarily be causal and that results only give evidence of association because “child malnutrition and mortality may cluster in the same households as a result of socioeconomic

and behavioral factors that cause malnutrition and mortality. When such confounding is operating, the observed, bivariate association between malnutrition and mortality would tend to *overestimate* the strength of the actual relationship between the two” (Pelletier, 1994, 2015S). When hypotheses are developed, it is important they are confirmed or validated, which is not always done [NGO food security advisor (6)].

Without more in-depth analysis that requires statistical expertise and some understanding of the variables and context, it is extremely difficult to interpret findings. Capacity for more in-depth statistical analysis is generally not available locally. INGO food security advisor (6) described a nutrition surveillance project operating since 2011 that lacks the capacity to analyze the data. Sometimes data are analyzed remotely by statisticians who in turn lack the understanding of the context that is necessary for making sense of the results and understanding program implications [Independent nutritionist (11)].

Development of the Link-NCA approach

With increasing recognition of the problem of persistent acute malnutrition, efforts turned to developing methodologies and response-oriented approaches to address this problem:

“ACF [Action Contre La Faim] first promoted Link-NCA in countries where they have operated for many years, and where there has been relatively little impact on reducing acute malnutrition in the longer term [NGO food security advisor (12)]. For some, the aim is not to learn about new risk factors; rather the idea is to influence donors. Thus, the push for Link-NCA is linked to calls for longer-term multisectoral nutrition-sensitive programming and influencing and leveraging funding.” [NGO food security advisor (12)]

Link-NCA is “a participatory and response oriented method to conducting a nutrition causal analysis” (ACF, no date). The development process of this approach is fairly unique. Drawing on their long history of working with an “International Scientific Committee,” ACF sought expert advice from both academics and professionals in this field as they developed and piloted this approach. They have now completed about 30 Link-NCAs in a range of contexts, across Africa, central and Southeast Asia,

and in the Caribbean (Haiti), which are available on their website (<http://linknca.org/studies.htm>). Link-NCA has become a well-known approach supported by a wide range of donors, INGOs, and UN agencies. The five steps of this methodology and background to its development are described in Figure 6 in Annex 1.

In our interviews, there was much commentary about the strengths and limitations of this approach, as well as of the challenges of doing NCAs generally (see Table 2 in Annex 1). Some of the main strengths highlighted by the interviewees were related to the point that the Link-NCA can raise awareness and even change attitudes among local and regional stakeholders:

“A district medical doctor said, ‘I really had this vision that women are traditional and don’t understand the causes of certain diseases, and follow strange behaviors and practices, but in fact now I realize how much they know. There are reasons for their behavior: it is rationale.’ The Link-NCA changed his perception and can produce a change in mentality, the way you look at the community, the way men consider women, or the (arrogant) technical experts.” [Nutritionist (16)]

It can also contribute to consensus building among stakeholders:

“It does bring together different stakeholders... bringing partners together to talk about how nutrition is addressed.” [Donor (17)]

In addition, the Link-NCA approach provides clear steps and a methodology that allows for comparisons across countries. For example, currently ACF is taking on a 30-country meta-analysis looking at the role of gender in child malnutrition. Other strengths mentioned included that it allows for a locally specific analysis, can reveal unexpected findings (such as much of the work on gender), and helps move away from a prescriptive, siloed approach to understanding the diversity of associations with malnutrition.

Challenges with the approach were also highlighted. However, it is worth noting that many of the criticisms of or challenges to the Link-NCA easily

apply to other developing methodologies; for example, coverage surveys such as SQUEAC (semi-quantitative evaluation of access and coverage) and SLEAC (simplified lot quality assurance sampling evaluation of access and coverage). Similarly, several of the criticisms, particularly those relating to uptake of findings and response, apply equally to other NCA methodologies. Thus, a better understanding of the strengths and limitations of the Link-NCA approach allows us to learn from this experience and progress in the approach.

While Link-NCA and similar methodologies are obviously considered important, there is in some quarters a lack of confidence and perhaps understanding of a mixed methods approach; for example:

“We don’t know how to prioritize these things. In the absence of a methodology that people feel very confident in. Perhaps there is not one single methodology that could address it, too context specific. People are paralyzed and cannot act.” [Donor (20)]

“The danger is that if the NCA does not show anything new, donors will stop investing in them.” [Nutrition advisor (22)]

The issue of response analysis or uptake of findings remains the single greatest challenge. These issues are not unique to the Link-NCA and illustrate the far wider issue of linking findings to response in a meaningful way:

“Did not always know how to translate the findings into theories or programs. Even the most expert person would be confused.” [Nutrition advisor (19)]

One issue that could be addressed is that real-time changes to programming are not incentivized, as opportunities are limited within the context of short-term funding and an inflexible program design and associated logframe. These issues suggest there might be a need for donor education [Nutritionist (1)] to understand areas around which there is a general consensus; for example, that the problem is a complex one [Nutritionist (1)], that there is a lack of simple answers, that a properly conducted NCA

requires substantial and wide-ranging resources (technical, financial, and time), and that NCAs must be sequenced with program decision-making. As one interviewee put it:

“Link-NCA synthesizes our current knowledge about a specific context, and so for some this is not enough or misleading to base policies and programs on this type of findings, because you can argue about the validity of this kind of results. But it’s the best we can do at the local level. If you are working at international level it may appear trivial, but in the field—not everybody knows or is sensitized to the multicausality, seasonality, and trends—there is a lot of misperceptions still, so from this perspective Link-NCA is adding value—complementing their knowledge with the scientific evidence we have at the moment.” [Nutrition expert, (16)]

Ultimately, a balance must be struck between the resources required, and the depth and intensity of the methods and consultative processes. The less intense and consultative approach may save time and money but will not produce the same degree of rigor, depth of analysis, and stakeholder engagement and buy-in.

4. What are the implications for current practice and policy?

As this report has made plain, unacceptably high levels of GAM have persisted in the same countries, regions, and even localities for many years and sometimes decades. This section considers the implications of this persistence for current practice and policy and starts by summarizing the obvious reasons for the limited impact of emergency programs. Next, we highlight some of the challenges facing the current aid system and discuss how these challenges might be addressed.

Why are current programs having a limited impact on persistent GAM?

The aim of international humanitarian programs is to prevent and alleviate suffering and save lives. A central part of this effort is addressing acute malnutrition. During an acute emergency, the focus must be on the here and now. There is little time to consider how the past influences the present (whether the past is the history of marginalization and vulnerability or the in utero fetal development). Over time in protracted crises, as the problem of persistent GAM becomes increasingly evident, agencies are caught in a bind. While their nutrition-specific programs are able to treat acute malnutrition, their programs have limited impact on the specific underlying causes that are contributing to persistent GAM. This situation presents two problems: first, how to stimulate debate on this issue without raising concerns about the performance and efficacy of international programs; and second, the issue of exit strategies and challenges linked with transition, when there are no tried-and-tested approaches or models of response to persistent GAM.

Limited experience of successful exit or transition in the context of persistent GAM

“In general, we are never ready to exit.” [INGO nutritionist (13)]

There is limited experience of transitioning from emergency humanitarian response to a new way of working, involving new tools and approaches and new partners and networks, one that is capable of addressing the problem of persistent GAM. While there has been a major shift towards building resilience and longer-term multisectoral programs, these programs rarely includes explicit nutritional goals. There are of course some exceptions (for example, the No Wasted Lives coalition and the Community Resilience to Acute Malnutrition program in eastern Chad (Marshak, Young, and Radday, 2016), but the limited extent of this experience shows how undeveloped this field is. A good example of this gap is that despite a donor focus on funding resilience programs, there is considerably less attention on how to build resilience to the seasonal peaks of GAM [Independent nutritionist (11)]. How many resilience-building programs in the Sahel, for example, understand when the seasonal peaks in acute malnutrition are and whether those peaks vary for different populations?

Structural issues hindering advances

It is worth considering the structural issues within the humanitarian aid system that hinder advances in more comprehensive NCA and response planning, and multisectoral nutrition programming. As pointed out by several respondents, the humanitarian nutrition cluster has been based on a short-term, siloed approach, with nutrition-specific interventions

at its heart, rather than prevention (which is either seen as part of development or falls under the remit of another humanitarian cluster [UN agency nutritionist (7), INGO nutrition advisors (4 and 5)]:

“Nutrition in emergencies is generally CMAM [Community Management of Acute Malnutrition] centered: the detection and treatment of acute malnutrition. Meaning you are focusing on the children that are SAM [severely malnourished], so ignoring the MAM [moderately malnourished] population. All messages are for SAM cases, much less for MAM cases. Treatment of MAM is more rushed and more of a distribution. If we focus our messages just in these groups, it is only a small population that receives those messages. We are not doing prevention in an adequate way.” [Nutrition advisor 23)]

“But in the countries we are discussing [protracted crisis], we continue to work in emergency phase, so keep our focus on the SAM kids. It’s a health facility-oriented kind of approach. Very difficult to get people to change their mindset.” [Nutrition advisor (7)]

“Now recognized that a siloed approach—just food security or care, etc. is problematic. The [underlying causes] are all interlinked—very important to think about pathways and mechanisms, and not in terms of siloed sectors.” [INGO nutrition advisor (4 and 5)]

The process of NCA is not part of the usual humanitarian funding/program cycle (assessment, proposal, program, M&E) which is in contrast to the UNICEF NCF linked to the “triple A approach” or program cycle (UNICEF, 1990).

Nutrition surveys are usually done once funding is secured and when there is little opportunity for changing programs. Resources for nutrition analysis are not generally available, and thus funding depends on ad hoc donor support. The issue of securing funding is made more difficult by the fact that doing a quality NCA is resource intensive:

“NCA and program planning are like the chicken and the egg—you cannot have one without doing the other first. This generally means any NCA

needed for program design at the proposal stage is done (if done at all) using available secondary data and is usually up to the country team (who is primarily dealing with the day-to-day concerns of programming).” [Independent nutritionist (11)]

“The real hard part is for people to take the time in the funding cycle to advocate for multi-year funding to be able to look more deeply at causes.” [Donor (17)]

“It [funding for NCA] depends on the response. If in a new context or with a new problem, [the donor] will ask the funded organization to do the NCA in the lifecycle of the project. However, most of the funding is just one year, so it is difficult to demand it. Frequently, [the donor] asks the NGOs to get other partners to do the NCA. But none of this is a requirement for humanitarian funding. Most donors do not even require a baseline SMART survey. Most of the time there is no time to even establish a baseline.” [Donor (17)]

In the interests of standardization, humanitarian programming is often mechanistic in terms of its targeting strategies and timing (for example, seasonal safety nets or SAM treatment), with little analysis of local conditions and needs or how to successfully engage local actors and ensure handover. For example, in the Democratic Republic of Congo, there is a system of tracking SAM admission trends, which are then used to trigger a SMART survey if a threshold is crossed and support for treatment of SAM, but they do not incorporate causal analysis. After more than five years, the INGOs find themselves continually returning to the same place every year [Nutritionist (11)]:

“Often we are working year in and year out with the same target groups or ‘beneficiaries’—women and children (while excluding others—youth, men, etc.).” [NGO Food security advisor (12)]

While the importance of nutrition data has long been recognized, malnutrition prevalence data, rather than analysis of drivers, have been universally privileged. Decision-making frameworks have always prioritized prevalence data and descriptive statistics (SFPs in the 1980s, Sphere in the 1990s, SMART and IPC in the 2000s), while paying scant attention to the

analysis of contributing factors, with the possible exception of food security in the 1990s, and more recently to infant and young child feeding (IYCF).

Part of the problem might be a result of overconfidence in our assumption that the drivers are generally well known, which in turn generates unjustified confidence in our response options. This confidence in part arises from the UNICEF NCF itself (see this point elaborated under section 2).

What is the answer?

Just like the problem, the answer is not simple, but below are a few strategies and ideas for moving forward.

Treatment and prevention need to go hand in hand at all stages of emergency, while efforts to hand over treatment programs need to be matched by supporting national bodies (government, civil society, and technical institutions) to develop a more comprehensive multisectoral approach.

Nutrition-sensitive program inclusion requires partnership, localization, and new ways of working. In emergencies, the nutrition INGOs are often the source of technical expertise, funding, and leadership. Shifting to a nutrition-sensitive approach requires a reconfiguration of partnerships, involving multiple sectors, often with an explicit goal of localization. Partnerships between international and national NGOs are now receiving greater attention as part of the localization agenda in the “Grand Bargain” struck by the World Humanitarian Summit (WHS) in 2016, which raises issues of power relationships within the partnership and consideration of inequalities. INGO and UN leadership must be supported by facilitation, collaboration, and joint learning; supporting of local partners and bridging the divide between practitioner, policy maker, and researcher; and bridging of the gap between local, national, and international actors. INGOs are potentially well placed to implement nutrition-sensitive programs, as their experience of handing over CMAM to government has shown, but they will need to cultivate a wider network of stakeholders encompassing multiple interests and perspectives.

The root causes of persistent GAM must be acknowledged and reflected on. The social and political context of persistent GAM and the fact that nutritional vulnerability is frequently a social construction (a result of social characteristics that disadvantage and disempower some groups, communities, households, and household members) mean the challenges will be greater compared with nutrition-specific interventions, and therefore a stronger base of stakeholder engagement and buy-in will be necessary.

Support for analysis and multisectoral response planning must be increased. The international community needs to provide the impetus for including causal analysis as part of the program cycle, irrespective of the donor and organization and their confidence in existing assumptions about the drivers of malnutrition. Donors and national governments and others need to promote longer-term investments that promote multisectoral approaches and combine research, learning, and capacity building (bridging the divides mentioned above).

A learning culture, linked to research uptake and response analysis, must be promoted. Researchers, donors, INGOs, etc. need to promote a culture of learning and open reflection about what has not worked as well and what has worked. Frank reflections, opinion pieces, and short field reports should be valued, as well as peer-reviewed papers in reputable journals.

5. What are the implications for future research?

The above section provides recommendations for how programs and policy can better address the issue of persistent GAM. Part of the answer is allowing for greater space for research to guide programming as well as an increased emphasis on research uptake. However, as this review and a recent World Bank report highlights, part of the reason that there is an insufficient knowledge on what programs are effective at preventing wasting is the limited evidence base of the pathways leading to the incidence of wasting (Shekar et al., 2016). In this section, we briefly summarize why the evidence base around persistent GAM is insufficient to provide clear recommendations for programming and policy, and offer suggestions for how the knowledge gap around persistent GAM can be addressed in future research.

Why is the existing evidence base on persistent GAM insufficient?

Persistent GAM has been identified in this review as a significant problem affecting numerous contexts. However, while this problem has been clearly highlighted by our respondents, the solution is far less obvious. In this section, we note some of the key gaps in the existing evidence that hinder our ability to address the problem of persistent GAM.

Limited data and analysis on trends in wasting

One of the challenges addressed in this report is the difficulty of the international nutrition community to identify what the long- and short-term trends in wasting are (see section 3). If we do not have trend data, how do we know there is even a problem? Increased attention on consistent collection of

wasting data corresponds to the emphasis on wasting in both the Sustainable Development Goals (SDGs) and the World Health Assembly (WHA) targets. However, unlike stunting, wasting is an acute measure of malnutrition and can exhibit significant variation within years. All too frequently, there tends to be an “assumption that peaks in GAM are associated with the lean pre-harvest season, but this does not hold in Burkina Faso and other countries. So, need to better understand seasonal differences” [Food security advisor (6)]. Incorrect assumptions regarding the peak of acute malnutrition directly impact our understanding and analysis of its drivers. Thus, the emphasis needs to be on consistent and standardized data collection on an annual basis (not just during an emergency, as tends to be the case with SMART data collection) as well as at key periods within the year.

All too frequently, communities are assumed to be homogenous within a certain geographical area. In Chad, children in pastoralist communities had significantly better nutritional status as compared to children living in more settled farming communities (Marshak, Young, and Radday, 2016). In addition, currently there is insufficient emphasis on designing surveys that can differentiate the prevalence and drivers of malnutrition by sex. Many of the data show discrepancies in malnutrition for boys and girls, but little of it is sufficiently powered to explain why that discrepancy exists. We know that age and sex matters for many humanitarian outcomes, and the recommendation is to always disaggregate data by sex and age (Mazurana et al., 2011). Yet most studies on nutrition do not set out to have a sample size large enough to allow for the recommended disaggregation.

Limited analysis on the relationship between wasting, stunting, and mortality

The Nutrition Conceptual Framework (NCF) includes both mortality and malnutrition (including wasting, stunting, and undernutrition) at the top of the conceptual framework. While the NCF does not implicitly assume that the different outcome measures have a consistent and linear relationship or that they have the same drivers, an overly mechanistic application of it can easily obscure the complexity of the specific pathways.

The complex relationship between stunting and wasting is highlighted by some of the divergent trends between the two measures identified in the areas experiencing persistent GAM. The best example is the case of Pakistan and India, where stunting has significantly decreased, while wasting is either staying static or actually showing a potential resurgence in Pakistan. This divergence in trends is also true of the findings coming out of Gambia, where some progress has been made on stunting, but wasting has persisted above 10% (Nabwera et al., 2017). One respondent shared findings from internal research (no report available) where the researcher superimposed wasting curves on stunting curves and showed that as stunting decreases, wasting increases [Nutritionist (14)]. This finding has implications for looking at the “multiple anthropometric deficits” category, which includes children who are both wasted and stunted. The strong interaction between acute and chronic malnutrition is associated with a significantly higher risk of death than either condition on its own (Briend et al., 2016). The importance of looking at stunting and wasting together was echoed by another respondent who suggested that the relationship between wasting and stunting and how the two forms of malnutrition might drive each other is linked to seasonality and repeated seasonal peaks of wasting [Independent nutritionist (11)].

On a global level, similar to stunting, there has been huge progress in reducing child mortality, with the global under-five mortality rate dropping by 49% (UNICEF, 2014). Similar to the relationship between stunting and wasting, a reduction in mortality is not necessarily an indicator of improved child WHZ. For example, Mason et al. (2012), looking at trends

between the two measures among populations affected by displacement in the Horn of Africa, found that between 1997 and 2009, under-five mortality generally fell by nearly half, while GAM remained steady over the same period (Mason et al., 2012). In the same Gambia study referenced above, mortality also significantly declined, with no statistical change in the prevalence of wasting (Nabwera et al., 2017). Furthermore, a meta-analysis using data from 53 developing countries shows that while 56% of child deaths were attributed to malnutrition, 86% of those deaths were attributed to mild-to-moderate malnutrition as opposed to severe malnutrition (Pelletier, Frongillo et al., 1995). These data are both contrary to the widespread perception that mortality is only associated with SAM and suggest some variation in drivers between WHZ and mortality. The possible variation in the drivers of stunting, wasting, and mortality is further supported by a randomized control trial in Bangladesh that compared nutrition outcomes between a set of villages receiving an integrated management of childhood illness strategy and the control. While a statistically significant impact was observed on stunting, the effect did not translate to differences in either wasting or mortality (Arifeen et al., 2009).

Limited evidence on physiological factors associated with wasting

Section 2 of the report highlights the uncertainty of key informants about what the underlying drivers of persistent GAM are and how that uncertainty might result in the overly mechanistic and simplified adaptation of the NCF. The existing framework primarily focuses in on the immediate and household-level causes of acute malnutrition. However, certain individual-level drivers are not explicitly included in the framework. These drivers include the role of environmental enteropathy, pathogens, and the microbiota, as well as the role of the overall pre-existing nutritional status, including low birth weight and the influence of maternal nutrition on child wasting. An additional research gap relates directly to the issue of zoonosis and the role of livestock in these individual drivers.

Environmental enteropathy is associated with water contamination and the ingestion of pathogens. It was suggested by some of the respondents as potentially

one of the drivers of persistent GAM, both in its direct impact on malnutrition and the role it might play in reducing the effectiveness of traditional humanitarian interventions such as vaccination campaigns (Naylor et al., 2015). While existing research is able to show an association between growth faltering (i.e., stunting) and environmental enteropathy (Crane et al., 2015), the evidence base relating to wasting and environmental enteropathy is far more limited.

Linked to the issue of environmental enteropathy is the health of the microbiota, often implicated as a possibly pathway for environmental enteropathy. Recently, changes in the gut microbiome have been strongly implicated in childhood acute malnutrition, suggesting a cyclical relationship in which malnutrition impairs the normal development of the gut microbiota, leading to its altered composition, affecting absorption in the intestine and immune function, therefore contributing to a greater risk of malnutrition (Kane et al., 2015). Thus, treatment in the form of refeeding alone would be insufficient to break this cycle and could be contributing to the phenomena of persistent GAM. For example, in the same villages in Gambia where no significant change in wasting was observed over the course of three decades, infants between the ages of 3 and 15 months presented with small intestinal mucosal enteropathy 75% of the time (Campbell et al., 2003).

Both environmental enteropathy and the health of the microbiota are linked with the ecological conditions of the child's environment. Kotloff et al. (2013) found that several pathogens, including ST-EPEC, *E. coli*, and *Cryptosporidium* were associated with a greater burden of diarrhea and increased risk of death in infants and toddlers (Kotloff et al., 2013). Transmission included both human-to-human and zoonotic species.

Our own research from Chad highlights the importance of considering the role of zoonosis in child malnutrition. As illustrated in the Kanem Case Study (Annex 2), the Sila Region of Chad also suffers from consistently high levels of acute malnutrition. Findings from an impact evaluation implicated both lack of access to clean water and the presence

of cattle at the village in lower child WHZ, thus hypothesizing the role of *Cryptosporidium parvum* (a zoonotic species transmitted from cattle to humans) as a driver of acute malnutrition in this area. And while Sila suffers from high levels of food insecurity on almost a yearly basis, at no point in the four years of data collection and analysis was any measure of food security correlated with malnutrition (Marshak, Young, and Radday, 2016). A review of the evidence around livestock and malnutrition found mixed results highly dependent on the type of livestock (Azzarri et al., 2015), the context (Headey et al., 2016), household versus village level cattle numbers (Marshak, Young, and Radday 2016), and different livestock water contamination levels by livelihood group (Gorham et al., 2017).

While the role of pre-existing nutritional status has been highlighted in the literature as critical to nutrition outcomes, it is not part of the NCF nor frequently analyzed. Black et al. (2013) identified that maternal undernutrition contributes to fetal growth restriction, which can increase the risk of neonatal deaths and, for those children who survive, the risk of stunting and wasting. Low birth weight was also found to be associated with twice the level of wasting in Bangladesh (25% vs. 14%), with no correlation to or modification by socioeconomic factors, (Rahman et al., 2016). Thus, research ignoring pre-existing nutritional status is unlikely to capture the full gamut of physiological factors affecting the risk of and potential increased vulnerability to wasting.

Limited analysis of the wider external trends associated with persistent wasting.

The original UNICEF NCF includes as basic causes "Resources & Control," "Human, Economic & Organisational," "Political and Ideological Superstructure" (see Figure 4, Annex 1), although these concepts remain poorly developed. Missing is the political economy underpinning the drivers of malnutrition, which is partly reflected in the institutional and policy context, and the history of shocks (climate, conflict, and other shocks). As several interviewees highlighted, it could be precisely these basic causes that are at the root of persistent GAM, considering that some of these conditions can persist long after the emergency. Because

these more basic causes linked to the political economy and context of crises have not been clearly articulated as part of a conceptual model of malnutrition in emergencies, they are frequently grouped together under a general heading of basic causes and are rarely deeply explored.

What is the answer?

Given the gaps highlighted in this report, we recommend a set of priorities that should be addressed in future research.

Monitor and publish trends on persistent GAM in selected locations. In order to be able to fully understand the scope of the problem of “persistent GAM,” there needs to be more consistent data collection (both within and between years). The resulting data and trends need to be publicized, noting limitations of comparability over time (varying coverage, agencies, populations, timing, etc.). More so, considerations need to be made for differences in both prevalence and trends across livelihood groups and gender. Such stratification has direct implications for study design and sample size.

Explore the relationship between persistent GAM, mortality, and stunting. The review points out that in some contexts trends in these measures do not necessarily correspond, and yet the measures themselves are likely to be interrelated. While future data collection and analysis should explore these relationships, secondary data analysis of existing population data (sufficiently large to have mortality as an outcome indicator) with a view towards a comprehensive meta-analysis could help clarify the relationship between wasting, mortality, and stunting. Secondary data analysis could also show how that relationship might differ by context and time, identify the risks associated with being both wasted and stunted, and help formulate more specific hypotheses for future data collection.

Conduct longitudinal studies to analyze the association between GAM and hypothesized drivers, taking into account seasonal variation. Data following the same child over time can help better highlight developments or changes in characteristics of the surveyed population related to malnutrition,

resulting in a much more reliable cause and effect pathway. Such data also can play a role in teasing out temporal relationships (seasonality and between-year variability), which help get at causality.

Once specific associations and potential drivers are identified, **conduct intervention trials to confirm the impact on the prevalence of GAM and measure the size of that impact.** Too often, research studies are not designed to show causality, only associations. In order to grow the evidence base, more emphasis needs to be given to conducting randomized control trials in different contexts with different populations, with an understanding of the possible limitations in external validity.

Promote more observational mixed methods studies to investigate in depth specific causal pathways. Such studies are useful in order to learn how to enhance the design and targeting of interventions to make them more effective. As part of this effort, explore and further develop alternative mixed approaches to RCTs where randomized trials are either inappropriate or beyond the resources available. For example, conduct participatory impact assessments to better understand local perceptions of project benefits.

Work with a wide array of stakeholders on the local, national, and international level to capture the wider external trends—policies, shocks, markets, climate, conflict, migration—that could be driving persistent GAM. These “basic causes” are difficult to capture in quantitative surveys (due to a lack of variation in the sample, as they frequently affect whole populations) and therefore require a more consultative process prior to and after data collection and analysis.

Update the Nutrition Conceptual Framework. The NCF is a remarkable tool that synthesizes existing knowledge into a relatively simple framework for analysis. We propose this framework should be amended through a process of consultation in order to better reflect some of the growing evidence base and additional areas for consideration (history of drivers, temporality (long-term and seasonal trends in drivers and malnutrition), gender, and livelihoods) that need to be considered in any context.

Conclusion

Despite global improvements in malnutrition and under-five mortality, in many contexts child wasting continues to be an ongoing and alarming problem. This problem is directly relevant to humanitarian action, especially in protracted crises, and to longer-term recovery and resilience building. Where emergency levels of GAM persist in contexts where interventions are ongoing, programs are struggling and potentially failing to achieve their goals.

Given the long-lasting and widespread scale of this issue, addressing persistent GAM is a policy and programming priority, raising accountability concerns and highlighting specific research gaps. The experienced nutritional professionals interviewed here were frank about their lack of answers and the risks of falling back on untested assumptions or oversimplifying complex pathways. Instead, we need a collaborative and interdisciplinary approach that systematically identifies drivers, interactions, and pathways of malnutrition. The challenge of persistent GAM is verging on a systemic crisis untouched by nutrition-specific programming, which calls for a radical reassessment of how we address nutrition in protracted crises.

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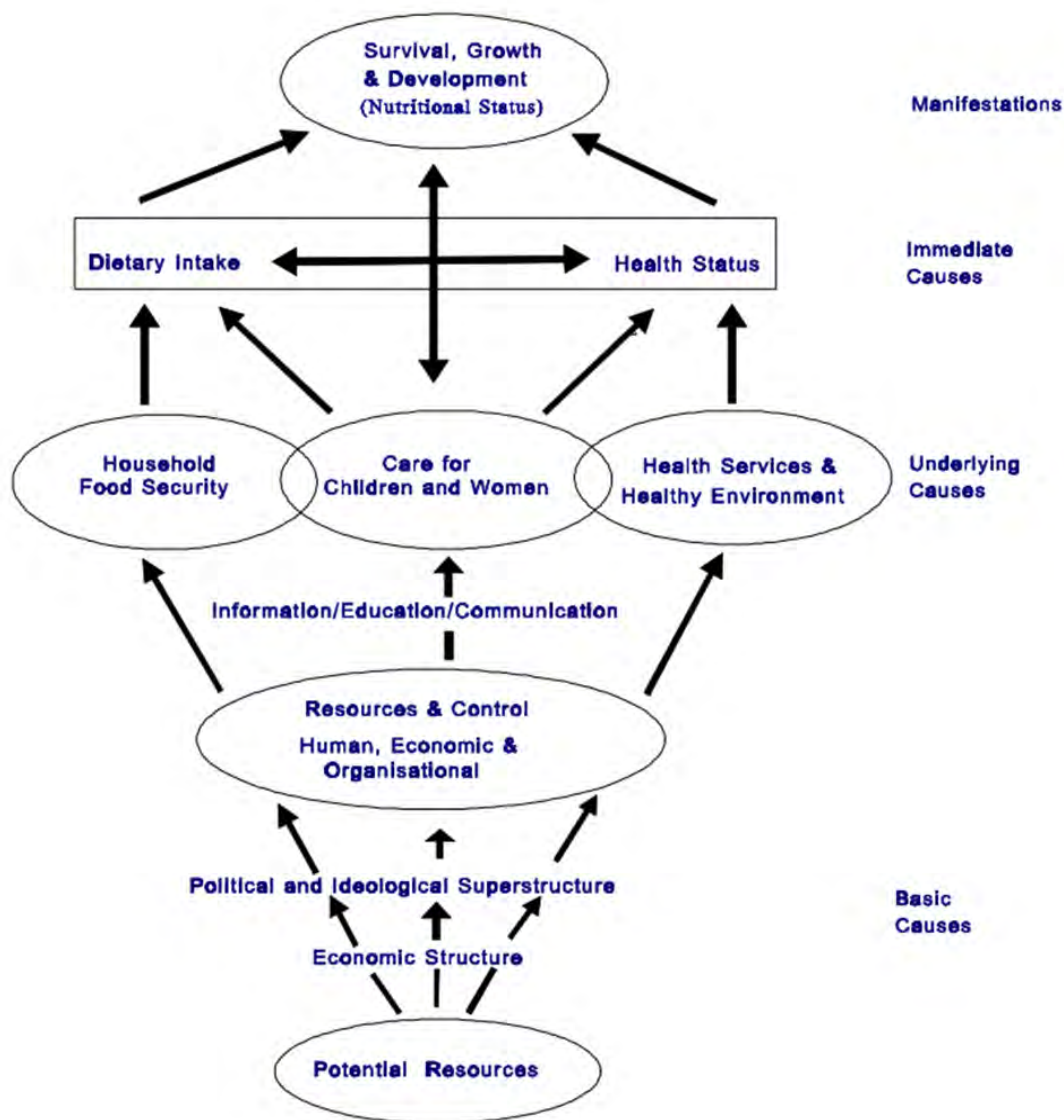
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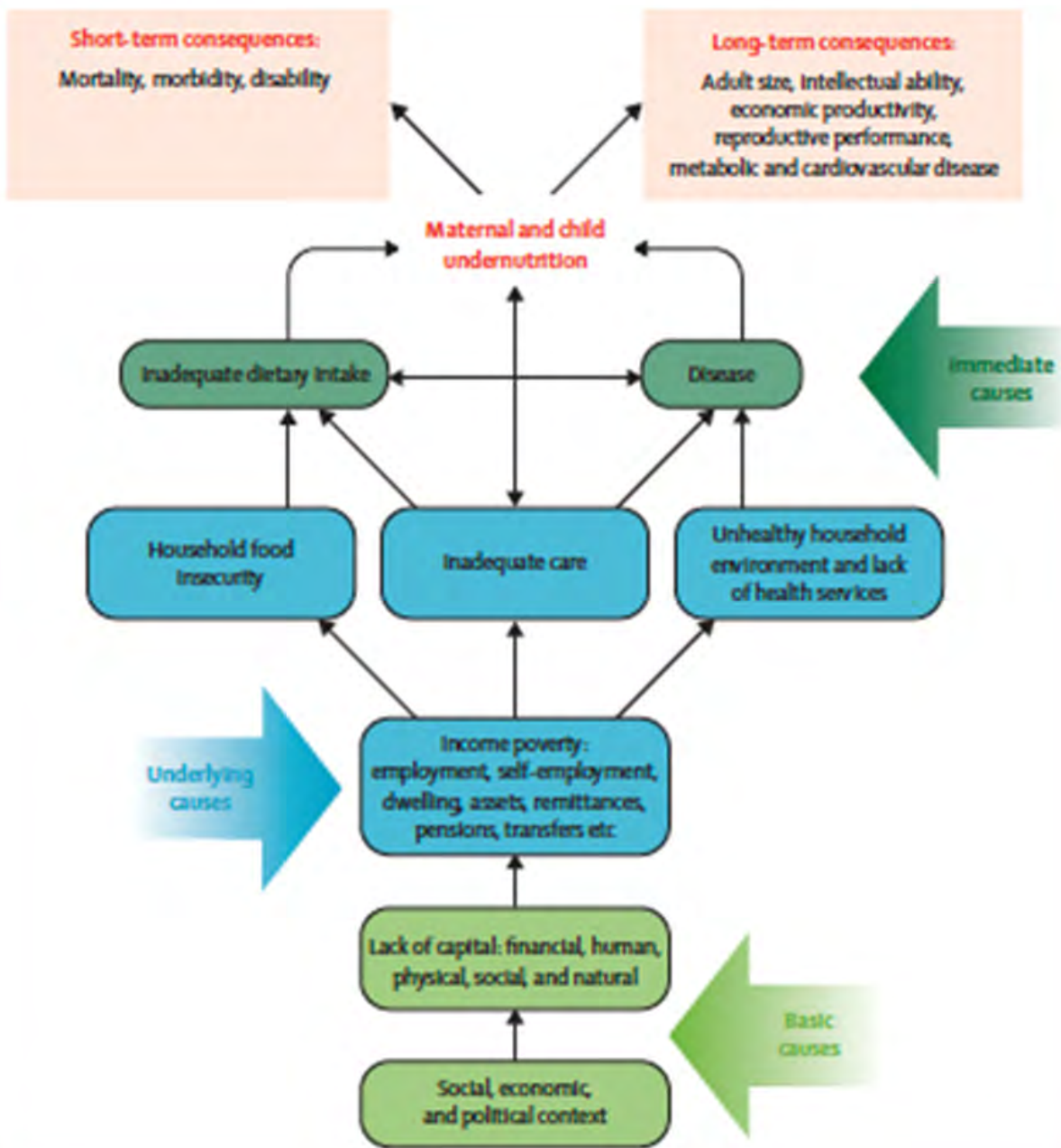
Annex 1. Additional Tables and Figures

Figure 4. UNICEF Nutrition Conceptual Framework (NCF).



Source: UNICEF, 1990.

Figure 5. Framework of the relationships between poverty, food insecurity, and other underlying and immediate causes of maternal and child undernutrition, and their short-term and long-term consequences.



Source: Black et al., 2008, 244.

Table 1. Range of methodological approaches used for nutrition analysis, with examples

Methods	Examples	Source of reference	
Scientific or social research quantitative surveys	<ul style="list-style-type: none"> Retrospective Cross-sectional 	Epidemiological studies	
		Anthropometric surveys	SMART, 2006
		Social research survey	
		Retrospective meta-analysis of available datasets; e.g., the Emergency Nutrition Network (ENN) and UNHCR collaboration and Ethiopia stakeholder workshop to review findings [Independent nutritionist (11)]	
	<ul style="list-style-type: none"> Longitudinal quantitative surveys 	Unusual in emergency contexts. Example: “In Nepal and Uganda, these are largely nationally representative surveys. We also tend to carry out longitudinal data collection. Because these are large sample size with multiple time periods, we can look at why kids were wasted at time 1, but not time 2, and again at time 3, etc. Allows you to dig into causal factors a lot better” [Academic (18)].	
Social science qualitative approaches		<p>Classic qualitative approaches/tools—ethnography, participant observation</p> <p>Adapted approaches/specific tools:</p> <ul style="list-style-type: none"> Participatory approaches/tools Barrier analysis Bottleneck analysis assesses “what are the main barriers to changing the overall nutritional status of the population served? This is more focused on structural changes, not household/community stuff, but rather at the level of the Ministry of Health and its partners. Are there bottlenecks in relation to staff, funding, etc.? The bottleneck analysis has been specifically adapted to look at nutrition by UNICEF” [Donor (17)]. 	<p>See for example:</p> <p>Hampshire, Panter-Brick et al., 2009</p> <p>Hampshire, Casiday et al., 2009</p>

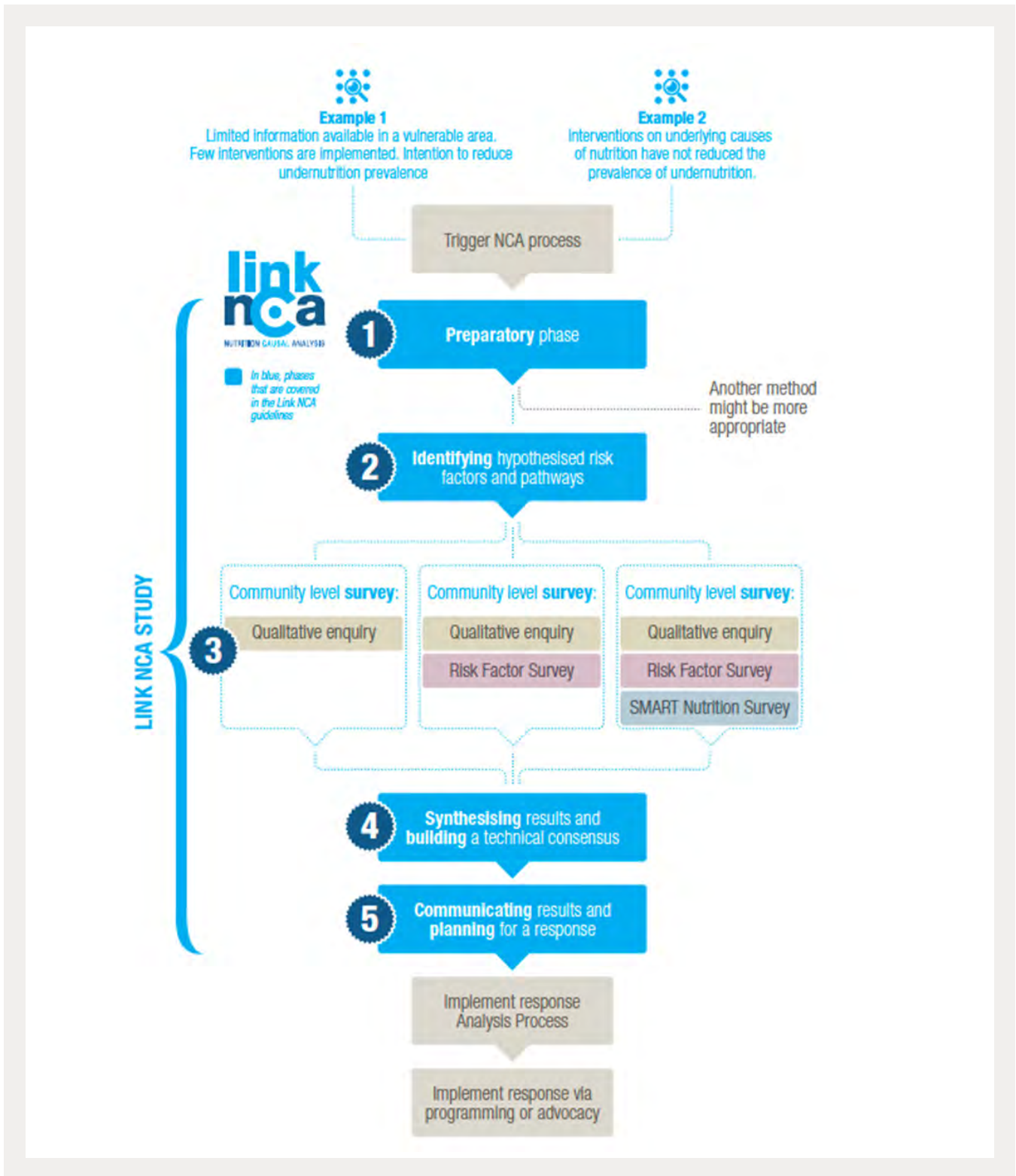
Mixed methods	Various combinations of the above and development of new approaches	Link-NCA is a participatory and response oriented method to conducting a nutrition causal analysis.	http://linknca.org ACF, 2015
		IPC Acute Malnutrition Framework	http://www.ipcinfo.org/ipcinfo-technical-development/ipc-nutrition-phase-classification/en/
		Nutrition Causal Analysis Framework for Donor Decision-Makers; at country level to encourage understanding of the classic elements of the framework or pathways, so you end up with a more considered and comprehensive program [Independent Nutritionist (11)]	
		Problem Tree Analysis [Independent epidemiologist (14)]	
		SQUEAC approach	Myatt et al., 2012

Table 2. Link-NCA—strengths and weaknesses

Strengths	
Consensus building among stakeholders	<p>“It does bring together different stakeholders....bringing partners together to talk about how nutrition is addressed” [Donor (17)].</p> <p>“The safest conclusion is that it provokes a more sophisticated conversation among operational partners and donors” [Nutritionist (20)].</p> <p>“In Somalia, the NCA has led to a different discussion of the programs. The best thing is that it has stimulated conversation, because often people take quite a limited view of the problem” [Donor (20)].</p>
Participatory approach	<p>“The added value is more about the participatory approach, seeing that the communities have a structure and a detailed understanding of what is going on...Promotes grassroots work that can help in changing mentalities: if a woman is not going in a health center—not feeling welcome, addressing this should be complementary to other needs-based interventions” [Nutritionist (16)].</p>
Clear steps and methodology	<p>“Methodology is well defined; learning event in Dakar—will invite some donors. Identifies risk factors; will combine reports from all studies” [Nutritionist (12)].</p> <p>“An actual methodology, not super complicated, but has specific steps to take, so you can compare. Good to actually look at causality and how things are being addressed and whether the program is working” [Donor (17)].</p>

Maximizes knowledge available	"Synthesizes our current knowledge in a specific context—there is a lot of misperceptions still, so from this perspective Link-NCA is adding value—complementing their [local] knowledge with the scientific evidence we have at the moment and in this way maximizes the knowledge we have at the moment" [Nutritionist (16)].
Reveals unexpected findings	"The value of qualitative methods [as part of the Link-NCA], is that you learn about unexpected causes, or get at information that would be otherwise hidden, e.g., gender dynamics, burden of responsibilities on women, use of inappropriate babycare centers for childcare" [INGO nutrition advisors (4 and 5)].
Locally specific	
Helps in moving away from a prescriptive siloed approach	This also helps to move away from a siloed approach (by revealing unexpected findings)" [(INGO nutrition advisors (4 and 5)].
Challenges (note that many of these challenges were mentioned by individuals, so do not necessarily reflect general opinion)	
Multiple methodological options	"The NCA methodology gives too many [methodological] options of what you call an NCA. For example, with SMART you know the approach. With an NCA, you have such a range of what you can call an NCA, even within the basic kit, it gets very washed out and has a lot of space for false marketing. People do something very basic and call it an NCA" [Nutritionist (22)].
Too locally specific	"Area covered in depth is so small that the findings are of less wider relevance [internationally]" [Food security expert working internationally (3)]. "Try to push country programs to do it and get it into their proposals. You cannot do it on the national level, needs to be done on a very small level. So, need to do 3-4 NCAs on a country level. But then don't know which ones to prioritize" [Nutritionist (22)].
Dealing with complexity	"Tried doing a causal analysis in Yemen, but ended up being a document on IYCF. Even laying out the causes were so complex. There were so many factors. Basically drowned in the vast number of different causes that played their part in the whole" (AM6_practioner).
Timing	"Does not fit/align with presenting business case development, chicken and egg—analysis is available too late [for donors/program decisions]" [Independent nutritionist (11)]. "LINK NCA takes 4-6 months [to produce] outcomes. That is a long period for research when funding is only for 12 months" [Nutritionist (23)].
Results not used, struggle to apply and interpret findings	"But it has not affected targeting (because needs are so great everywhere: women and young children) needs so great across whole [sectoral] spectrum" [Donor (20)]. "But the issue is that the NCA is divorced from any change in response. You can do one, but programs don't change" [Nutrition Advisor (23)]. "Often divorced from really good response planning from what it is showing. That is because the issues coming out are multisectoral, and a nutrition NGO does not always know how to deal with that. Working [multisectorally] in one issue is difficult, but working across multiple multisectoral issues is extremely difficult—different processes, different funding cycles" [Nutritionist (24)].

Figure 6. The five steps to an NCA.



Source: Chalimbaud et al., 2015, 23.

Annex 2. Case Studies

Grand Kanem Region of Chad

Context: The Grand Kanem Region of Chad is located in the Sahelian band. According to the Famine Early Warning Systems Network (FEWSNET), the predominant livelihood zones found in Grand Kanem are transhumance in the southern two-thirds, and “northern oasis cultivation with camels and natron mining” in the northern third (FEWSNET, 2011a). In a typical year, the rains last from late May to the beginning of October; the pastoral lean season typically lasts from April to the beginning of June, at which point the agricultural lean season begins and lasts until the ends of the rainy season in October (FEWSNET, 2013c). The region is vulnerable to droughts, flooding, and locusts, and is impacted by trade routes with Libya.

A historical look at GAM: GAM prevalence from 1994–2002 is highly variable, going from 10% to over 30% and back down to 15% within one two-year period between November 1994 and October 1996. GAM prevalence from 2008 to 2016 is more even and shows a steady decline. There are no data between 2002 and 2008. Overall, the trend from 1994–2016 is a gradual decline in GAM.

Despite the overall downward trend in GAM rates, in the nearly two decades’ worth of data, the GAM prevalence in Grand Kanem has only dipped below the emergency threshold of 15% four times (and two of those times had a prevalence of 14% and 14.9%). These percentages mean that Grand Kanem has likely been experiencing chronic emergency levels of acute malnutrition for around two decades. While certain spikes in GAM prevalence can be explained by specific crises (e.g., the droughts of 2009/2010 caused a dramatic spike in GAM prevalence during those years), there are many years with alarmingly high GAM rates that no single crisis or adverse event can explain. For example, during 2013, all indicators of food security (both agricultural and pastoral) were positive, and FEWSNET categorized all of Grand

Kanem as food secure (FEWSNET 2013a, FEWSNET 2013b); yet the GAM rates were still over 15%. This difference points to the possibility that while food security crises and natural disasters can greatly exacerbate malnutrition in Kanem, there are other factors helping to drive Kanem’s chronically high levels of malnutrition.

An examination of key driving factors: According to a Link-NCA carried out by ACF-France in May 2012, the region struggles with insufficient agricultural and livestock production (due to climate change, lack of agricultural training and tools, crop damage from insects and birds, lack of irrigation). There is a lack of income and difficult access to markets that make it hard to get adequate food.

However, malnutrition remains high even when there are strong agricultural production periods. The most direct cause is care practices. There is voluntary maternal anorexia (in order to give birth to a lower-weight baby and reduce risk of maternal mortality). Mothers do not practice exclusive breastfeeding (they give their children water during the hot season, which is often not clean). When an infant or child does develop diarrhea, they are given ineffective and sometimes harmful treatment by traditional healers. Infants are weaned too suddenly and lack dietary diversity (especially lack of access to animal-source proteins and fruits and vegetables).

Infection rates are high due to consumption of unclean water and a lack of good hygiene practices, paired with a weak state healthcare system. One cross-cutting concern related to care and feeding practices is low literacy and education rates among women, which could lead to a poor understanding of nutrition messages or to additional socioeconomic barriers in actually implementing good nutrition and care packages (Magen, 2012).

Cox's Bazar, Chittagong, Bangladesh

Context: Cox's Bazar (also spelled Bazaar in some publications) is located in southeastern Bangladesh, bordering Rakhine State, Myanmar. Like much of coastal Bangladesh, the area is prone to flooding and tropical cyclones. Cox's Bazar also receives influxes of migrants and refugees from the marginalized Rohingya population from neighboring Myanmar. In addition to the production of rice and shrimp/fish farming that are common across coastal Bangladesh, Cox's Bazar is also known for its salt production and tourism industry.

A historical look at GAM: Evaluating the GAM prevalence in Cox's Bazar is challenging because it is not indicated in the dataset whether the measurements taken were from Rohingya refugee camps or the general population. However, given ACF and UNHCR's active presence in Rohingya camps (and the fact that ACF wrote an NCA study in the two main Rohingya camps during the period that most of their data came from), the rest of this analysis will assume that the data discusses Rohingya refugee populations in Cox's Bazar in Bangladesh.

May 2009 saw a peak of GAM in Cox's Bazar of just under 18%. After this, GAM prevalence in Cox's Bazar appeared to stay relatively steady between 12% and 16% during a five-year period from November 2009 to November 2014; GAM remained above the emergency threshold of 15% during measures taken from May 2010 to November 2011. Interestingly, Cox's Bazar was hit multiple times during this period with cyclones, floods, and landslides, but these events seemed to occur soon after the measurements were taken; this timing makes it difficult to link high GAM levels with specific adverse events. For instance, GAM prevalence hit 15.56% in May 2010; however, the major flooding event of the year happened in June 2010 (BBC, 2010). GAM prevalence was recorded at just over 15% in May 2011, and again, the major flooding event of the year happened just afterwards in July 2011 (IFRC, 2011). Even the peak of 17.8% GAM was recorded in May 2009, and Cyclone Aila

hit Bangladesh on May 25 of the same year; it is impossible to discern whether the measurement was taken in the five days between the cyclone hitting and the end of the month. However, just five months later in November 2009, ACF recorded a GAM well below the emergency threshold, at 12.27%. The data are not collected often enough to make a clear judgement about the association between natural disasters and GAM rates; however, it does seem safe to say that natural disasters do not seem to be the only factor behind high GAM levels.

Since we are discussing camp settings, it is also useful to note that the GAM prevalence recorded during the crackdown by the Bangladeshi government on Rohingya refugees in early 2010 was 12.7%, below the emergency threshold. However, as the crackdown was on undocumented Rohingya refugees at a makeshift site outside the official camps, it is possible that these conditions were not reflected in the camp population being studied (IRIN, 2010).

An examination of key driving factors: A nutrition causal analysis carried out by ACF in Kutupalong and Nayapara refugee camps in Cox's Bazar in December 2011 found that, first and foremost, food assistance given to this population was inadequate calorically and was often shared within households. This sharing, combined with the lack of household income, led to diets inadequate in quantity and quality for children. Maternal workloads are heavy, which leads to inadequate time for quality childcare practices. Hygiene is also an issue in the camp; latrines are insufficient in quantity and inappropriate for children, which results in high levels of open defecation and subsequent high morbidity levels in children (ACF, 2011).

Northern Bahr-el-Ghazal, South Sudan

Context: Northern Bahr-el-Ghazal is in the northwestern part of South Sudan and borders Sudan. Its principal livelihoods are sorghum production and cattle (FEWSNET, 2013g), and the hunger typically lasts from May until August (FEWSNET, 2013h). Lowlands in the area are

vulnerable to flooding. Because the state borders Sudan, it receives many “returnees:” Southern Sudanese who had been living in Sudan and want to return to the South.

A historical look at GAM: In the nearly ten-year period between September 2005 and November 2014, all but two GAM measurements registered above the emergency threshold of 15%. While it is generally possible to see some link between certain adverse events (flooding, conflict, trade restrictions with Sudan, etc.) with particular peaks of GAM levels around and above 20%, even during times that are considered relatively food secure (classified green on the IPC, notes of good harvest and low food prices), GAM consistently remains well above emergency thresholds.

An examination of key driving factors: A nutrition causal analysis was carried out by ACF in December 2011 in Aweil East County in Bahr el-Ghazal. First, the study confirmed that while food security was “precious...the association between food insecurity and acute malnutrition is not entirely clear in South Sudan. The analysis of this study also discovered there is no correlation among malnutrition, household hunger scale, and food consumption score. However, child dietary diversity was identified as an associated factor that contributes to the wasting of the study children” (Woldetsadik, 2011). The analysis found that high levels of childhood morbidity in the two weeks before the study were significantly associated with acute malnutrition; particularly diarrhea and malaria, but not acute respiratory infections. There is low water availability, and what water exists is rarely treated. Unhygienic conditions contribute to the aforementioned high child morbidity (Woldetsadik, 2011).

IYCF practices are not ideal; many children are given food or water before six months, which makes them vulnerable to disease. If and when children do get sick, there is a lack of primary and community health care services (Woldetsadik, 2011).

Maradi and Zinder, Niger

Context: Maradi and Zinder are located in southern Niger, bordering Nigeria. According to FEWSNET, the livelihoods zones in Zinder include the rainfed millet and sorghum belt, southern irrigated cash crops, the agropastoral belt, transhumant and nomad pastoralism—camels, a small area of seasonal watercourse irrigated crops, and desert (FEWSNET, 2011b). In a typical year, the rainy season (and its accompanying agricultural lean season) lasts from mid-June until the beginning of October; the pastoral lean season stretches from mid-March until the beginning of July. There is also significant labor migration between December and May (FEWSNET, 2013f). The region is vulnerable to drought and floods. Niger in general is dependent on remittances from migrant workers in Libya and Côte d’Ivoire, and local market prices are influenced by imports from Nigeria.

A historical look at GAM: Maradi and Zinder have had fluctuating GAM levels over a roughly eleven-year period between October 2005 and August 2016, which frequently crossed emergency thresholds of 15%.

Both regions had GAM levels of 16% in October of 2005, which then declined to below 10% within the year thanks to good harvests that year (UNSCN, 2006). In 2007, Zinder’s GAM levels began a steady climb upwards that would hit emergency levels of above 15% by September 2008 and reach a peak of 17.9% by October 2010. The peak of GAM is likely explained by the failed rains and subsequent drought that occurred in 2009 (UNSCN, 2010); Maradi also had above-emergency levels of GAM in 2010 (including a peak of 19.7% in May of that year). But the two years of above-emergency GAM levels in Zinder that preceded the 2009 drought are interesting; there is an indication that prices were elevated, and there was a shorter-than-average rainy season in pastoralist areas during that time (UNSCN, 2009). But there is no single adverse event that seems to explain above-emergency levels of GAM.

After 2009/2010 drought crisis, a number of other factors came into play. Crises in Libya and Côte d'Ivoire in 2010 caused migrant workers from Niger to return home, cutting off important sources of remittances (USAID, 2011). Pest damage in southern agricultural region at the end of 2011 (GIEWS, 2012) kicked off sustained high grain prices that would last until 2015 (FEWSNET, 2011a-d; FEWSNET 2012a-c; FEWSNET 2013a-h; FEWSNET, 2014). The trends in Maradi and Zinder differ during this period: both saw a drop in GAM levels in August 2011 (the end of the drought crisis) to below emergency levels. Maradi's GAM levels would return to above emergency levels by 2012 and stay there until a recording of 12.9% GAM in August 2016. Zinder's GAM levels fluctuated greatly: every other reading would be just at or above emergency levels, including a peak of 18% GAM in August of 2015 that was higher than the peak during the drought crisis of 2009/2010. The next recorded GAM level in August 2016 would fall dramatically to 11.7%. Despite both regions experiencing similar pressures (high cereal prices, lower remittances), Maradi had steadily high emergency levels of GAM, while Zinder had fluctuations of GAM that often crossed emergency thresholds. There does not seem to be any single adverse event that explains the peak of 18% GAM levels in Zinder in August 2015.

vulnerable to wasting during the lean season; all other factors point to care practices and infection as a driving factor of acute malnutrition.

An examination of key driving factors: In an NCA carried out by FEWSNET between 2014-2016 in Maradi and Zinder, food security was not associated with child wasting in either the post-harvest or lean season. The factors that were most strongly correlated with increased likelihood of wasting in both seasons was the age of the child (children 6-23 months of age were most at risk) and recent occurrence of diarrhea. In the lean season, other factors strongly associated with wasting included living in an agropastoral livelihood zone and having had recent fever. In the post-harvest season, other factors strongly associated with wasting included lack of maternal education and lack of handwashing by caregivers (McDonald, 2017). The seasonal differences in associations between nutrition indicators and other household/respondent characteristics may indicate that something about the agropastoral livelihood makes children more

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