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Entitlement Failure from a Food Quality Perspective

The Life and Death Role of Vitamins and Minerals in Humanitarian Crises

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Abstract

The substantive role that vitamin and mineral deficiencies play in shaping crisis-related morbidity and mortality was not widely understood when Amartya Sen elaborated his arguments about moral rights of the hungry, entitlements, and public action. This chapter examines two main aspects of the 'entitlement agenda' as they relate emergencies: (1) the role of micronutrients in contributing to diseases and death in humanitarian crises, and (2) knowledge and awareness of micronutrient concerns and solutions among the income-poor households most affected in emergencies. We argue that solutions to entitlement failure must operate not only at the level of prices and markets, but equally in the domains of public health and public nutrition. Entitlement-solutions focused only on food quantity, and not also on diet quality, are likely to fall short of their intended goals, and of a deeper responsibility to enhance the life-chances of survivors.

Keywords: entitlement theory, micronutrients, food, humanitarian, emergencies, Sen

JEL classification: Q18, I38, I18

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Acronyms

CDC Centers for Disease Control and Prevention

CTC community therapeutic care

EOS enhanced outreach strategy

NTDs Neural tube defects

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1 Introduction

While a lack of energy and protein has long been associated with increased risk of mortality during periods of food crisis, the importance of vitamins and minerals in shaping the vulnerability of individuals, and of entire populations, to disease and death has received less attention (Toole 1993). Although a lack of food (in absolute terms) is not usually identified as a major 'cause' of death in most humanitarian emergencies, much crisis-related mortality can be ascribed to a lack of *appropriate* foods where key nutrients are concerned. Food quality (the diversity of foods consumed and their adequacy in terms of nutrient content) therefore matters a great deal in determining the evolution and impact of emergencies, contributing not only to outbreaks of disease but to diminished capacity of individuals to cope with entitlement failure.

While micronutrient deficiencies operate at a 'micro' (or clinical) level, they nevertheless reflect broader entitlement failure at a macro-level. Unlike food commodities, nutrients are invisible; consumers are usually unaware of their importance, their presence, or their deficiency. Consumer demand for food does not therefore equate with effective demand for nutrients. In this sense, public action intended to remedy vitamin and mineral deficiencies is unusual: it is largely supply-, rather than demand-driven. This raises challenging questions about meeting (enforcing and/or fulfilling) entitlements of hungry people not only to *adequate* food, but to an *appropriate* basket of foods to meet nutrition and health requirements. While humanitarian professionals increasingly rely on micronutrient interventions to prevent crisis-related morbidity and mortality, populations most directly affected remain largely unaware of the deficiencies that they face (and will continue to face once the emergency has passed), and how they themselves might use recovered entitlements, in terms of income or exchange, to enhance their own micronutrient status.

This study explores two main aspects of the micronutrient problem as it relates to entitlements in humanitarian emergencies: the diseases that arise directly or indirectly as a result of vitamin and mineral deficiencies—often fatal in their own right; and knowledge, or awareness, of micronutrient concerns (and solutions) among income poor households. The delivery of nutrients in emergencies is a key aspect of all relief operations today, but that in itself is insufficient without empowering beneficiaries with knowledge related to the importance of micronutrients, the food sources of those micronutrients, and greater capacity to act on such knowledge in both crisis and non-crisis settings.

2 An entitlement to be free from 'hidden hunger'

Although it is reported that around 83,000 people died of 'famine' in the first few years of the twenty-first century (CRED 2005), it is widely accepted that few people ever die of famine *per se*. While constrained access to food is a key feature of most humanitarian crises, an absence of food is not always the most significant aspect, nor is a total lack of food usually the cause of elevated mortality among large numbers of people. In Sen's (1998: 195) view, 'the causation of famines is often best seen in terms of a radical decline in the real incomes of a section of the population' and, as such, the focus of analysis should be on the dynamics of income and purchasing power rather than food availability. While this conceptual approach has been hugely influential in debates on

famine causation, it can be argued that the role of food in the equation deserves to be re-examined—not to shift the pendulum back towards supply-side thinking, but rather to enhance the concept of entitlement so that it can incorporate recent scientific findings on the role of nutrients in determining vulnerability to death.

Micronutrient deficiencies raise important new questions about the nature of food entitlements. 'Hidden hunger', a deficiency unknown to the individual but well-known to those engaged in public action, challenges the simple conception of entitlement because 'access' in this case relates to intangibles—the knowledge, behaviour change, and microscopic inputs which are all needed to achieve sound nutrition, but which are not as yet in high demand by those who need them most. When they are delivered (as in emergencies) they are supply-driven, not supported by demand.

A diversified diet (a broad variety of foods consumed) is closely related both to adequacy in total food consumption needs, and with adequacy in terms of micronutrients. A monotonous diet is the norm for hundreds of millions of households that are ultra poor and food insecure. But even where families consume adequate amounts of energy (kilocalories) and protein, this does not automatically equate with adequacy in terms of vitamins and minerals. According to the World Health Organization (2002: 83), deficiencies in iron, vitamin A and zinc each rank among the top ten leading causes of death through disease in developing countries—outside of emergency contexts. As a result, it is increasingly understood that 'micronutrient malnutrition is very widespread, and is probably the main nutritional problem in the world' (Allen 2003: 3875). Given the widespread nature of deficiencies in normal times, the stage is set for large-scale outbreaks of deficiencies in situations where food consumption (particularly of items of higher dietary quality) is impaired by natural disasters or armed conflicts.

Some crises involve previously well-nourished populations that suddenly face an elevated risk of mortality through disease, displacement, or the trauma of conflict (such as in Bosnia, Kosovo, and Azerbaijan). Other crises compound an already serious situation, bringing acute and chronic malnutrition into play simultaneously. For example, high levels of chronic malnutrition in Ethiopia and Bangladesh mean that even slow-onset crises can provoke a worsening of conditions with increased mortality. Thus, pre-existing malnutrition influences how a crisis unfolds and responses must be tailored accordingly.

The role of micronutrients in shaping crisis-related morbidity and mortality was not widely understood when Sen elaborated his ideas on food access via entitlement bundles. According to his formulation, entitlement is defined in terms of 'ownership rights', and in that sense what a person eats depends on what food he or she is able to acquire (Sen 1998; 1999). Furthermore, one's ability to acquire food relates not only to food supply but to the functioning of the entire economy, and indeed to prevailing political, economic and social arrangements. These have been hugely influential ideas which shed light on the political economy of famine causation, while effectively pushing *food* into the analytical background.

Sen (1998: 196) did recognize that 'in explaining the exact patterns of … deaths and suffering, we can get additional understanding by supplementing the income-based analysis with information on the conversion of incomes into nourishment'. However, that statement related only to issues of gender inequality and intra-household

distribution of resources, and he added the caveat that 'in a general analysis … these additional matters may be of secondary importance'.

While not disagreeing with the view that major humanitarian crises represent broader failure of the development agenda, the process by which incomes translate (or not) into nutrients before and during a crisis determines the nature and evolution of human suffering. Indeed, it is today recognized that 'severe malnutrition is both a medical and a social disorder' (WHO 1999: 1). That is, physiological complications of an individual should not be dismissed as secondary to the political or economic complications of whole populations—personal micronutrient deficiencies signal population-wide deficiencies that are directly linked to the macro-level processes of concern to Sen. Indeed, the view that malnutrition is a social disorder is entirely consistent with Sen's (1981) conception of famine as a failure of 'social contract'.

What is more, the fact that micronutrients (a form of 'hidden hunger') play such a pivotal role in determining whether or not people die in emergencies—it is not only about people having purchasing power—requires us to reconsider the role of food *as food*. While access to food is an issue embedded in markets, prices and legal systems, access to good *nutrition* is a process embedded in household caring practices, specialized knowledge (about micronutrient needs and nutrient-rich sources of food), and an ability to allocate income to food quality, not just food quantity.

3 The quality of entitlement

Having 'something to eat' is not in itself enough to achieve a sound nutritional status, nor indeed sufficient to prevent malnutrition. For example, periods of widespread food scarcity invariably lead to scavenging and the consumption of products not part of a conventional diet. During the continent-wide European famine of 1817, desperate Germans and Swiss ate sawdust baked into bread, carrion, their own watch-dogs, even grass and roots (Webb 2002). During famine in southern Africa in 1896/7 colonial officials reported that people were, 'suffering from a disease, which I believe is caused through eating … rotten skins, and wild roots, the effect of which causes them to purge considerably' (cited in Iliffe 1990: 26). Such 'purging' often resulted in faster death than if such foods had not been consumed. More recently, it has been noted in Ethiopia that over-consumption of boiled grass pea (*Lathyrus sativus*) during periods of famine may allow consumers to survive (since the grass pea is drought-resistant and continues to be available when other cereals have disappeared), but it often condemns them to a neurodegenerative disorder that leads to irreversible paralysis (Getahun *et al.* 2003).

In other words, while extreme hunger leads to desperate actions, turning to what are essentially toxic products may, in itself, kill or cripple the consumer long after the crisis has past.[1] As Mokyr and Ó'Gráda (2002: 20) put it, in relation to the Great Famine in Ireland of the late 1840s, 'the Irish became victims of food poisoning due to the consumption of inferior foods that would have been discarded in normal time, or to nutritionally sensitive diseases brought on by impaired immunity'.

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[1] According to Rivers (1988: 59) 'the dietary deviations of famine have received surprisingly little scientific attention, and yet they are most important in dictating the pattern of nutritional disease that occurs'.

However, even where conventional foods are consumed, a reliance on an inappropriately balanced diet can also lay the foundation for morbidity and mortality. It is generally accepted that as long as sufficient amounts of food are available, the average diet in developing countries can supply both adequate energy and protein. However, dietary sufficiency in energy and protein does not mean that consumption of sufficient vitamins and minerals in recommended quantities is assured. Thus, while consumption of maize and groundnuts may fill the belly and assuage hunger, such a diet is not enough to meet the full spectrum of minimum daily nutrient requirements.

On the one hand, many commonly consumed energy and protein-rich foods, such as maize and soya, contain 'anti-nutritional factors', such as phytates, that inhibit the body's absorption of iron and other nutrients. Similarly, widely-consumed items such as tea contain tannins which also reduce iron absorption. Thus, even a diet sufficient in energy and protein may not be sufficient to assure survival.

On the other hand, eating only a few starchy food items may fill the belly (assuage hunger) but will not allow the consumer to meet minimum daily nutrient requirements. A more varied diet is a valid outcome in its own right, associated with a number of improved nutritional outcomes (such as improved birth weight, child growth), improved status of certain micronutrients, such as iron (haemoglobin concentration), and reduced risk of mortality from cardiovascular disease. However, there is also statistically significant association between dietary diversity and household per capita consumption, as well as between dietary diversity and per capita caloric availability *from non-staple foods*, which is where diet quality tends to reside (Hoddinott and Yohannes 2002). In other words, diversified diets are closely linked to household food security, and both are closely linked to nutrition and health outcomes.

Importantly, this is where entitlement theory (in its attention to the dynamics of markets and purchasing power) and humanitarian operations intersect. As food prices rise in the context of crisis, poor households typically (i) allocate a relatively higher share of their total expenditure on food in order to maintain current levels and composition of consumption (and hence spend less on other necessary goods; (ii) shift their consumption to 'less desired' (cheaper) staple foods, such as moving away from rice consumption to eating sorghum, or tubers such as cassava; (iii) spend relatively more on staples and less on 'quality' foods (which tend to be micronutrient rich, including meat, eggs, vegetables, etc.), and/or (iv) reduce their overall consumption of food (often adults skipping meals to protect the consumption level of their children).

These processes have been documented throughout Africa and Asia in the context of food crises (von Braun, Teklu and Webb 1999) Thus, while Sen (1998) argues that 'starvation occurs when some people cannot establish entitlement over an adequate amount of food', the problem should be reframed thus: malnutrition and the risk of mortality both increase when people cannot establish or maintain their entitlement over an adequate basket of foods providing sufficient quality, as well as quantity, to meet at least minimum needs.

For example, the economic and drought shocks impacting Indonesia during the late 1990s combined—primarily through their effect on food prices—to impair food consumption. A study in rural Java shows that food price shocks led poor consumers (those in the lowest income quartile) to sacrifice both micronutrient-rich foods and preferred grains (shifting from rice to cassava consumption) in an effort to minimize the

decline in total caloric intake (Block *et al.* 2004). This was particularly apparent for certain commodities, such as eggs, a relatively affordable and important source of micronutrients. Household egg consumption declined steeply from December 1996 through October 1998, falling at an average rate of 2.5 per cent per month over that period. Egg consumption over that period fell from 0.54 to 0.24 eggs per person per week, at a time when egg prices rose by 117 per cent in national markets. Similarly, consumption of green leafy vegetables (another important source of iron, vitamin A, calcium, folate, and other trace minerals) fell by nearly 6 per cent over the same period (a statistically significant difference). Since vegetables accounted for two-thirds of child vitamin A intake before the sample, this had important implications for their micronutrient status: anaemia (iron deficiency) increased significantly among children, and especially among boys (although girls suffered similar declines over time).

A separate study of urban consumers during the same Indonesian crisis finds that while urban diets were relatively more varied than in rural areas prior to the crisis, urban households responded to the crisis in ways that mirrored the pattern in rural areas; that is, urban diets became less varied as consumption of higher-quality foods declined in response to price increases and the need to stabilize household consumption of staple foods (Wasito, Susilowati and Gross 2002). As a result, there was a large decline in urban consumption of meat, eggs, bread and noodles, but little decline in intake of rice, cooking oil or sugar, i.e., foods protected by government price subsidies.

4 What do micronutrient deficiencies mean in a crisis?

So households consumed fewer eggs, fewer vegetables, and fewer other sources of micronutrients; as long as people survived does, it really matter if their diet quality suffered? In fact, it matters a great deal—particularly in locations where food crises are frequent and severe. Since nutritional status (which includes micronutrient status) is critical to morbidity and mortality in emergencies (and indeed long after a crisis has passed), the *quality* of food consumed is a critical aspect of food entitlements, reflecting both constrained access to appropriate resources and constrained knowledge.

Malnutrition's main contribution to disaster mortality is through disease. Mortality rates increase when epidemics of measles or cholera sweep through concentrations of displaced, traumatized, people—but it is the people who are weakened (immune-suppressed and already sick) who die first and fastest. Throughout history, the main killers during emergencies have been diseases such as cholera, typhoid and typhus, diphtheria, malaria, and diarrhoea and respiratory diseases—often combined and almost always aggravated or precipitated by deficiencies in key micronutrients which, in themselves, can result in serious, often fatal, disorders.[2]

While the dynamics through which micronutrient deficiencies interact with disease are complex, an understanding of their multiple interactions continues to grow. Disorders such as scurvy (deficiency of vitamin C), pellagra (niacin deficiency), beriberi (thiamine deficiency), and angular stomatitis (riboflavin and other deficiencies) have all emerged

2 Based on an analysis of the causes of death in the refugee crises in Thailand, Somalia, and Sudan in the 1970s and 1980s, Toole and Waldman (1988) note that measles, malaria, acute respiratory infections, diarrhoea, and malnutrition caused up to 80 per cent of all deaths.

as problems in humanitarian settings over the past decade—despite the fact that these were long thought of as historical curiosities. If *just one individual* is diagnosed with these disorders it is today assumed that a population-wide threat must exist, usually because of restricted access to certain types of food. The response calls for population-wide interventions *as well as* individual treatment, since only correcting deficiencies among individuals with clinical signs of the deficiency will not resolve broader, underlying deficiencies that led to that condition. Some of the deficiencies that have emerged during recent times are briefly elaborated in the following below.[3]

4.1 Vitamin C deficiency (scurvy)

Vitamin C deficiency (scurvy) was noted in the context of relief operations in Mauritania in 1974, across the Horn of Africa in the 1980s, in Somalia and Kenya in the mid 1990s, and again in Afghanistan in 2001/2. Scurvy is associated with bleeding gums, swollen joints, and haemorrhaging in the arms or legs leading to paralysis (particularly among children). For instance, during the Irish famine of 1846-50 the local name for the disease was 'blackleg', an apparent reference to limb discolouration caused by subcutaneous haemorrhaging (Woodham-Smith 1968).

Scurvy is a rapidly developing condition because the body does not contain large reserves of vitamin C; clinical signs appear after roughly 4 months of dietary inadequacy (Rivers 1988: 64). That said the condition can also be resolved quite rapidly, once vitamin C is reintroduced into the diet. In Kohistan district of Afghanistan in 2001/2, almost 7 per cent of mortality among children under-5 years of age was attributed to scurvy (Assefa *et al.* 2001). That particularly serious outbreak was associated with famine conditions linked to conflict between the Taliban regime, local rulers, and US-backed military forces, which compounded dietary inadequacy in remote, mountainous regions. It was countered through a mass distribution of vitamin C capsules that quickly brought the situation under control (Cheung *et al.* 2003).

4.2 Vitamin B1 deficiency (beriberi)

Reported among Cambodian refugees in Thailand in 1978 and again in 1985, beriberi was identified among Bhutanese refugees in Nepal as recently as 1999. This deficiency is most common among consumers of highly milled cereals (such as rice) or starchy carbohydrates (particularly tubers, including cassava), and where anti-thiamin factors (elements of food that inhibit thiamin absorption) are present, such as high consumption of tea or betel nuts. The deficiency also appears to be closely linked to high energy expenditure levels. The case fatality among thiamin deficient infants is very high, resulting from cardiac failure, oedema (swelling caused by fluid retention—a common feature in famine contexts), and progressive paralysis (WHO 2000). If untreated, beriberi has high fatality rates among adults as well—a review of outcomes of 2,670 cases undertaken in 1868 found mortality rates of 33 per cent (De Méricourt 1868). In the above case of the Bhutanese refugees, the outbreak was controlled by replacing a

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3 While each deficiency is discussed individually, it is important to point out that the presence of one micronutrient problem usually signals the presence of other deficiencies that often interact in synergistic ways (Gibson 2004).

portion of the polished rice in the food ration with parboiled rice and the addition of fortified blended foods.

4.3 Vitamin B_3 (deficiency of niacin, or its precursor tryptophan, leading to pellagra)

Pellagra was a problem among Mozambican refugees in Malawi from the late 1980s to the mid-1990s, and Tanzania in 2001; it remains a concern in Angola even in 2005. Pellagra appears most often among populations dependent on maize or sorghum and limited diet diversity beyond. It causes severe diarrhoea, skin discoloration, and precipitates mental deterioration (dementia), leading to death. The importance of enhancing the diet to compensate for niacin deficiencies is clear, since case rates of between 5 and 10 per cent were seen among the refugees in Malawi, 20 per cent of those being children under 5 (Toole 1993).

4.4 Riboflavin (angular stomatitis)

Riboflavin (*angular stomatitis*) was reported among Bhutanese refugees in Nepal during the 1990s. While this form of oral dermatitis is not typically life-threatening, its emergence in food-dependent populations can be a harbinger of other B-vitamin deficiencies (Blanck *et al.* 2002). Concern arose when a six-fold increase in angular stomatitis was recorded from December 1998 to March 1999 (from 6 to 36 cases per 1,000 per month). This was resolved when a micronutrient fortified blended food and parboiled rice were added to the food aid ration.

4.5 Vitamin A (xerophthalmia, measles, diarrhoea, malaria)

Vitamin A deficiency is the world's leading cause of preventable blindness, and much attention in developing countries linked to this particular nutrient gap focuses on xerophthalmia, or the deterioration of the eyes. However, vitamin A deficiency is also a systemic disease that affects cells and organs throughout the body, causing changes to the immune system and to respiratory and intestinal tract functions—hence it has close two-way interactions with diseases such as measles and malaria.

Since the human body stores vitamin A in sizeable quantities, most outbreaks tend to reflect the seriousness of previous, sub-clinical deficiencies as well as immediate risk factors.[4] Acute outbreaks were recorded in Sudan in the mid-1980s, where night blindness (a loss of nocturnal vision) gave way to progressively more serious scarring and alteration of the cornea and ultimately to blindness. There is evidence that xerophthalmia was a major concern during the Irish famine of the 1840s: an epidemic of what was then termed 'ophthalmia' gave rise to great alarm among officials in charge of workhouses as cases among paupers rose from 11,400 in 1849 to over 42,000 in 1851 (Kennedy *et al.* 1999). More recently, during the 1998 floods in Bangladesh, the prevalence of night blindness among mothers living in flood-affected areas increased to levels four times above the national average (Torlesse *et al.* 2003). Night blindness

4 Men are significantly more likely to be affected than women, although pregnant and lactating women are at high risk during that period (Rivers 1988).

during pregnancy has been associated with a heightened risk of maternal mortality from infection; a study in Nepal finds that pregnant women with night blindness experienced a five-fold increase in infection-related mortality than women without night blindness (Christian *et al.* 2000).

However, vitamin A is also closely linked in a feedback loop to the progression and impact of other, non-nutritional diseases, such as measles. For example, a lack of vitamin A is closely related to measles mortality, while the extra stresses of contracting measles or malaria can itself precipitate severe vitamin A deficiency among children who were already vitamin A deficient (Weise-Prinzo and de Benoist 2002). For example, in Ethiopia during the crisis of 2000/1, measles alone or in combination with wasting accounted for 22 per cent of deaths among children younger than 5 years, and for 17 per cent of among children aged 5 to 14 (Salama *et al.* 2001).[5] It has been shown that eradicating vitamin A deficiency would cut child deaths due to measles by 50 per cent—in non-crisis situations (UNICEF 2002).[6] As a result, the Centers for Disease Control and Prevention (2001: 288) now advise that, 'mass measles vaccination with vitamin A distribution is an important intervention during the acute phase of famines'.

4.6 Iron (anaemia and malaria)

Iron is thought to be the most prevalent micronutrient deficiency in the world, and hence is inevitably present in emergencies. The mild form relates to lack of energy, pallor and blood loss, however more severe consequences relate to impaired psychomotor development, growth impairment, and immune deficiencies. Refugees and internally displaced people (people displaced from home but within the boundaries of their own country, hence not gaining refugee status), typically arrive in camps in a nutrient-depleted state. This, coupled with the camp crowding and unsanitary conditions that facilitate the spread of communicable diseases, leads to greater exposure to serious infection, including malaria. According to Caulfield, Richard and Black (2004a), 'deficiencies in vitamin A, zinc, iron, folate, as well as other micronutrients, are responsible for a substantial proportion of malaria morbidity and mortality'.[7]

While malaria is not a communicable disease, it has been a significant factor in many famines. For example, analysis of colonial era famines in India led Maharatna (2002) to argue that 'the occurrence of malaria epidemics in the wake of famines should be attributed to the occurrence of acute nutritional stress and its debilitating effects'. Indeed, Zurbrigg's (1992) study of mortality in the Punjab in the late 1800s suggests very strong links between undernutrition, periodic famine and deaths due to malaria. More recently, malaria was implicated in elevated morbidity and mortality in Madagascar during the food crisis of the late 1980s (when malaria accounted for 25 per cent of excess deaths among children and 70 per cent among adults (Garenne *et al.*

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5 Most of these deaths occurred prior to humanitarian intervention efforts.

6 Supplementation of children under 5 has been found to reduce mortality by 23 to 34 per cent in vitamin A deficient populations (UNICEF 2003).

7 Although evidence exists linking child mortality to anaemia, anaemia can be caused by malaria, iron deficiency, or other causes. The specific contribution of iron deficiency to malarial mortality among children has not yet been quantified due to lack of data. (Stoltzfus *et al*. 2004).

2002), and in Burundi in 2000/01 when a malaria epidemic surged across half of the country bringing about almost three million cases out of seven million total inhabitants of the country (Connolly *et al.* 2004).

Similarly, malaria had largely disappeared from North Korea by the 1980s (becoming a 'non-endemic area') until 1993 (Lim 2001). Yet, a latent malarial reservoir in the demilitarized zone was re-activated by several years of flooding coupled with the compromised nutritional status of the population at that time. As many as three million North Koreans lost their lives during the famine period (roughly 1994-99), and the number of malaria cases stabilized only in the early 2000s, falling from as many as 300,000 annual cases in 2000 (already post-famine) to under 100,000 in 2003 (IFRCRCS 2001; OCHA 2004). In such cases, the 'environmental parameters' were much to blame for malaria's resurgence, including the breakdown of vector control and treatment systems, large-scale movements of people (from non-endemic to endemic areas), and large numbers of people sleeping in relatively unprotected, close proximity (where mosquito bite ratios rise sharply).

4.7 Iodine (goiter)

A nutrition assessment of host as well as displaced populations in the Darfur region of Sudan in mid-2004 showed evidence of widespread and severe iodine deficiency (CDC/WFP 2004). Iodine deficiency is associated with higher foetal and neonatal mortality (including still births and congenital abnormalities), particularly among male infants (WHO 2000). By contrast, supplementation of mothers with iodine during pregnancy results in substantial reduction in mortality (in the Democratic Republic of Congo), and children born to mothers receiving iodine supplements improved cognitive functions (in Papua New Guinea) (Allen and Gillespie 2001). Such conditions are unlikely to be directly exacerbated by disasters (although the disruption of markets that may previously have made iodized salt available certainly does occur). However, displacement of populations to new locations where iodine is deficient in local foods and where treatment of already serious conditions is hampered would provoke public health concerns.

4.8 Zinc (diarrhoeal disease, pneumonia, malaria)

The combination of a lack of clean water, crowding, poor sanitary conditions, and environmental conditions that favour bacterial cross-contamination leads to the vicious cycle where malnutrition lays people open to diarrhoeal diseases which aggravate malnutrition—and both contribute to early death. For example, as many as one in seven of those who died in the Irish famine of the 1840s were recorded as having died not of food shortage ('starvation'), but of diarrhoeal diseases, including dysentery (Kennedy *et al.* 1999).[8] Similarly, diarrhoeal diseases were the prime cause of mortality in Somalia during the 1991/2 famine, Afghanistan during 2001, and in the Democratic Republic of Congo from 1999 to 2002 (Moore *et al.* 1993; Assefa *et al.* 2001; Salama e*t al.* 2004).

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8 Physicians conducting post-mortems on the famine dead during the late 1840s–early 1850s recorded that the deceased often had empty and translucent intestines, indicative of serious diarrhoea (Donovan 1848).

Zinc deficiency affects about 5.8 billion people worldwide, and has been shown in epidemiological trials to increase the risk of diarrhoea in young children by 33 per cent, pneumonia by 69 per cent, and malaria by 56 per cent (IZiNCG, 2004; Caulfield, Richard and Black 2004b). The link between diarrhoea and zinc deficiency is a perfect example of the feedback loop between malnutrition and disease: the amount of zinc lost through defecation increases three-fold with diarrhoea, resulting in imbalances with other micronutrients such as magnesium (Black 2003).

The overall result of nutrient deficiencies aggravated by, and aggravating disease progression, results in three million deaths annually from diarrhoeal disease among under-five children. Most episodes result from consumption of contaminated food. Unfortunately, humanitarian emergencies establish the conditions whereby water sources are easily contaminated but so too are food sources, as they become exposed to pathogens associated with unsanitary food handling, pests, flies, and unclean cooking utensils. As a result, diarrhoeal outbreaks in emergencies must be controlled through measures to protect water and food supplies more generally (based on public education and the careful citing and management of relief centres), as well as by treating the individual.

4.9 Folate (neural tube defects)

One additional condition worthy of mention here is the outbreak of neural tube defects following hurricane Gilbert (which struck the Caribbean in 1988), because this case highlights some of the additional, often invisible, ramifications of major disasters. Neural tube defects (NTDs) are severe spinal abnormalities, such as spina bifida cystica, meningocele, and encephalocele, which impact normal child growth. In the aftermath of hurricane Gilbert's devastation of several islands, a significant rise in NTDs was noted in hospitals in Jamaica. NTDs were uncommon in Jamaica in the 1980s, with a decade average incidence of only 1.4 per 10,000 live births. In the nine months following Gilbert, this rate rose to 5.7 per 10,000 (Duff *et al.* 1991; Duff and Cooper 1994). This large increase was due to a drop in dietary folate intake among pregnant women, resulting in both folate deficiency and iron-deficiency anaemia (Duff and Cooper 1994). Normal sources of folate in Jamaica are fresh fruit and vegetables which were scarce and expensive in the year following Gilbert's visit. This serious public health concern, relating to dietary shortfalls post-disaster, focused attention on the need for folate supplementation in emergency contexts with a view to preventing post-emergency complications (Readett, Serjeant and Serjeant 1989).

5 Implications for public action in emergencies

Despite an increase in number and scale of most kinds of humanitarian crises in recent years 'excess mortality' in emergencies has been falling.[9] From 1900 to 1960, there were ten years in which the total number of disaster-related deaths exceeded one million people *each year* (CRED 2005). Since that time, mortality attributable to disasters has not exceeded 600,000 people in any given year. Reported non-violent deaths in the

9 Excess mortality is operationally defined as a crude mortality rate exceeding one death per 10,000 people per day (WHO/UNHCR/IFRCRCS/WFP 2000).

context of major emergencies declined by almost 40 per cent between 1993 and the early 2000s compared with the previous decade (Guha-Sapir and van Panhuis 2003).[10] Armed conflicts in East Timor and Bosnia produced famine-friendly conditions in the mid-1990s, but mass non-combatant mortality was averted (even if other military and moral catastrophes were not). Similarly, the serious droughts in southern Africa in 1991/2, and again in 2001/2, caused massive shortfalls in food availability but no clearly-defined 'famine' deaths ensued, thanks to rapid, targeted, multi-sectoral interventions.

Underpinning such successes is an evolving awareness of the importance of micronutrients in determining how large-scale disasters unfold, and how best to respond through relief interventions. When lives are under threat, actions are needed to address the most severe manifestations as rapidly as possible. There are two challenges to be met in emergency response: (i) how to correct outbreaks of micronutrient deficiency disease at the individual level (lowering the mortality rate of those most severely affected), and (ii) how to prevent micronutrient status from deteriorating at a population-wide level (thereby preventing epidemic infection on a larger scale) and linking improvement to sustainable post-crisis gains. In this sense there are two main approaches that relate to micronutrients: (i) the targeted transfer of micronutrients to those in need, and (ii) empowerment with knowledge about deficiency disorders and potential solutions.

5.1 Targeted transfer of micronutrients

According to Salama *et al.* (2004), case fatality rates for severely malnourished children in emergencies have fallen dramatically in the past decade thanks to 'better protocols and products'. Both have resulted from advances in medical and nutritional sciences during the 1990s, coupled with an increasingly professional application of such knowledge on the ground (Sphere Project 2004; Collins 2001).

WHO (2003: 16) recognizes that 'all severely malnourished children have vitamin and mineral deficiencies', and that 'malnourished children do not respond to medical treatment in the same way as if they were well nourished'. As a result, medical approaches to treating and rehabilitating severely malnourished individuals already lay heavy emphasis on addressing micronutrient needs. Indeed, WHO (2003) specifies that 'correcting micronutrient deficiencies' is a critical step in the process of treating the severely malnourished. This typically involves two kinds of products: micronutrient fortified foods, and micronutrient supplements (in pill or liquid form).

In the immediate life-saving or stabilization phase of treating severely malnourished children, the aim is to stabilize the metabolism and treat potential infections, including addressing dehydration, hypoglycaemia, hypothermia and electrolyte imbalances with glucose/sucrose solutions and rehydration salts (that contain minerals such as magnesium, zinc, copper and potassium), while also dosing directly with vitamin A and

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10 There was an increase in disaster fatalities in 2003 (reaching 80,000), largely because of the deadly heat wave in Europe and the earthquake that struck Bam in Iran—both events caused more than 20,000 deaths (Munich Re 2004). Sadly, the level for 2004 was sharply higher due to the more than 300,000 deaths associated with the Asian tsunami of 26 December.

folic acid (Prudhon 2002).[11] In the subsequent transition phase, vitamin A and folic acid continue to be administered, alongside the introduction of supplements of zinc, copper, iron, and possibly multivitamins.

Providing vitamin A supplements is standard protocol for treatment of measles and xerophthalmia, and was widely distributed in Indonesia's camps for people displaced by the tsunami in 2004/5. Similarly, UNICEF supported the distribution of vitamin A capsules in camps in Darfur. In each case, the intent was to prevent mortality in situations where serious crowding and food stress could have resulted in outbreaks of measles or other infectious diseases. For example, a pooled analysis of studies finds that children with measles who received two doses of vitamin A supplements as part of treatment had a 64 per cent lower risk of death compared to children receiving a placebo (D'Souza and D'Souza 2004). Thus, while the humanitarian goal was to save life, the mechanism was protection from disease and the means was a micronutrient transfer.

For outbreaks of scurvy, WHO recommends delivery of 1 g of ascorbic acid daily for two-three weeks as treatment. In Angola, vitamin B supplements were provided in the short term to treat outbreaks of pellagra. In Darfur, iodized oil was recommended in supplement form as an immediate measure to treat those with visible goiter (a sign of serious iodine deficiency). And in Aceh province of Indonesia, zinc supplements were widely distributed to head off outbreaks of diarrhoeal disease.[12]

In the recovery/rehabilitation phase of treatment, multiple feedings are required daily using foods that deliver increasingly large amounts of energy, lipids, protein and micronutrients, which result in suitably rapid weight gain. It is important in this phase to proceed with extreme vigilance because over-rapid weight gain too soon in the recovery process can lead to fluid overload, resulting in cardiac failure (Prudhon 2002). Similarly, the process of refeeding can, in itself, provoke thiamine deficiency (causing Wernicke's encephalopathy—damage to the brain and nervous system which is fatal if not treated), and early dosing of thiamine prior to rapid refeeding has therefore been suggested (BMJ 2004; Crook 2004).

Numerous specially-formulated products have been designed to support nutritional rehabilitation (including weight gain), all of which are heavily based on micronutrient delivery. For example, liquid (milk)-based formulas such as F-75 are used in the stabilization phase. Sachets of this powder (reconstituted with boiled/chlorinated water) provide around 20 vitamins and minerals. In later phases, more solid therapeutic foods (such as a viscose peanut butter-like pastes eaten directly from the foil packaging) and various blended flours (such as corn soya blend—a cereal/pulse mix eaten as porridge or a thick drink) also provide around 20 micronutrients. The latter cereal blends can also be used in later phase supplementary feeding and interventions aimed at preserving weight gained, or preventing malnutrition among those not yet affected.

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11 All malnourished children present a potassium deficit which adversely affects cardiac and gastric functions. But for potassium to effective enter body cells and be retained the magnesium balance usually has to be corrected.

12 A recent study in Bangladesh finds that children treated with zinc during diarrhoeal episodes not only had less diarrhoea but also a lower incidence of acute lower respiratory infections (Baqui and Black, 2002). The same study found that iron coupled with zinc also appears to have value in protecting under-nourished children from severe diarrhoea.

Even in the process of broader food aid delivery, food ration planning has evolved rapidly with the aim of maximizing nutritional benefits. Major humanitarian agencies have gradually adopted rations that seek not only to protect minimal metabolic functions (at a minimalist 'starvation-avoidance' level) but also to reduce mortality by correcting pre-existing nutritional deficiencies and allowing for the physical activity necessary to be able to access food.

In Bangladesh, prone to frequent serious flooding, the fortification of staple foods (wheat flour) has also shown itself to be of value. A vulnerable-group development programme, managed by a local nongovernmental organization (BRAC) supports literacy and legal rights training to over 500,000 ultra poor women while also offsetting start-up costs on new income generating activities. Food rations are offered to these women to offset the costs of their time while in training and setting up income-earning jobs. In the course of the intervention, it became clear that vitamin A and iron deficiency anaemia were widely prevalent among the target group. Thus, in 2002 a pilot project to fortify whole-meal wheat flour was introduced. Four small hammer mills were equipped with micronutrient fortification devices, with former beneficiary women employed to manage the milling and fortification process. The four units provided 28,000 families participating in a vulnerable group development project with 25 kg of milled, fortified flour each month. Studies carried out by USAID/MOST show that the cost-savings are recognized by beneficiaries, and an efficacy study by ICDDR/B confirms the beneficial impact on vitamin A status (Van den Briel and Webb 2003). In 2005, the project was to expand to 40 units to meet the needs of 430,000 participants per year (UNICEF/MI 2004).

5.2 Empowerment with knowledge about micronutrients

In the Indonesian crisis described earlier, overall consumption was at least partially shielded by public action that protected consumption of staple foods. Even the poor were able to rely on basic commodities at a fixed price, thereby buffering the shock and minimizing consumption effects. But only at the macronutrient level. Price subsidization was focused on staples, but this only allowed the poor to maintain minimum caloric intake, not to enhance consumption of micronutrient-rich foods that would protect them against deficiency diseases. The result was a sharp increase in micronutrient deficiencies among children.

Except, that is, among households that had knowledge about the importance of micronutrients to child health and growth. Most people affected by micronutrient deficiencies do not show overt clinical symptoms, and they are usually unaware of their own deficiency. In locations where a majority of children are malnourished, it is hard for parents, or indeed governments, to recognize the problem at hand (among many other pressing priorities), let alone to prioritize malnutrition as an issue that must be tackled head on. This is even more so when most people are suffering micronutrient deficiencies. In such a context, just as food on the market does not guarantee access to that food for those without purchasing power, sufficiency diversity of foods on the market does not guarantee that even if people have purchasing power they will choose the right foods to buy (in nutritional terms). Choice (of food) does not in itself equate with a capability to choose (the right food). Using Sen's (1999) terminology, this, of course, represents a form of 'capability deprivation'.

Hence, the importance of raising understanding of micronutrient problems, and awareness of solutions. While the value of interventions that enhance mothers' nutrition knowledge has been recognized for decades, questions have persisted about the relative importance of nutrition information gained through formal education versus through non-school channels. To be food secure, households need the understanding of what constitutes an appropriate diet, as well as the skills and motivation to make sound choices on family care and feeding practices. Parents gain such information from many sources and the centrality of formal education, particularly for women, to successful development has been widely documented—largely through its positive effects on women's empowerment, social equity, delayed marriage and fertility effects, and higher income-earning potential. However, it has also been found in countries such as Brazil and Morocco that certain types of nutrition knowledge are significantly associated with child nutrition, independent of mothers' level of formal education or household income (Webb and Block 2004).

That this matters in times of crisis was demonstrated in Asia during the drought and economic crisis of the late 1990s, where short-term child nutritional status was found to be much more responsive to nutrition information acquired through public service messages than to maternal schooling (Webb and Block 2004). What is more, the information related to vitamin A: the children of mothers who had heard (and remembered) messages about the importance of vitamin A to child growth, and what foods were a good source, were less likely to be malnourished (in terms of macro or micronutrients) than children of mothers who did not have such knowledge (a statistically significant difference). It was therefore concluded that information transfers could potentially play a useful buffering role in the context of shocks. While price stabilization, food aid distribution and other forms of intervention are still needed in many contexts, certain types of nutrition knowledge could help mothers at least partially shield their infants through periods of food crisis by protecting diet quality, not just quantity.

This means standardizing messages based on best practice, tailoring the communications method to local cultural norms, investing in better measuring impact, and systematizing its use across all aspects of nutrition programming. Current examples of this in the context of emergency and post-emergency programming are community therapeutic care (CTC) and nutrition education in the context of child survival activities in Ethiopia. A novel approach to bringing knowledge and responsibility for the care of malnourished children to mothers at home is CTC, developed by Valid International and piloted in a dozen countries by CONCERN and other NGOs. This approach offers a potential bridge for child nutrition between curative and preventive approaches, using newly formulated therapeutic foods but at the same time empowering mothers themselves to care for their malnourished children and making them more aware of the causes of malnutrition (ENN 2004). This approach treats the majority of acutely malnourished children at home (rather than taking them away to rehabilitation centres, usually requiring the mother to also spend significant amounts of time away from home—and their other children), and focuses on outreach and community mobilization to promote participation, self-identification of problems, and longer-term behavioural change.

Another approach relates to joint programming in Ethiopia by UNICEF and WFP. Since March 2004, UNICEF and WFP have supported the regional bureau of health in implementing an enhanced outreach strategy (EOS) for child survival in the most food

insecure and drought affected areas of southern Ethiopia.[13] A fortified food supplement is provided to mothers of malnourished children, alongside maternal child health activities. The novel nature of this intervention is that it seeks much wider coverage by entrusting storage and delivery of food across many hundreds of locations with local women empowered to manage the activity (including store and recordkeeping). Furthermore, nutrition education materials are disseminated by locally-empowered women. Materials are designed to complement and strengthen nutrition activities in the health posts, offering mothers information about nutrient-rich sources of food as well as a range of other conventional nutrition and health education messages. These are provided orally by project staff (before food is handed out to mothers), reinforced by posters and brochures in local languages.

Of course there are other domains of information sharing that need attention. For instance, shaping public awareness is contingent being able to assess the extent of a problem. In the case of micronutrient deficiencies in emergencies, one of the major barriers limiting adequate public action has been the dearth of field-friendly techniques to measure the prevalence and risk of deficiencies. In some cases sub-clinical deficiencies can only been identified through biochemical tests. Such tests normally require the collection of blood samples, which is an intrusive procedure, especially among stressed populations, as well as laboratory equipment not suited to emergency settings.

Some progress has been made on this front. Notable has been the development of the Hemocue machine during the 1990s—a portable machine that allows field-level assessment of haemoglobin levels using a simple finger-prick.[14] More recently, a method has been developed to assess the prevalence of sub-clinical vitamin A deficiency using dried blood spots (Erhardt *et al.* 2002). Though both methods have been used for several years in developing country settings, they have yet to be incorporated into emergency nutritional surveys as standard practice.[15]

Another tool with promise is the use of dietary diversity indicators as part of food security assessments. Dietary diversity is usually defined as the number of different food groups or food items consumed over a given period of time. Dietary diversity has long been known to correlate quite strongly with nutrient adequacy in developed country settings, and more recently has been validated in many developing country settings as well (Arimond and Ruel 2004). As of yet, dietary diversity indicators have not been validated as food security indicators nor as indicators of adequacy of specific micronutrients in emergency affected settings, however they hold great promise on both fronts. It is logical that populations affected by emergencies tend to decrease the variety of their diets, and to therefore open up the doors for micronutrient deficiencies to arise. If they are shown to be valid proxies for micronutrient status or deficiency risk, they would be useful for triggering action without the need for intensive clinical surveys.

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13 The activity aims to rehabilitate malnourished children while preventing a deterioration in nutritional status among other children under 5 years of age.

14 Haemoglobin levels are a proxy for iron deficiency.

15 The nutrition survey undertaken by WFP/CDC in Darfur in 2004 was the first time both methods were used during a conflict-related emergency.

6 Conclusions

Public action to remedy and prevent outbreaks of micronutrient deficiency disorders is not only critical in emergencies; it represents the fulfilment of one of Sen's (1997) 'moral rights of the hungry'. Entitlements are secured when hungry people establish ownership over an adequate amount of food, or where their moral right to food is translated into a 'practical right'. Humanitarian action represents precisely that—a practical enforcement of the moral right not to die of a lack of food. The humanitarian imperative demands that relief be provided unconditionally to those who are suffering, whoever and wherever they are (Webb 2003b).

That said, enforcing this right to food increasingly means the delivery under extremely difficult circumstances not simply of the right quantity of commodities, but the right quality of foods. Addressing vitamin and mineral deficiencies is a core aspect of humanitarian relief and as such represents a commitment by the international community to uphold the moral right of the hungry not just to sustenance but to something farther reaching, i.e., sound nutrition. But this raises questions about current limits to emergency action. While the delivery by humanitarian personnel of therapeutic foods saves lives (and hence can be characterized as the active 'enforcement' of Sen's (1997) moral right to food), it does so in a time-bound way. Access to micronutrient-fortified foods usually ends once an individual is released from therapeutic or supplementary feeding, or when an emergency relief activity winds up. Thus, the state-of-the-art use of micronutrients to save life does little to empower the person whose life has been saved. That person typically does not gain either (i) the knowledge about micronutrients and health that are needed to build effective demand for *nutrients*, not just food; or (ii) the ability to secure (access to) micronutrient-rich foods through market or other channels on a regular basis once a crisis has passed.

This is important because even increased purchasing power (which may come from cash transfers of price subsidies on staple foods) does not axiomatically translate into increased consumption of micronutrients by those who need them most. This is both because the needs are 'hidden' to most consumers, and even when known to the consumer such dietary requirements often out of reach of poorest families who already allocate as much as 75 per cent of their total expenditure on food. In other words, the moral rights of the hungry to appropriate foods are today 'enforced' during an emergency, but they are rarely 'fulfilled' in the longer term (Sen 1997). Ironically, emergency professionals have succeeded in raising the level of nutritional and health in emergencies to such heights that recipients of such assistance often end up better nourished than they had ever been before, and better nourished than other individuals in the same country not immediately affected by the crisis (and thus not eligible for emergency aid).

Since 'malnutrition' transcends simple descriptive dichotomies such as 'emergency' or 'development', new approaches are needed to define ethically acceptable forms of humanitarian intervention that not only save lives but also enhance the effective demand of individuals for gaining access to *nutrition*, not just food. Supporting entitlements of the hungry cannot stop at ensuring access to food, since micronutrient adequacy demands access to the right foods as well as the right knowledge (about nutrition), leading to household-level behaviour change, not simply enhanced access to markets or purchasing power. Solutions to entitlement failure must therefore operate not only at the level of prices and markets, but equally in the domain of public health and public

nutrition. Entitlement-solutions focused only on food quantity, and not on diet quality, are likely to fall short of their intent and of their deeper responsibilities.

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