Lessons on Nutrition of Displaced People[1,2]

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ABSTRACT Policies for protecting the nutrition of displaced people (including refugees) have evolved significantly since the sharp increase in numbers began in the 1970s. Food supplies have often been grossly inadequate, probably contributing to the very high mortality rates and severe malnutrition observed in camps. These are related, in part, to low estimates of food energy needs, moving from the idea of "survival" rations (1200–1800 kcal/person/day) through "minimum" (1900 kcal) to a current target level, likely to be usually adequate, of 2100 kcal. Some donors aim to provide 2400 kcal to preclude the need for supplementary feeding. Micronutrient needs in food supplies have received less attention, despite reemerging epidemics of micronutrient deficiencies (e.g., scurvy, pellagra) in camp populations. Supplied commodity baskets are still not routinely designed to meet micronutrient needs. The relative roles of different feeding programs need clarification; therapeutic feeding in severe malnutrition is well established, although experience of supplementary feeding is mixed. Better information on nutrition, health and survival is now routinely available; in particular, using trigger levels of mortality rates (e.g., 1/10,000/day as a crisis) has helped enhance action. The existence of severe wasting in children is highly predictive of increased mortality and could be tested as a readily observed indicator. Overall, procedures for alleviating and preventing malnutrition have indeed improved, but much more slowly than the scientific basis could allow. A general conclusion is that learning lessons and applying them more quickly could still prevent much malnutrition and save many lives among displaced people. J. Nutr. 132: 2096S–2103S, 2002.

KEY WORDS: • *refugees* • *food supplies* • *emergency assistance* • *feeding programs*

Persistent high mortality rates among refugee populations were recognized at least two decades ago. The problem was illustrated vividly by Toole and others (1,2), as shown in **Figure 1**, where the extraordinarily high mortality rates for populations in camps persisted for months after their arrival, or even began to rise again. Even if the initial high death rates could not be readily avoided, it seems that once people were in camps, in touch with assistance, that the continuing large numbers of deaths should surely be preventable. This presentation is about how this prevention could be improved and in a more timely manner.

The world was not prepared for the rapid increase in numbers of refugees seen from the early 1980s onward (**Fig. 2**) (3). Indeed it is still not fully prepared. The institutions responsible for helping refugees and displaced populations (these face similar problems and are regarded here together) stemmed from the aftermath of World War II, and were initially designed to deal with displaced populations mainly in Europe. However, these populations were in societies that had significant social and physical infrastructure, even though this had been damaged by the war, and were in a situation entirely different from that faced by the refugees displaced some 30 y later. Many of these now came from the internal conflicts in Africa, and the global total of refugees alone was estimated to reach nearly 20 million people by the mid-1990s, with probably the same number or more of displaced people, so that about 50 million people are affected. The very high mortality rates experienced by these populations in Africa can be calculated to account for a significant proportion of the overall child mortality in the continent.

Aside from the institutional issues, the world also had difficulty in applying science in an adequate way. In many cases overly rigorous calculations were made of nutrition requirements, so that the larger problem of success in delivering anything like adequate quantities of food, no doubt often under difficult circumstances, tended to be overlooked and was not often measured.

Food supplies

Estimates of overall food supplies to refugee camps, accumulated in the mid-1990s, showed that in many cases this supply was grossly inadequate; for example, in one such survey nearly a quarter of the camps were getting <1000 kcal/person/d, and almost all were getting <2000 (4, p. 81). When linked to the reported mortality rates (**Fig. 3**), it could be seen that below 1500 kcal/person/d, virtually no camps had a normal mortality, and in many mortality was extraordinarily high. In Figure 3, it should be noted, a normal mortality of around

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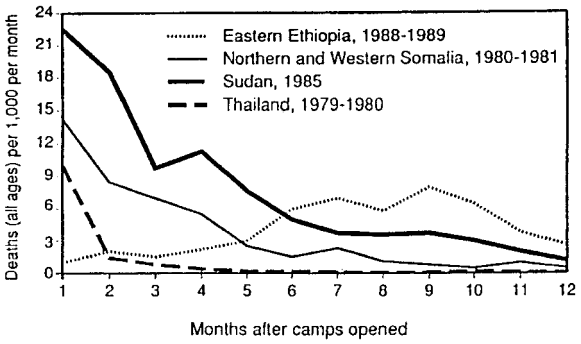


FIGURE 1 Crude mortality rates for persons in refugee camps.

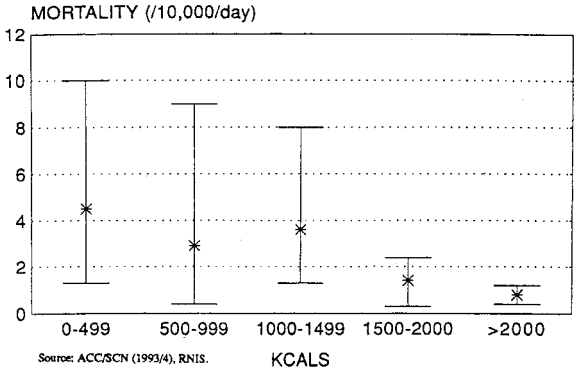


FIGURE 3 Mortality range and mean, compared with food energy (kcal) supplied to refugee camps with data available in 1994.

0.3/10,000/d is right near the bottom of the *y*-axis. Although these results are associations, not strictly causal, it is extremely likely that grossly inadequate food supplies were contributing both to mortality and to malnutrition and ill health. Considerable energy was spent on estimating requirements to the nearest 100 calories on theoretical grounds (5,6), but much more important would have been ensuring that an approximately adequate diet was actually made available in camps. Nonetheless, the estimates of kcal need were for many years set on the very low side, in part responding to what was well described as "the quartermaster syndrome," in which food supplies were eked out by minimizing distribution.

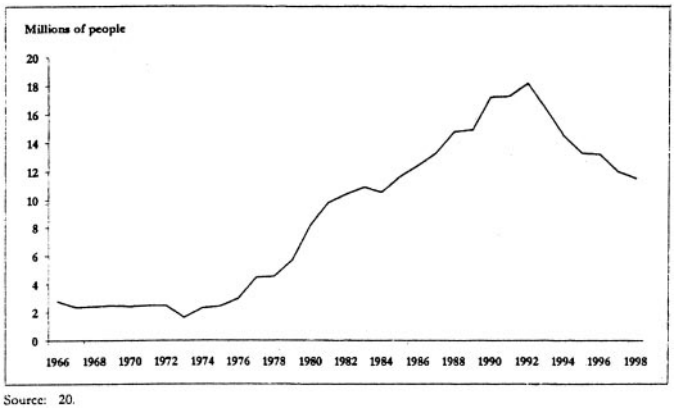
The evolution of policies for providing for food energy in general rations is illustrated in **Table 1**. Here, as in other tables, a historical view is taken that also includes a future perspective; that is to say, using history as a guide, envisaging how we would like the situation to look if we were reviewing the topic from, say, 2010. Thus at the bottom of the tables there is an area that includes decisions now needed. The tables show, by timing, the main features of policies and programs, and then in the last column some examples of the information or influences that led to these policies and programs.

For food energy levels, the early supply recommendations envisaged a "survival" or "emergency" level of around 1200 to 1800 kcal/person/d (7). (Note this is an average, dividing the overall supply by the total population numbers, irrespective of the demographic composition; it can be roughly compared with other food supply and requirement estimates, such as national data related to food balance sheets.) These were based on estimates of energy requirements from parameters such as body weight, demographic composition and activity levels (8). The survival ration calculation used a low energy expenditure level of 1.1 × basic metabolic rate (BMR); this can be compared with the value of 1.5 to 1.6 × BMR, equivalent to light activity, now used for making national estimates. In fact, if one comes to think about it, why should there be such a thing as a "survival" or "emergency" ration? People need food in emergencies to do more than just keep alive but inactive—even if just survival was a humane concept—and unless provided with enough energy to be at least normally active they will deteriorate. That is what was seen in mortality and malnutrition data. In 1989 this was replaced by a "minimal level" set at 1900 kcal/person/d (6), which was intended as a standard preliminary estimate before more detailed assessments could be made. It was aimed to provide for a temporary minimum supply to go beyond survival, to be followed by better-estimated supplies as situations came under control. Perhaps predictably, but unintendedly, the minimum level rapidly became the target for sustained periods, and was used as such for much of the early 1990s. With increasing information on the continued starvation and mortality in refugee camps, such as that shown in Figure 3, a closer look came to be taken at the issue of determining overall supplies.

More realistic estimates of energy requirements of around 2000 kcal/person/d became current, together with the recognition that among destitute people food supplies would be traded to contribute to other needs if there was no other economic resource. This pushed the intended supply as high as 2400 kcal/person/d, at least on the part of the International Committee of the Red Cross (ICRC) (9). The view was that with an ample food supply there will be less if any need for additional feeding programs, plus a small margin to allow trading for the essential diversity of the diet, and possibly for other needs (10).

This process was helped along considerably in 1995 by the U.S. National Academy of Sciences committee, which was charged with recommending to USAID the best policy on refugee food needs (11). This committee recognized that a single calorie figure to be applied to all emergency food assistance was preferable, as a practical matter to support planning of supplies and logistics. They therefore decided on recommending a single minimum target figure of 2100 kcal/person/d, which was in line with estimates of requirements at the national level.

This level of 2100 kcal/person/d was endorsed by UNHCR and WFP in 1997 (12). Finally, WHO issued its long-awaited manual on emergencies in 2000, also recommending an average figure of 2100 kcal/person/d, with a range of 1900 to 2300 kcal/person/d (13, pp. 4–5).



Source: 20.

FIGURE 2 Trends in numbers of refugees worldwide.

TABLE 1

Evolution of policies for food energy levels in general rations for displaced populations[1]

General ration levels for camps		
Period	Policy and programs	Information/influence basis
To late 1980's	"Survival" and "emergency" levels, about 1200–1800 kcals	Minimum requirements approach Hungry set at very low level, $<1.2 \times$ BMR Quartermaster syndrome Urge to move away from emergency use of food aid
1989	"Minimum level" of 1900 kcal, unintendedly became target	Increase in numbers, complexity More information and publicity on mortality and starvation
1994	Intended levels became 1900 to 2400 kcal (MSF, ICRC)	Persistence of malnutrition and mortality Destitution as focus Emergencies mainly from conflict now; drought food crises mainly fixed by market and employment/welfare
1997	Minimum target 2100 kcal (MSF, USAID, UNHCR/WFP)	US NAS report recommends single figure of 2100 kcal Increased awareness of human rights SPHERE and other guidelines Trading regarded as somewhat less sinful
2000	WHO manual (2000) recommends 2100 kcal average, range 1900–2300	Calculated from 1985 FAO/WHO/UNU requirements
2000s?	*Follow ICRC to 2400 kcal as more effective, precluding need for other feeding programs . . .* *Acceptable, multicommodity, diverse diets the aim . . .*	*Impatience with continued persistence of hunger due to supply constraints; acceptance that emergencies are most suitable and priority use of food aid; quartermaster finally retires . . .*

[1] BMR, basal metabolic rate; MSF, Médecins sans Frontières; ICRC, International Committee of the Red Cross; USAID, United States Agency for International Development; UNHCR, United Nations High Commission for Refugees; WFP, World Food Program; US NAS, United States National Academy of Sciences; SPHERE, Standards for Public Health in Emergency Response; WHO, World Health Organization.

Thus the intended ration had changed from the minimum of 1200 kcal/person/d to up to 2400 kcal/person/d over about 20 y, doubling the recognized needs. It is impossible to avoid the feeling that, had a more generous approach been taken earlier, at least some of the suffering associated with displacement and malnutrition could have been avoided.

This evolution was also part of a wider movement to increase awareness of the human rights of displaced people, and to establish more humane guidelines, such as through the mechanisms such as the *Standards for Public Health in Emergencies* (14). At the same time, there was some belated recognition that trading was actually a mark of destitution and should not be regarded as necessarily an abuse of supplies (15).

Looking to the future, as shown at the bottom of Table 1, we might hope that the trend will continue to aim at an ample food supply, recognizing the economic as well as nutritional contribution of food. Relief efforts become easier to organize if multiple feeding programs are not needed, specifically if supplementary feeding can be avoided because the general ration is adequate to cover the needs of everyone—for example, following the ICRC lead. The additional resources needed are relatively minor compared with the costs of staffing and organizing more complicated programs.

Food quality and micronutrients

About 10 y ago the UN was paying increasing attention to nutrition of refugees, and a number of us became concerned with the persistence of misconceptions on the subject. These can be revisited in the present context [they were given in a letter submitted to The Lancet (16)]. Four of the misconceptions we highlighted were as follows: *1*) "starving people can eat any thing"; *2*) "refugees can manage with less"; *3*) "trading foods indicates that people do not need all of the rations"; and *4*) "energy adequacy means nutritional adequacy." On the first three of these there is progress, although these misconceptions are still to be found. The fourth, referring to the quality of the diet, still needs considerable work (see **Table 2**) (17,18).

The question of micronutrients in diets for displaced populations was taken for a long time (and maybe still is) to be minor compared to that of providing overall food needs. In fact, in the 1980s, the occasional observation of micronutrient deficiencies was regarded as an unintended consequence of emergency feeding programs (19). However, the extent and gravity of micronutrient deficiency in developing countries was becoming recognized—perhaps most widely with the observed impact of vitamin A supplementation on mortality, as well as the increased recognition of mental retardation attributed to iodine deficiency—which increased awareness of the risk of deficiencies in displaced populations. Equally, clinicians became increasingly horrified to see the reemergence of specific micronutrient deficiencies whose existence had been considered as passing into history: scurvy seen in the Horn of Africa; pellagra again in East and Southern Africa; and beriberi in Nepal (20,21). This increased awareness led to improved rations when the missing micronutrients could easily be added as fortificants, although for those such as vitamin C (expensive) or iron (difficult) solutions were slow in coming.

The simple task of calculating the micronutrient supply in rations is still not universally done. Such calculations show that it is predictable that micronutrient deficiencies will emerge after a while with the usual general ration of three or four commodities (more certainly when these do not contain a fortified blended food). In **Table 3** the calculation is shown both in principle for the intended food supplies and as in practice received by (in this example) Rwandan refugees (22). In both cases it is clear that without the fortified food, there would be a grave risk of deficiency of at least vitamin A and vitamin C. Even with fortified foods, vitamin A may be short in the theoretical ration. In the real ration as received in Rwanda (in 1994), all four of the vitamins and minerals

TABLE 2

Evolution of policies for micronutrients for displaced populations[1]

	Micronutrient deficiencies	
Period	Policy and programs	Information/influence basis
1980s	Ad hoc, when recognized (e.g xerophthalmia, beriberi)	Seen as "unintended consequences" of emergency feeding programs
1990s	Interventions becoming routine for VAD (capsules, oil fortification) and iodine (salt). Others ad hoc	Widespread deficiencies documented (Toole, 1992). Awareness of micronutrient deficiencies generally much heightened (WSC, ICN, EHH . . .) Scurvy in Horn of Africa; pellagra in East and Southern Africa; beriberi in Nepal
	Rations usually deficient and not routinely assessed for micronutrient deficiency risk. Some lack of clarity in providing energy targets with micronutrient-deficient commodity mix	Those open to infrequent provision tackled. For those needed weekly or less no routine intervention applied. For vitamin C and iron, effective intervention at feasible cost not available, but research undersupported
	Few commodities in basket Trading not generally encouraged	Diversity of commodity basket still seen as luxury; trading as ingratitude
2000s?	*Routine fortification of general rations* *Multiple commodity basket of food assistance including some fresh foods seen as target*	*Recognition of seriousness of problem, including in human rights context*

[1] VAD, vitamin A deficiency; WSC, World Summit for Children (17); ICN, International Conference on Nutrition (27); EHH, Conference on Ending Hidden Hunger (18).

assessed were in short supply. Thus it is no wonder that widespread micronutrient deficiencies are found.

There is a logical problem here: there is no such thing as a micronutrient-rich energy-free food. So if the ration is intended to reach 100% of energy requirements, and no trading is envisaged, then without pharmaceutical supplements there is no logical way in which micronutrient deficiencies can be avoided. Any energy-adequate micronutrient-deficient ration inevitably and predictably leads to deficiencies. Nonetheless, meeting energy needs usually remains the aim of donors, with micronutrients being seen as someone else's problem. Cracking this logical bottleneck would go a long way to ensuring better health and nutrition of refugees. Thus in the future the practice should be routine fortification of general rations and multiple commodity baskets containing familiar and nutritious foods. Trading of staples for a more diversified diet is a further solution, but still not encouraged by the donors, despite evidence that it is a useful coping mechanism (15).

Feeding programs

Ensuring an adequate general food supply is the overriding priority. If this fails, then no amount of additional feeding programs will be able to keep pace with the rapid deterioration into malnutrition. Nonetheless, a whole structure of feeding programs has emerged. A common pattern of programs is shown in **Figure 4**, initially divided into general and selective. Selective programs are of two types. First, therapeutic feeding

TABLE 3

Micronutrient content of rations with and without fortified blended foods (1995)[1]

	g	*kcal*	Vitamin A RDA: 1717 IU	Niacin RDA: 15 mg	Vitamin C RDA: 27 mg	Iron RDA: 22 mg
Cereals (wheat)	400	1400	0	6.8	0	9.6
Oil	30	270	0	0	0	0
Beans	40	140	0	0.9	0	2.0
Total			0	7.7	0	11.6
			(0%)	(51%)	(0%)	(53%)
Corn soya blend (CSB) fortified	60	210	1020[2]	4.8	24	10.8
Total	530	2020	1020	12.5	24	22.4
			(59%)	(83%)	(89%)	(102%)

But with the reality of wheat = 420 g, oil = 25 g, beans = 120 g, and CSB = 20 g, as for the Rwandan refugees, this is:

	kcal	Vitamin A	Niacin	Vitamin C	Iron
	2185	340[3]	11.4	8	19.7
		(20%)	(76%)	(34%)	(90%)

[1] Adapted from Toole (21).
[2] Currently available CSB would provide 1556 IU, which is 90% of the RDA shown (22).
[3] Currently available CSB would provide 552 IU, 32% RDA (22).

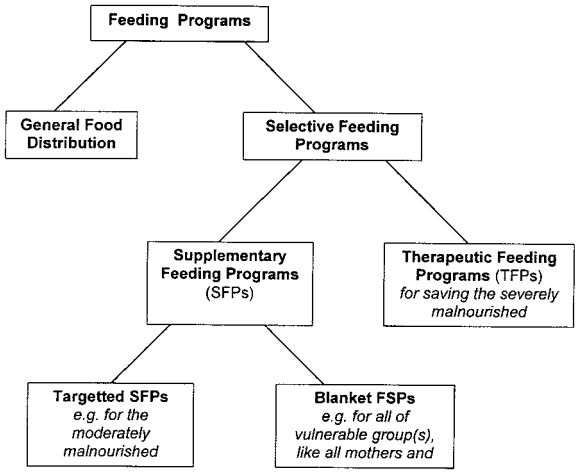


FIGURE 4 Types of feeding programs.

programs for treatment of the severely malnourished (as the name implies) are now well established and recognized as necessary where there are such severe cases of malnutrition that normal foods will not save lives. The second type of program has been referred to as supplementary feeding, and it is in this area that there is still considerable lack of clarity. Supplementary feeding programs are often distinguished into those targeted, either toward the moderately malnourished alone, or toward the moderately malnourished plus other groups. When these become wide enough, they are referred to as blanket supplementary feeding programs, for all of the specified vulnerable groups (e.g., all mothers and young children).

Therapeutic feeding programs are now well established (see **Table 4**). They stemmed from research in treatment of individual children in experimental wards (e.g., in Uganda and Jamaica) and, to begin, with the transferred use of expensive hospital diets to refugee situations. In particular, casein was used rather than milk products alone because of concerns for lactose intolerance; however, it soon became clear that this concern was minor compared with the need to have readily available and not-too-expensive mixtures. Thus the procedures of frequent feeding with high energy milk-based diets were successfully introduced into refugee situations in the 1970s; in fact, the procedures are much the same to this day. For example, the procedures described by WHO in 2000 (13) are virtually the same as those for 22 y earlier (19). One example of early application is in Mason et al. (23), where we showed in a refugee setting that very rapid catch-up could be achieved using a simple dry skim milk/sugar/oil/micronutrient mix, fed as a milk-like preparation at a concentration of 1 kcal/g and at an intake of 150 kcal/kg body weight/d. The growth rates were such that children could recover within a few weeks, and the mortality rates even under the difficult circumstances of refugee camp were no worse than those in a hospital setting. However, this mortality of 10–20% has persisted for many years, and the next stages of evolution of treatment of severe malnutrition should involve reducing this mortality while at the same time maintaining high recovery rates (24). This seems to be related, as shown by Golden (25), to different syndromes of malnutrition in different areas, themselves related to previous diets, and to be controllable by some modifications of established procedures. Improvements in the future would focus on this, together with greater efficiency of running therapeutic feeding, for example, with prepackaged products and better training.

Supplementary feeding, on the other hand, still causes some confusion (see **Table 5**). In part, these programs stemmed from experience with applied nutrition programs in nondisplaced populations, which in turn derived from concerns for protein availability some 40 y ago, a concern that still can haunt nutrition to this day. A commonsense view would be that if the general ration is adequate, except for the severely malnourished, supplementary feeding should not be needed. Moreover, the diet should be sufficiently diverse and appetizing that, as soon as the appetite returns in treatment of severe malnutrition, the general rations will continue the recovery process. Equally, the diet should be good enough to prevent deterioration of moderate malnutrition into severe, indeed to allow recovery of an affected population. This is the view, for example, of ICRC and of an increasing number of nutritionists.

One complication is that it has sometimes turned out to be easier to provide supplementary feeding than to provide for general rations. When access is difficult, because of conflict or politics, supplementary food can sometimes be supplied through the health system, where trucks carrying sacks of grain for general rations do not get through. A different type of complication is that humanitarian assistance agencies really like to run supplementary feeding programs; they make for good photographs and copy, help to raise funds and give a hands-on task for people to work on, even (or particularly)

TABLE 4

Evolution of approaches to therapeutic feeding for treating severely malnourished children[1]

	Therapeutic feeding	
Period	Policy and programs	Information/influence basis
1960s	High tech expensive diets (e.g. K-mix 2)	Hospital ward research
1970s	Widening application of high energy milk-based diets to camps, shown to be effective	Application of research experience to camp child populations, conversion to routine operations (Oxfam, SCF . . .)
1980s on	Routine use	Shown that better results with full micronutrient mix (Golden, AICF)
	More micronutrient enrichment	Well-established intervention (WHO 1978–2000, incl. mortality of 10–20%)
	Prepackaged products and more standardized procedures	Mortality further reduced with increased care, medical attention and improved regimes

[1] SCF, Save the Children Fund, UK; AICF, Action International contre la Faim.

TABLE 5

Evolution of policies for supplementary feeding programs for displaced populations

	Supplementary feeding	
Period	Policy and programs	Information/influence basis
1970–1980s	Common feature, often blanket	Applied Nutrition Programme experience Protein gap thinking
	Frequently substituted for adequate general ration	Photogenic
1990s	Role questioned	Inertia
	More targeted	Possibly new important role for well-fortified processed supplement (e.g. fortified CSB)
	Still somewhat unclear policy	
	ICRC: needed at all?	
2000s?	*Generally made obsolete by much improved general ration suitable for all except the severely malnourished*	*Policy clarification and monitoring and evaluation showing good results with adequate general rations*

when the general ration is in short supply and should be the top priority.

We would hope that in the future most supplementary feeding would be made obsolete by much improved general rations, perhaps with other means of covering micronutrient problems such as fortification or sometimes distribution of vitamin/mineral supplements, and that the policy on the role of supplementary feeding would be clarified. A start was made on this at a meeting in 1995 (26, pp. 31–32), although changing the habits of agencies takes longer than the intervening 5 or 6 y.

Information for decisions

The information basis for decisions for addressing nutrition problems in displaced people has evolved considerably in the last 20 y or so (see **Table 6**). Through the 1980s most information was anecdotal, linked to appeals for resources. The experience was that television pictures were particularly effective in generating action, beginning with the well-known case in the Ethiopian drought in the early 1970s, where children scrambling for grain were shown on European television, which launched relief operations.

At the same time, it became rather widely accepted that the international agencies and nongovernmental organizations (NGOs) that are operating relief programs were sometimes selective about the information that was released, and inconvenient news was being suppressed. One crucial example of this was a report, internal to Save the Children Fund, that documented the avoidance of reporting about deteriorating conditions in northern Kenya, in a UN-controlled camp, leading to prolonged failure to take action and the consequent substantially raised mortality. Moreover, the nonsystematic nature of information generally available mirrored that in nonemergency areas; the evolution of better information on refugees in part followed developments in the field overall, such as the establishment of the demographic and health surveys (DHS) in the 1980s, with core funding from USAID.

Important studies led by CDC vividly documented the extraordinarily high mortality rates and prevalences of severe malnutrition, especially in the Horn of Africa, in the 1990s

TABLE 6

Information availability on health, nutrition, and mortality in displaced populations[1]

	Information	
Period	Policy and programs	Information/influence basis
Up to 1980s	Mostly anecdotal, linked to appeals	General lack of information on mortality, health and nutrition (e.g. in 1970s only four national anthropometric surveys)
	TV shots effective	
	Uncomfortable info sometimes suppressed by governments and intergovernmental organizations (IGOs)	
1990s	More systematic compilation and distribution of mortality, malnutrition, and related information	Studies showing lethal effect of suppressing information on camp conditions
		CDC and other surveys showing very high mortality and malnutrition rates
	Increased press awareness	"Invasion" of Somalia at time of ICN
	RNIS, Reliefweb, etc.	UN pressures for more action; failing that, more information
	Indicators	Interpretation of key survey data
	Standardized mortality (e.g. 1/10,000/day) from CDC established and widely applied	Consensus brokered
		Relation with wasting established
	"Global" malnutrition defined by MSF as wasting plus edema	
2000s?	*Continued support and timeliness of information*	*Targeted research and results sharing*
	Sorting out of indicators so standardized assessments available, also facilitating trends	*Improved camp and population monitoring*

[1] RNIS, Refugee Nutrition Information System (28); CDC, Centers for Disease Control.

(1). These and others led both the humanitarian and the health agencies to take more seriously the effectiveness of relief. Again, these matched an increasing activism among NGOs, such as Médecins sans Frontières (MSF), which managed to get medical and humanitarian assistance more and more effectively into the most serious situations, sometimes at substantial risk. Another important event was the U.S. intervention in Somalia, which coincided exactly with the International Conference on Nutrition in 1992, reinforcing the Pope's appeals for prevention of starvation at that conference (27). Within the UN, this was followed by increasing frustration at realizing the magnitude and severity of the situation was continuing, itself highlighted by improved information. Among the UN's initiatives to improve the effectiveness of its relief, the Refugee Nutrition Information System (RNIS) began regular publication in 1994, which at least had the benefit of ensuring that information was no longer suppressed, and demonstrated that in fact much data were available that, brought together, would create a consistent picture (28). This has contributed to a better understanding of the situation of refugees and displaced people, especially in Africa, and highlighted unmet needs for relief.

During this period increasing agreement on norms was achieved, stemming from CDC's proposal of mortality rates, measured in deaths per 10,000 per day, such that 1 per 10,000 per day was regarded as a crisis and 2 per 10,000 per day as being out of control (2). To communicate such figures, in the UN we also interpreted these rates as "times normal" (i.e., as a multiple of 0.3/10,000/d), which is about the expected nonemergency mortality. Thus 1/10,000/d is roughly 3 times normal and 2/10,000/d is 6 times normal. Definitions of malnutrition also became more standardized, with the concept of "global malnutrition," which includes prevalence below a cutoff corresponding to moderate and severe malnutrition, and including edema (29). (There is some question as to whether including edema is desirable for estimating trends, but it certainly helps to have an accepted figure.) Nonetheless, work remains in establishing agreed measures and cutoffs; for example, prevalences of low arm circumference use cutoffs that range from 11 to 12.5 cm.

Using wasting to predict and prevent mortality

The relationship between wasting prevalences in children and elevated mortality was first documented from camp level

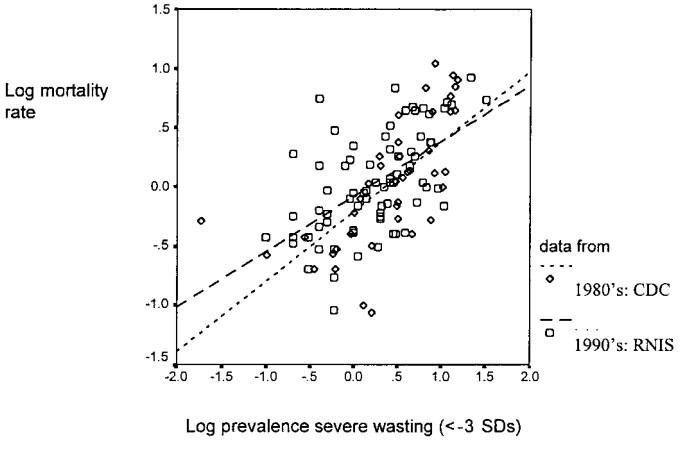


FIGURE 5 Relation between mortality and prevalence of severe wasting (<−3 SD weight/height).

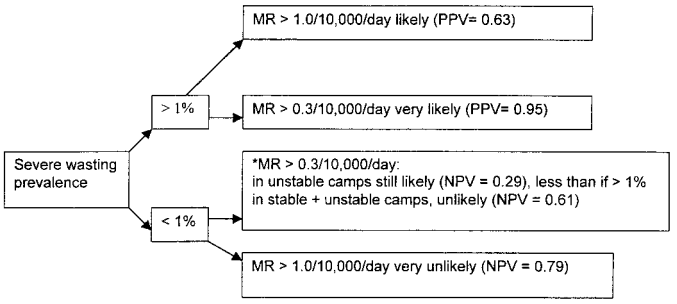


FIGURE 6 Presence of *any* severe wasting predicts raised mortality.
*This is the uncertain link.

data in the 1980s (30). Recently, a new compilation was made from the RNIS, and these data from the 1990s were combined with those from the 1980s. The results are shown in **Figure 5**. The relationship seems very stable through time, being almost exactly the same in the two sets of data from the 1980s and 1990s. The association is strong, with 10% prevalence of wasting (<−2 SD weight/height) being equivalent to a mortality of 1 per 10,000 per day. Although there is considerable scatter around the fitted line, nonetheless the relationship is close enough to lead to a possible use of wasting prevalences to predict mortality rates, more specifically to identify camps that are likely to be in a crisis. Estimating from prevalences of severe wasting (in contrast to mild to moderate in the previous figure), an algorithm can be suggested from the specificity/sensitivity in the relationships in these data, as shown in **Figure 6**. This indicates that severe wasting (<−3 SD weight/height), which is normally very rare in most populations, can be used as a flag for raised mortality. This method of "zero reporting" implies that if any severe wasting is seen (in Fig. 6 the cutoff is taken as 1% prevalence), then the probability is high that there is a mortality rate certainly above normal, possibly very much above normal. The converse is true for prevalence less than 1% in relation to severe mortality, but in the middle with the cutoff of 0.3 per 10,000 per day mortality is where the relationship needs further work. Nonetheless, given that the main problem is often knowing with any degree of certainty the population, there is great advantage in a method that is based on existence or nonexistence of a particular condition (zero reporting). This method now needs to be tested, but would be a useful contribution to assessment procedures.

Overall, we can see considerable improvement in procedures intended to alleviate malnutrition and mortality in populations of displaced people when these are in contact with assistance, usually in camps. In terms of how science can be used to improve implementation, the overall lesson—"the meta-lesson"—is that *we need to learn lessons faster*. Undoubtedly, procedures now are an improvement over those of 10 or 20 y ago. Moreover, further improvements are possible today, if we were able to apply the knowledge that we have. Undoubtedly, opportunities have also been missed for prevention because of delays in putting well-established knowledge into action. Using history to determine our actions today would lead us to give top priority to learning our lessons faster, toward applying our present knowledge more urgently to improving procedures.

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