

# Public nutrition in complex emergencies

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Public nutrition is a broad-based, problem-solving approach to addressing malnutrition in complex emergencies that combines analysis of nutritional risk and vulnerability with action-oriented strategies, including policies, programmes, and capacity development. This paper focuses on six broad areas: nutritional assessment, distribution of a general food ration, prevention and treatment of moderate malnutrition, treatment of severe malnutrition in children and adults, prevention and treatment of micronutrient deficiency diseases, and nutritional support for at-risk groups, including infants, pregnant and lactating women, elderly people, and people living with HIV. Learning and documenting good practice from previous emergencies, the promotion of good practice in current emergencies, and adherence to international standards and guidelines have contributed to establishing the field of public nutrition. However, many practical challenges reduce the effectiveness of nutritional interventions in complex emergencies, and important research and programmatic questions remain.

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Complex emergencies are often characterised by a high prevalence of acute malnutrition (wasting and nutritional oedema) and micronutrient deficiency diseases. The current humanitarian response to nutritional crises originated in the 1940s and 1950s.<sup>1</sup> The earliest efforts to estimate the extent and severity of the problem of malnutrition occurred during the Nigerian civil war in Biafra,<sup>2</sup> the famines in Ethiopia,<sup>3,4</sup> and among the Cambodian refugees in Thailand.<sup>5</sup> Guidelines on nutritional surveys and nutrition programmes in complex emergencies were subsequently published.<sup>6–9</sup>

Over the past decade, although lessons have not necessarily been applied from one complex emergency to another, experience has been gained with each crisis. Understanding of malnutrition has improved and policies and practices have evolved from a narrow focus on protein-energy malnutrition to a more problem-solving approach, which we have termed “public nutrition”.<sup>10</sup> Public nutrition requires an analysis of nutritional risk and vulnerability and assessment of nutritional outcomes (malnutrition). It emphasises the broad range of interventions and strong programmatic links that are needed to address the three groups of underlying causes of malnutrition (figure). A range of combined strategies is needed to protect, promote and support nutrition (beyond treatment of malnutrition), and we focus this paper on activities that have a more direct effect on population nutritional status in complex emergencies (table 1).

Despite the existence of proven interventions, the prevalence of acute malnutrition has remained high in complex emergencies during the past decade (table 2).<sup>12</sup> Many complex emergencies, such as the situation in southern Sudan, are not short-term, but protracted or recurrent. Complex emergencies have occurred in the past decade without resulting in an increased frequency of wasting. For example, after the North Atlantic Treaty Organization air-strike on Kosovo in 1999, the prevalence of acute malnutrition, defined as the percentage of children with a weight-for-height Z-score of minus 2 or less and those with oedema, in the refugee camps in Macedonia remained stable at 2.4%. Similarly in Afghanistan, surveys in the major cities in 2000 showed

the prevalence of acute malnutrition to range from 5.6% to 8%. In both of these situations the politicisation of humanitarian aid occurred, with aid being increasingly treated as a component of foreign policy.<sup>13</sup> A further issue is the absence of impartiality in donor allocations of resources; emergencies in Africa are allocated less, relative to need, than emergencies in Asia and eastern Europe.<sup>14</sup>

Despite the relative absence of wasting, nutritional risk is evident in almost every complex emergency. In protracted or recurrent crises, such as those in the Horn of Africa (including, for example, Ethiopia, Kenya, Somalia, Sudan) or Asia, frequency of stunting (chronic malnutrition) might also be relevant. Micronutrient deficiency disorders, particularly deficiencies of vitamin A, iron and iodine, are frequently a major public health threat.<sup>15</sup> Outbreaks of scurvy in Afghanistan in 2001, pellagra in Angola in 2001, and angular stomatitis among refugees in Bangladesh in 1997 and refugees in Nepal in 2000, have shown that the consequences of micronutrient deficiency have yet to be adequately addressed.

## Nutritional assessment and surveys

The prevalence of wasting and nutritional oedema among children aged under 5 years is used as a proxy for the prevalence of acute malnutrition. In complex emergencies such data are usually gathered using two-stage 30-cluster surveys that measure the height and weight of children aged between 6 months and 5 years and obtain data on possible underlying causes of

### Search strategy and selection criteria

The paper is based on the personal bibliographic databases of the authors combined with a search of published work using MEDLINE, FirstSearch, Web of Science, JSTOR, ScienceDirect, and Ingenta, and more than 30 keywords, including: “undernutrition”, “severe malnutrition”, “anthropometry”, “interventions”, “nutritional indicators”, “rations”, “supplementary feeding”, “food aid”, “food security”, “micronutrients”.

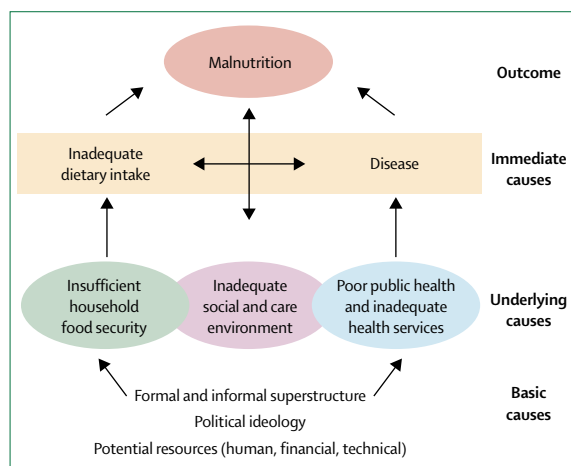


Figure: Underlying causes of malnutrition

malnutrition. This information is used to identify relief needs, to prioritise affected groups or geographical areas, to plan nutritional interventions, to target scarce resources, and also to monitor the effectiveness of aid programmes.

### Anthropometric assessment of children

The international standard for measurement of acute malnutrition is the weight-for-height index based on the US National Center for Health Statistics reference population, expressed in Z scores or percentage of the median or both. The Z score is recommended, particularly for surveys,<sup>16,17</sup> although percentage of the median is routinely used as the criterion for admission to and discharge from targeted selective feeding programmes. Acute malnutrition is described as global (weight-for-height Z score of  $\leq -2$  or oedema) or severe (Z score of  $\leq -3$  or oedema). For global acute malnutrition, percentage of the median is  $<80\%$  or oedema, while for severe acute malnutrition it is  $<70\%$  or oedema. Despite this focus on acute malnutrition (the tail-end of the distribution), review of the entire distribution is needed to understand how the entire sample has been affected.<sup>18–20</sup>

The mid-upper-arm circumference is a useful measure<sup>21–23</sup> but for surveys it needs to be related to reference values for height (or length)<sup>24</sup> or age.<sup>25</sup> The use of unadjusted mid-upper-arm circumference persists because it is more straightforward than weight-for-height, and also because it might be better for predicting mortality.<sup>26</sup>

### Assessment of adolescent and adult nutritional status

Increasingly, non-governmental organisations are including assessment of adults in 30-cluster nutrition surveys. However, there is no consensus on indices and cut-off criteria. For adults the body-mass index (weight in kg divided by the square of height in metres) remains the recommended index.<sup>27</sup> However, large individual

variations in body shape can alter individual body-mass index by as much as  $4 \text{ kg/m}^2$ .<sup>28</sup> Additionally, height and weight can be difficult to measure in elderly or severely undernourished adults who are unable to stand. For adolescents, variable age of onset of puberty is also a difficulty.<sup>29</sup> Mid-upper-arm circumference has been used specifically for targeting adults and adolescents in emergency selective feeding programmes.<sup>27</sup> The addition of clinical signs such as oedema, inability to stand, and dehydration might also improve sensitivity and specificity of mid-upper-arm circumference-based admission criteria.<sup>30</sup>

### Standardisation of survey methods

Standardisation—which is essential to minimise bias, ensure valid comparisons, and review trends over time<sup>31,32</sup>—has been achieved for survey design, the anthropometric measurement of children, the calculation of nutritional indices, and the statistical description of malnutrition prevalence.<sup>17,33–35</sup> However, the two-stage 30-cluster design is not used without difficulties. First, because there might be a trade-off between measuring the specific localised effect of an emergency, and the wider effects on the surrounding area, the choice of sampling frame needs careful consideration. Second, surveys in pastoral populations might be difficult because such groups are often widely dispersed and mobile and might have fewer than the required number of children per cluster. In such contexts, increasing the number of clusters and decreasing the number of children per cluster or sentinel site monitoring<sup>19</sup> could be considered.

Despite the existence of international guidelines, survey protocols might need to be adapted and then endorsed by national or other coordinating bodies. The Government of Ethiopia has developed new national survey guidelines, which are routinely used by most agencies in that country.<sup>36</sup> Methods for assessing the underlying causes of malnutrition are less standardised. In Ethiopia, for example, only six of 67 surveys in 2000 recorded measles immunisation status.<sup>37</sup> Data on all three groups of underlying causes are crucial to understanding the risks associated with acute malnutrition, and for decision making.

### Micronutrient deficiency disorders

The assessment of micronutrient deficiency disorders in complex emergencies has not been standardised. As a priority, assessors should review the risk by looking at the micronutrient composition of the food ration and alternative sources of food available. Specific staples have been linked with specific disorders (eg, maize-based rations with pellagra, and rice-based ones with beri-beri). A history of micronutrient deficiency disorders previously endemic in the affected population also helps.<sup>38</sup> Clinical and biochemical investigations have been undertaken in Nepal, Kenya, and eastern Europe,<sup>39</sup> but more user-friendly methods and equipment are urgently needed.<sup>15</sup>

Aim	Essential actions	Gaps, challenges, and constraints
Assessment and analysis of the causes, type, severity, and extent of malnutrition Necessary to determine needs, prioritise geographical areas, and types of interventions, target resources, and design interventions	<ul style="list-style-type: none"> <li>• Anthropometric surveys (two-stage 30 cluster surveys).</li> <li>• Analysis of the underlying causes of malnutrition related to food, health and care</li> <li>• Assessment of risk of micronutrient deficiency diseases</li> </ul>	<ul style="list-style-type: none"> <li>• A modified survey methodology for surveys among pastoral and other dispersed populations</li> <li>• Incorporating assessment of mortality more systematically into surveys</li> <li>• Development of user-friendly tools for assessing micronutrient deficiency diseases using biochemical indicators</li> <li>• Regularly incorporating analysis of underlying causes of malnutrition</li> <li>• Further standardisation for the assessment of adolescent and adult nutritional status</li> </ul>
Assessment and analysis of the affected population's normal means to access food, the impact of the disaster on current and future food security, at-risk groups, and programmatic implications Support the nutritional needs of all groups who are unable to meet their nutritional requirements	<ul style="list-style-type: none"> <li>• Famine early warning and nutritional surveillance systems that alert to nutritional risk rather than malnutrition</li> <li>• Food security assessments, which might be combined with nutrition surveys</li> <li>• General food distribution including the planning of a nutritionally adequate food ration and the design of appropriate distribution and targeting mechanisms</li> <li>• Monitoring systems that establish coverage of, access to, use of food ration, and effect</li> </ul>	<ul style="list-style-type: none"> <li>• Incorporating food security, nutrition, and health concerns within early warning systems</li> <li>• Use of early warning and surveillance to mobilise actions which prevent malnutrition</li> <li>• Implementing a range of food security interventions that enable people to meet their food needs and which address and prevent malnutrition</li> </ul>
Address the nutritional and support needs of at risk groups (infants, young children, pregnant and lactating women, elderly people, and the chronically sick)	<ul style="list-style-type: none"> <li>• Supplementary feeding programmes for all members of sub-groups of the populations identified as at risk (blanket coverage of at risk groups)</li> <li>• Support, protect and promote exclusive breastfeeding and appropriate young child feeding practices through training, development, and application of relevant policies and monitoring</li> <li>• Understand and address the nutritional needs and risks of older people, and the chronically sick, with an emphasis on strengthening community capacities and social support networks</li> </ul>	<ul style="list-style-type: none"> <li>• The particular nutritional difficulties of older people, people with disabilities, and the chronically sick are generally not considered and need to be reviewed, particularly with respect to strengthening regular programmes</li> <li>• Effective, integrated, and feasible nutrition interventions for people living with HIV</li> </ul>
Address micronutrient deficiencies	<ul style="list-style-type: none"> <li>• Vitamin A supplementation every 4–6 months to all children aged 6 months to 5 years (and older children when feasible)</li> <li>• Fortification of food aid commodities including oil, salt, blended food, and, when possible, cereal flour</li> <li>• Provision of foods rich in micronutrients</li> <li>• Supplementation as a short-term strategy</li> <li>• Treatment and prevention of malaria, diarrhoeal disease, and other diseases</li> <li>• Ensure affected population has access to iodised salt</li> </ul>	<ul style="list-style-type: none"> <li>• Impact studies of integrated strategies for addressing and preventing micronutrient deficiency diseases</li> <li>• Role and contribution of wild foods for preventing and controlling micronutrient deficiency diseases</li> <li>• Further development of guidelines for small-scale fortification interventions at community levels</li> </ul>
Address moderate acute malnutrition	<ul style="list-style-type: none"> <li>• Targeted supplementary feeding programmes, achieving maximum coverage through decentralised distribution</li> <li>• Demonstrated understanding of underlying causes of malnutrition to ensure advocacy and implementation of alternative programmes</li> </ul>	<ul style="list-style-type: none"> <li>• Understanding the impact of supplementary feeding programmes at the population and community level, especially in the context of inadequate household food security and in relation to alternative interventions</li> </ul>
Treatment of severe acute malnutrition	<ul style="list-style-type: none"> <li>• Therapeutic feeding programmes, including community therapeutic care</li> </ul>	<ul style="list-style-type: none"> <li>• Strategy for integration into longer-term health facility services and policies</li> <li>• Further development of guidelines for community therapeutic care</li> </ul>
Policies and capacity development	<ul style="list-style-type: none"> <li>• National nutrition policies incorporate emergency nutrition appropriately</li> <li>• National guidelines for emergency interventions based on universally accepted best practice and adapted to the context</li> <li>• Training programmes</li> <li>• Emergency preparedness activities</li> </ul>	<ul style="list-style-type: none"> <li>• Mechanisms and processes that facilitate policies to be applied in practice</li> </ul>

**Table 1: Nutrition in emergencies: aims, analysis, and action**

## Interpretation and decision making

Agencies have developed decision-making frameworks that relate the prevalence of malnutrition and presence of aggravating factors to possible nutritional interventions (table 3).<sup>33,40</sup> However, because the relation between mortality and malnutrition is so complex, especially outside refugee camps, the severity of the complex emergency cannot be established by such factors alone. Also, the interventions prescribed by this framework are restricted and do not include possible non-food interventions. In some countries the national prevalence of acute malnutrition is consistently higher than the benchmark of 10% or 15% proposed for the establishing of supplementary food programmes.<sup>41</sup>

The prevalence of acute malnutrition should be interpreted in the context of mortality, coping strategies, disease, seasonality, and other factors. Efforts continue to improve analysis of underlying causes of malnutrition and consideration of a wider range of non-food aid interventions,<sup>42,43</sup> which should help to avoid the food-first bias in programming.

## Meeting food needs through general food distribution

The predominant humanitarian response to acute food insecurity is the provision, for all affected groups, of a general food ration, usually consisting of dry cereals, pulses, vegetable oil and, wherever possible, salt and

Year and month	Location	Prevalence of acute malnutrition*
<b>Asia</b>		
1997	Bangladesh, refugees from Burma	June, 1997 14.7%; February, 1998 11.5%
September–October, 1998	North Korea (countrywide survey representative of 71% of the population)	15.6%
December, 1999–February, 2000	West Timor (refugees from East Timor), Belu and Kupang district	23.6% and 12.1%
1994	Southern Iraq, Marsh Arabs	June, 1994 25%
<b>Southern Africa</b>		
July, 2002	Angola, Kuando Kubango Province, Matungo & Mavinga town	25% and 12.4%
July, 2001	Bie Province, Camacupa	12.5%
May–June, 2002	Benguela Province, Ganda, Huila province, Caconda (IDPs)	From 9% to 16.6%
July, 2001	Kuito, IDP camps	13% (reports of pellagra)
June, 1997–September, 1999	Malange	From 2.3% to 21.5%
August, 1997	Moxico Province, Luau. Refugees	34%
<b>West Africa</b>		
October, 1993	Liberia, Upper Margibi County	34%
1993	Vahun town, refugees from Sierra Leone and IDPs	30%
1996	Bong County, Gbarnga	August, 1996 23.7%
	Buchanan	August, 1996 47.0%
	Monrovia displaced	August, 1996 21.2%
	Monrovia residents	August, 1996 13.3%
January, 1998	Sierra Leone, Freetown, displaced camps	From 3% to 21%
<b>Great Lakes Region of Africa (Rwanda, Burundi, Tanzania, Zaire, Uganda)</b>		
July–October, 1994 to July, 1996	Former Zaire, Goma	
	Katale camp	July, 1994 23.6%; October, 1994 10.4%; May, 1996 3.5%
	Kahindo camp	July, 1994 20.2%; October, 1994 17.5%; July, 1996 2.5%
	Kibumba camp	July, 1994 20.2%; October, 1994 6.3%; July, 1996 3.5%
	Mugunga	May, 1994 16.4%; October, 1994 16.4%; May, 1996 1.6%
August, 1997	Burundi, Kayanza province, regroupement camps	August, 1997 from 12.8% to 13.4%
	North Gitega province	January, 1998 19.7%
	Bubanza province	February, 1998 16%
October, 1999	Democratic Republic of Congo, IDPs in North and South Kivu	9.7%
<b>East Africa</b>		
January, 1993	Ethiopia, Ogaden Region, Gode town, IDPs & refugees	June, 1993 44%;
September, 1996	Ogaden Region, Somali refugees	From 15% to 21%
2001	Somali Region (formerly Ogaden), Gode District	August, 2001 29.1%
	Western Ethiopia, Sudanese refugees	June to July, 2001 from 9.0% to 20.7%
March, 2003	Somali Region (formerly Ogaden), Fik Zone.	From 31% to 33%
1996	Kenya	
	Western Kenya, Kakuma refugee camp	April, 2001 17.2%
	Eastern Kenya, Dadaab refugee camps	August, 1996 from 15.1% to 18.6%; February, 2001 16.1%
March, 2000	Somalia Bakool Region, Hudur Town	21.2%
	Bay Region, Baidoa and Burhakaba	15.5% and 22.0%
December, 2001	Belet Hawa District	37.1%
<b>Southern Sudan</b>		
March, 1993	Ame, Ayod, Akon, and Kongor	From 75–84%
April, 1994	Labone camp	30.7%
1998	Gogrial County, Ajiep	July, 1998 80.3%; October, 1998 48.0%; January, 1999 14.6%
	Pochalla	June, 1998 33.7%
	Gogrial County, Panthou and Toch	October, 1998 40.8%
	Bahr el Ghazal, Wau (IDPs)	October, 1998 71.6%
April, 2001–September, 2002	Upper Nile, Phou State, Old Fangak district	From 20% to 31.4%
July, 2000–December, 2002	Upper Nile, Unity State, Bentiu and Rob Kona	From 20% to 38%
March, 2001–June, 2002	Aweil East, Malualkon	From 15.5% to 28.9%
February, 2002	Jongelei, Bieh State, Akobo, and Nyandit	32%
April, 2002	Unity State, Bentiu, and Rob Kona Towns	21% and 24.3%
May, 2003	Upper Nile, Malakal, Balliet, Tongo, and Fashoda	18.4%
May, 2000	Western Sudan, El Lait and Taweisha. Displaced southerners	19.5%
All data extracted from quarterly Reports on the Nutrition Situation of Refugees and Displaced Populations (RNIS) published by ACC/Sub-Committee on Nutrition of the UN. RNIS classifies nutritional emergencies into one of five categories. Classification is based on prevalence of acute malnutrition, degree of nutritional risk, underlying causes of malnutrition and constraints restricting humanitarian response. Category I corresponds to highest risk and category V lowest. Examples described above are classified as Category I, a critical situation. *Prevalence of wasting expressed as <-2 Z scores weight-for-height and nutritional oedema. IDPs=internally displaced people.		
<b>Table 2: Prevalence of acute malnutrition in selected emergencies during the past decade<sup>12</sup></b>		

Prevalence of malnutrition (<-2 Z score or oedema)	General ration	Interpretation and selective feeding intervention
Malnutrition rate >20% or malnutrition rate 10–19% with aggravating factors*	Advocate for general ration of 2100 kcal	Serious Blanket (all members of sub-groups) and targeted supplementary feeding and therapeutic feeding
Malnutrition rate >10–19% or malnutrition rate 5–9% with aggravating factors		Alert Targeted supplementary feeding and therapeutic feeding
Malnutrition rate >10% with no aggravating factors		Acceptable No need for population level intervention (individual attention for malnourished)
*Aggravating factors to consider are: crude mortality rate >1, inadequate general food ration, epidemic of measles, shigella or other important communicable disease, severe cold and inadequate shelter		
<b>Table 3: Guidelines to assist in decision to implement nutrition programmes<sup>39</sup></b>		

blended food. In situations of extreme insecurity (eg, eastern Democratic Republic of Congo in 1997, and Somalia in 1992) general rations were distributed cooked.<sup>44,45</sup>

The average minimum requirement for energy for a population with a typical developing country demographic profile is 2100 kcal (8·8 MJ) per person per day<sup>38</sup> (revised upwards by UN agencies from 1900 kcal).<sup>46,47</sup> This minimum requirement serves as an initial planning figure for general rations. It is suitable for light physical activity, an ambient temperature of 20°C, and for people with no obvious severe health, nutritional, or other type of physiological stress. If these variables change then the initial planning figure should be adjusted.<sup>48</sup> Additionally, the ration should provide 10–12% of energy from protein and at least 17% from fat.<sup>38</sup> Micronutrients have received less attention, despite frequent outbreaks of deficiency disorders.<sup>49,50</sup> Food security assessments also assist in planning the general food ration by estimating the contribution of other sources of food to daily nutritional needs. Some populations, including refugees and internally displaced populations, might be entirely dependent on food aid while in-situ populations might have only lost access to specific food commodities.

The general food ration should satisfy not only the population's nutritional requirements but also qualitative criteria of cultural acceptability, safety, digestibility, and ease of preparation and storage. While general guidelines on the quality of food aid commodities do exist, the southern African drought of 2001 highlighted the absence of specific regulations on genetically modified food donated in complex emergencies. At first several governments refused to accept these commodities because of concerns over safety and to prevent dissemination of seeds that could potentially threaten exports.<sup>51</sup> Later most governments accepted milled genetically modified maize but Zambia did not alter its position.<sup>52,53</sup> The World Food Programme had to increase regional purchases of non-genetically modified maize. The air-dropping of humanitarian daily rations (packets containing individual ready-to-eat meals, biscuits, matches, etc) in militarised contexts<sup>54</sup> has been considered inappropriate in complex emergencies,

because of the high cost, poor cultural acceptability, and restricted targeting of this type of ration.

Effective distribution of general food rations necessitates a working logistics and distribution system and targeting. Food aid targeting is the process by which areas and households are selected to receive emergency food aid, and this targeting relies on an analysis of who is at risk and why and uses a range of health, food security, and nutrition indicators.<sup>55</sup> Poorly targeted food assistance might reduce the nutritional effectiveness of food aid.<sup>56</sup> Irregular distribution, lack of access as a result of insecurity, and the erratic supply of non-cereal food aid commodities, including beans, groundnuts, vegetable oil and salt, are frequent causes of micronutrient deficiency disorders<sup>57</sup> and deteriorating nutritional status.<sup>58,59</sup>

Food aid usually dominates humanitarian response appeals, accounting for up to 90% of total budgets.<sup>10</sup> In July, 2003, the Government of Ethiopia and the World Food Programme estimated that 12·6 million drought-affected Ethiopians were in need of food assistance. Donor response was rapid.<sup>60</sup> This predominance of the food-first approach might be at the expense of crucial health and non-food interventions.<sup>61,62</sup>

### Addressing moderate acute malnutrition

Supplementary feeding programmes add to general food rations for nutritionally vulnerable groups, with the objective of reducing the prevalence of moderate malnutrition and associated mortality in malnourished children and other at risk groups such as pregnant and lactating women. While the relative risk of mortality for an individual child with moderate malnutrition is lower than that for a severely malnourished child, more of these children will die because a higher proportion of the population is affected by moderate malnutrition.<sup>63</sup>

The supplement of 500–1200 kcal per day, consisting of fortified blended food mixed with oil, is in the form of an on-site meal or a dry take-home premix. Measures of effectiveness include average daily weight gain, length of stay, and numbers of people recovering, dying, being transferred, or leaving the programme before they recover.<sup>33,40,64,65</sup> A dry take-home supplement is generally thought to be more effective than wet feeding on-site as

it achieves greater coverage, increases the proportion of children who recover, and reduces the numbers of defaulters.<sup>66-69</sup>

The effectiveness of such programmes has been challenged.<sup>66,70-72</sup> Standard programme-monitoring indicators are not systematically applied in complex emergencies<sup>69,72</sup> so the effectiveness of different programmes is difficult to compare. Efficacy in treating moderate malnutrition might be restricted if blended foods are given without additional oil. Also, although good results in both camp and non-camp settings have been reported in Africa,<sup>68</sup> effectiveness is often restricted by poor coverage. Coverage is affected by access and distance to the central food distribution site, security concerns, the quality of care being offered, and cultural factors such as ethnicity, trust, stigma, cultural taboos, and traditional childcare practices.<sup>68</sup> Context-specific factors are important for the design of effective supplementary food programmes. For example, decentralisation of dry supplementary feeding, with a larger number of smaller sites, might achieve greater coverage, especially for dispersed populations.

The effect of moderate acute malnutrition and associated mortality on a population basis is difficult to measure. Changes are not necessarily attributable to supplementary feeding, and are just as likely to be a result of improved food security, caring practices, or the health environment. For example, the strategy of the International Committee of the Red Cross is to improve the general ration, and so allow malnourished children to be fed normal family foods.<sup>73</sup> The merits of different approaches have not been compared rigorously. Despite the drawbacks, supplementary feeding programmes continue to be widely used, in part because of widely available blended foods, and they are often considered to be the only pragmatic response to addressing acute malnutrition.

### Management of severe acute malnutrition

Therapeutic feeding programmes have a major role in reducing malnutrition-related mortality in complex emergencies. These programmes can be set up in hospitals or other health facilities or in temporary structures. Tried-and-tested guidelines and manuals are available.<sup>74,75</sup>

### Improvements in treatment protocols and effectiveness

Changes in recent practice include low-protein F75 and F100 therapeutic milks fortified with minerals and vitamins, feeding regimens that include small, frequent meals with the quantity determined according to body-weight, correction of electrolyte imbalances and infectious disease complications, the use of Resomal, a low sodium, high potassium rehydration solution, and the supplemental suckling technique for severely malnourished infants aged under 6 months.<sup>76</sup> Prognostic tools have been developed that can be used to compare

reported mortality with expected mortality in therapeutic feeding programmes.<sup>77</sup> With the input of scientific advisory committees and the protocols and guidelines based on these new findings,<sup>74,76,78</sup> non-governmental organisations have developed protocols and the logistical and human resources systems to be able to implement them in difficult working conditions.<sup>79,80</sup> The dissemination of WHO guidelines<sup>75</sup> and the development of indicators for minimum standards for the treatment of severe malnutrition<sup>65</sup> have also contributed to improved practice.

Treatment protocols have also been developed for severely malnourished adults; these protocols are similar to those for children.<sup>81</sup> Such regimens have been associated with recovery rates of 75% or more even among the most emaciated individuals.<sup>82</sup> The design of adult feeding programmes is often more complicated than those for children. The potential for adult centres to become quasi-hospices for those with chronic illnesses, to contribute to population displacement, to undermine survival strategies, and to contribute to adverse outcomes for the children of the inpatients, are some factors that should be taken into account at the design stage. The acceptability in adults of a milk-based diet might also be poorer, thus increasing length of stay.

### Operational challenges and home-based treatment

Progress in managing severe acute malnutrition has largely taken place in centralised, inpatient settings such as hospitals or within refugee camps. Humanitarian agencies and governments face operational challenges when implementing therapeutic feeding programmes in complex emergencies,<sup>83</sup> including the absence of trained staff, government workers who are unfamiliar with new protocols, and the high set-up costs, including costs of staff, drugs and specialised foods.<sup>84</sup> Other operational constraints include poor acceptability and low coverage (coverage has been reported to be as low as 10–20%).<sup>85</sup>

Building on experience with adapting protocols to decentralised community-based settings,<sup>86</sup> home-based treatments with ready-to-use therapeutic foods have been developed.<sup>87,88</sup> Community therapeutic care is a promising option for increasing the numbers of severely malnourished children who have access to treatment, and potentially reduces the risk of cross-infection.<sup>89-91</sup> However, several issues are unresolved. Eligibility criteria for home-based treatment include age cut-offs and severity of malnutrition so younger children or those with underlying complications including oedema might be excluded. Patients in the community might also develop complications once weight gain has started.

### Micronutrient deficiencies

The provision of vitamins and minerals through the general food ration, which often consists of a restricted number of dry foods, is difficult. Rations limited to cereals, oil, and pulses or even a single commodity ration



(cereal) are still common,<sup>45</sup> and deficiencies of vitamin A, iron, and iodine are common in complex emergencies.<sup>15</sup> Rations based on highly refined cereals deficient in zinc, potassium, and magnesium have been associated with high mortality from diarrhoeal disease.<sup>92</sup>

Food fortification and vitamin A supplementation are routine practices in complex emergencies but the use of other strategies depends on the specific context and operational constraints.<sup>38</sup>

### Food fortification

Food fortification is an inexpensive and efficient way of providing micronutrients.<sup>93</sup> The policy of the World Food Programme and major food aid donors is that all oil, salt, and blended food should be fortified with micronutrients, either singly (iodine in salt and vitamin A in oil) or in combination.<sup>94,95</sup> Although specific guidelines exist for the fortificant premix,<sup>96</sup> the final composition of micronutrients in blended food varies because of differences in quality of cereal and soya used and quality control of the fortification process.<sup>95</sup> The acceptability of blended food used in complex emergencies is good and because its resale value is far less than that of other food aid commodities, it is generally consumed by the intended recipients and not sold.<sup>97</sup> Other commodities can also be fortified—for example, maize flour was fortified in Malawi in the early 1990s to combat niacin deficiency among Mozambican refugees.<sup>98</sup> However not all micronutrients are very suitable fortificants; vitamin C is not stable and may degrade on exposure to high temperatures (in storage or during cooking), high pH, and oxygen. Finally, the bulk of cereal food aid is provided as whole grain and therefore fortification is only possible once supplies are in-country, which is not always feasible because of financial and technical constraints in complex emergencies. Even when a range of fortified food aid commodities is provided, the recommended daily requirements<sup>33</sup> are not met for all micronutrients, particularly vitamin A, iron, vitamin C, riboflavin and niacin (table 4).

### Improving access to foods rich in micronutrients

Another potential strategy for prevention of micronutrient deficiency diseases is the inclusion of a food commodity in the general food ration, such as pulses, groundnuts, red palm oil, fruits, and vegetables, that has a high concentration of the key deficient vitamins. In Malawi, the distribution and consumption of groundnuts protected Mozambican refugees against pellagra.<sup>99</sup> However, such strategies are often limited by resource constraints and logistical difficulties. Fresh foods are particularly difficult to provide to large populations on a regular basis. The practice of resale or exchange of some of the food ration in order to access a more diverse range of foods is common in complex emergencies.<sup>45,99</sup>

A range of food security interventions are available that potentially increase access to nutritious food in complex

Vitamin/mineral	Recommended daily requirements <sup>32</sup>	General ration	
		Amount	Percent of requirements
Vitamin A (retinol equivalents)	500 µg	426 µg	85%
Thiamine (B1)	0.9 mg	1.89 mg	210%
Riboflavin (B2)	1.4 mg	0.67 mg	48%
Niacin	12 mg	6.8 mg	56%
Folic acid	160 µg	209 µg	131%
Vitamin C	28 mg	21 mg	75%
Vitamin D	3.8 µg	24 µg	632%
Iron (assuming low bioavailability)	22 mg	16.79 mg	76%
Iodine	150 µg	240 µg	160%

\*General ration included 430 g rice, 60 g pigeon peas, 25 g vegetable oil, 40 g wheat soy blend, 20 g sugar, 7 g salt, and 100 g onions, and was provided to Bhutanese refugees in Nepal in 1994.<sup>97</sup>

**Table 4: Daily requirements of vitamins and minerals for population needing emergency food aid compared with amounts provided by typical general ration\***

emergencies, including home gardening, livestock and veterinary programmes, market interventions, microcredit schemes, food or cash for work programmes.<sup>100,102</sup>

### Supplementation

It is standard practice in emergencies to provide vitamin A supplementation every 4–6 months to all children aged 6–59 months (infants aged 6–12 months 100 000 IU orally and children older than 12 months 200 000 IU orally) to prevent vitamin A deficiency, and to reduce the risk of mortality, eye diseases, and other sequelae of measles.<sup>33,103</sup> Vitamin A supplementation is often given in conjunction with measles or other vaccination campaigns. Because water-soluble vitamins are needed on a daily basis, the distribution, acceptability, and compliance for such supplementation might present difficulties.<sup>104</sup> Supplementation might be useful to control micronutrient deficiency disease outbreaks in the short-term when food-based approaches are not feasible or are being investigated.<sup>105,106</sup>

### Nutritional needs of at risk groups

In complex emergencies, sex, age, HIV status, and other characteristics have a role in establishing nutritional risks, which can be exacerbated by changes in social networks and support structures.

#### Infants

Exclusive breastfeeding for 6 months reduces morbidity and mortality from a range of infectious diseases including diarrhoea.<sup>107–111</sup> In complex emergencies, in which hygiene and care practices might be compromised and overcrowding is common, the risk of diarrhoea and other infections is high and breastfeeding is even more essential.<sup>112</sup> Policies and guidelines on infant feeding in complex emergencies are based on protecting, promoting and supporting exclusive breastfeeding.<sup>107,112–114</sup> However, adherence to good practice

is often constrained by an absence of institutional memory, and failure of leadership and coordination.<sup>115,116</sup>

In complex emergencies, the conditions required for the safe use of breastmilk substitutes, clean water, facilities for hygienic preparation, and a regular supply, are difficult to guarantee and the associated risks are higher.<sup>117</sup> When replacement feeding is deemed necessary, the procurement and distribution of breastmilk substitutes should adhere to the provisions of the International Code of Marketing of Breastmilk Substitutes and subsequent relevant World Health Assembly resolutions, specifically Resolution 47.5.<sup>118,119</sup> Unsolicited and inappropriate donations, such as occurred in Kosovo,<sup>115,120</sup> could undermine exclusive breastfeeding practices. Furthermore, the scarcity of appropriate complementary foods for young children when blended food is not included in general food rations, difficulties addressing the nutritional needs of large numbers of unaccompanied infants and young children,<sup>121</sup> and poor awareness of the benefits of breastfeeding all contribute to poor outcomes.

Indicating increasing knowledge of the mechanism and risk of mother to child transmission of HIV, current UN recommendations endorse exclusive breastfeeding for the first 6 months for mothers who are HIV-negative or who do not know their HIV status. If, however, a woman has tested positive for HIV, and when replacement feeding is acceptable, feasible, affordable, sustainable, and safe, avoidance of all breastfeeding by HIV-positive mothers is recommended.<sup>122–124</sup> Otherwise, exclusive breastfeeding is recommended during the first months of life and should then be discontinued as soon as it is feasible. In emergency contexts, awareness and knowledge of HIV status is usually poor and resources for replacement feeding are scarce.<sup>125</sup> The recently revised Sphere Nutrition Standards recommend that “if voluntary and confidential testing for HIV/AIDS is not possible, all mothers should breastfeed”.<sup>112</sup>

### Pregnant and lactating women

The nutritional requirements of pregnant and lactating women are higher than the population average,<sup>33</sup> and therefore exceed the amounts provided in the general food ration. The International Committee of the Red Cross provides an increased general food ration in part to compensate for these increased needs, while other relief agencies provide all pregnant and lactating women with a food supplement through supplementary feeding programmes.<sup>126</sup> Although compliance with daily supplementation protocols is difficult to maintain, pregnant and lactating women should receive daily supplements of iron and folic acid.

### Older people

The effect of emergencies on older people is increasingly recognised; HelpAge International have advocated strongly for better recognition of the rights, needs, and contributions of older people in emergencies.<sup>127</sup> In

besieged areas of Bosnia Herzegovina, older people were at greater risk of undernutrition, which was associated with disease, cold, psychological stress, and difficulties with food preparation.<sup>128</sup> Among older Rwandan refugees, nutritional risk was related to lack of mobility, income, access to land, access to food rations, and other essential services, and to psychosocial trauma.<sup>129</sup> Loss of social networks and support systems increases the vulnerability of older people. Increasingly, older people are also acting as caregivers for young adults and family members who have been affected by HIV, thereby incurring both physiological and financial costs that affect their nutritional status.<sup>130</sup>

Generally, more programming strategies are required to address the needs of older people without undermining their capacity to support themselves. The Sphere Minimum Standards advocate the use of community-based systems to ensure appropriate care for older people.<sup>112</sup> Recommended actions include improving access to the existing general food rations and supplementary feeding programmes, ensuring food rations are easy to prepare and consume, and that rations meet the additional nutritional requirements, specifically micronutrients.<sup>112,131</sup>

### People living with HIV

The recent food crises faced by countries in southern Africa have been directly linked to the HIV/AIDS epidemic.<sup>132</sup> This epidemic is threatening the ability of communities to recover from famine, because the most productive household members are predominantly affected by the disease.<sup>133</sup> Furthermore, people living with

#### Panel: Priority areas for investigation

- 1 Increasing coverage and effectiveness of therapeutic feeding programmes
- 2 Improving acceptability and nutritional adequacy of general food ration and timely delivery of agreed amounts
- 3 Improved analysis of different types of famine
- 4 Impact assessment of food security and livelihood interventions to identify effective non-food responses
- 5 Compare supplementary feeding with upgrading quality and quantity of general ration (or other type of food security intervention)
- 6 Development of measures for assessment of micronutrient deficiency diseases
- 7 Strategies to promote, protect, and support maternal nutritional status in emergencies, beyond supplementary feeding and supplementation
- 8 Guidelines for strengthening social support mechanisms and networks as a means of support for nutritionally at risk groups
- 9 Further development of appropriate responses for older people in complex emergencies



HIV/AIDS are at increased risk of malnutrition because of a loss of appetite, eating difficulties, malabsorption of micronutrients, increased metabolic rate, and loss of nutrients.<sup>134</sup> Optimum nutrition in a form that is digestible and appropriate can help maintain health and prevent weight loss as long as possible in the asymptomatic period, and later mitigate the symptoms of the disease.<sup>135</sup> WHO has recommended that asymptomatic people living with HIV receive 10% more energy, symptomatic people living with HIV receive 20-30% more energy, and children receive 50% more than HIV negative individuals. Recent recommendations have suggested only increased energy and not protein requirements. However, no specific standards are available for planning nutrition programmes for people living with HIV in complex emergencies, although some relief agencies have discussion documents and policy statements.<sup>136</sup>

## The future

In conclusion, major advances in the field of public nutrition in complex emergencies have been made in the past decade, including technical advances in anthropometry, survey methods, fortification, and treatment of severe malnutrition. More generally, conceptual advances have been made in understanding the causes of malnutrition associated with complex emergencies. Further investigation is needed in a number of specific areas (panel).

Finally, institutionalisation of the public nutrition approach will require development of national capacity, especially within governments in countries affected by chronic or recurrent complex emergencies. Because of the multisectoral nature of public nutrition, several government ministries will be responsible but one ministry will still need to take a leadership role. While academic institutions will certainly play a part, strong coordination and leadership from major UN agencies, such as UNICEF, WHO, the UN World Food Programme, and the UN Food and Agricultural Organisation, is needed.

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