

## **Malnutrition–Mortality Relationships among Refugees**

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Mortality measures are among the best objective indicators of a refugee population's recovery from the emergency phase of a crisis, as well as the best measure of the population's long term well-being. However, nutrition-related excess mortality and post-emergency phase nutritional deterioration continue to be identified in refugee relief operations. Studies in refugee and non-refugee situations have clearly established the relationship between mortality and malnutrition, including both energy-protein and micronutrient deficits. Comparative data from relief operations in Thailand (1979–80) and Sudan (1984–85) suggest strong concordance between crude death rates and frequency of childhood malnutrition. Comparison of malnutrition and mortality data from 40 refugee settings suggests a consistent and predictable relationship between malnutrition and mortality rates. In addition, severe and epidemic deficits of vitamins A (xerophthalmia), B-1 (beriberi), C (scurvy) and niacin (pellagra), each of which can be fatal if prolonged and untreated, have been identified in recent international relief operations in which rations were deficient in the relevant vitamin. The mechanism explaining the malnutrition–mortality association in refugee populations appears to be a greater severity and frequency of otherwise 'expected' infections. The continued occurrence of nutrition-related mortality after the immediate emergency phase in international relief operations suggests that factors in addition to accepted technical and humanitarian norms play a role in ration adequacy. These additional factors may be amenable to further study and intervention.

### **Background and Introduction**

Despite many years of international relief community experience with the provision of food to large numbers of refugees in major relief operations over long periods, recent and current refugee populations are still not assured access to adequate rations. Since 1979, nutrition-related excess mortality persisting or beginning beyond the initial weeks of a refugee relief operation has been documented on several occasions (Toole and Waldman, 1990). In addition, at least one recent report has documented anthropometric deterioration in refugees'

nutritional status during an international relief operation (CDC, 1989). However, although the links between malnutrition and mortality and between inadequate rations and malnutrition appear obvious to health workers with developing country experience, that relationship may be less obvious to governmental and international agency administrators. The purpose of this review of malnutrition-mortality relationships among refugees is to ensure that the adverse mortality and disease consequences of providing (or allowing provision of) quantitatively or qualitatively inadequate rations to refugee populations are clearly understood.

### *Definitions*

*Adequate ration* is defined as the amount of nutrients sufficient to allow for: 1) recovery from pre-existing malnutrition, 2) necessary work (including additional necessary migration), 3) obligate excess heat production in situations of disease, inadequate shelter and/or cold stress and 4) adequate future growth of children (including growth *in utero*).

*Malnutrition* is defined as a disease or other functional physiological deficit resulting from intake of an inadequate amount of one or more necessary nutrients. It can be identified by observation of physical signs or symptoms related to recent lack of dietary nutrients. In the practice of refugee nutrition and health, in which the luxury of laboratory studies is often unavailable, such evidence includes but is not necessarily limited to anthropometric measurements of low weight-for-height, low arm circumference, or any of the signs or symptoms of vitamin deficiency disease such as xerophthalmia, beriberi, scurvy, pellagra (vitamins A, B-1, C, niacin), etc.

*Excess mortality* is a quantification of those deaths which could have been prevented had standard and recommended primary health and nutrition programmes and practices been applied.

*Famine* has been objectively defined as an increase in mortality in the face of reduced food availability.

Both ration inadequacy and malnutrition can refer to dietary deficiencies which are either quantitative (i.e., lack of calories, now called dietary energy) or qualitative (i.e., lack of one or more of the many other necessary dietary components, such as vitamin C, iron, or oil).

### **The Value of Mortality Measurement as an Indicator of Population Health Status**

In developing countries, mortality rates, and particularly mortality rates among children, have been considered as one of the best overall measures of population well-being. Recently, for example, UNICEF has become a strong advocate of measuring mortality rates among children under five, as well as the changes in these rates, as the primary measure of 'levels of, and changes in, the well-being of children' (UNICEF, 1990). The *Handbook for Emergencies* of the Office of the United Nations High Commissioner for Refugees (UNHCR) states

that ‘high child mortality . . . is very often associated with high levels of malnutrition . . .’ and advocates collection of mortality data in refugee populations for this reason (UNHCR, 1982).

Mortality rates in refugee populations in physical crisis can be shown to decrease rapidly in situations of provision of adequate food, water and other public health measures and basic curative health care. For example, the rapid reduction in mortality rates among the severely malnourished Cambodians who had entered camps in eastern Thailand in late 1979 provided reassurance about the effectiveness of the relief operation (Nieburg, 1984).

Of interest, mortality data is one of two components of the most commonly used measurable definition of famine; the other component is food deficit. Although populations often become refugees by virtue of leaving famine-affected areas, it is clearly possible for people who have become refugees for some other reason to undergo a famine (as defined in this manner) while living—or dying—in a refugee camp.

#### **Relationships Between Poor Nutritional Status and Mortality in Individuals**

An understanding of the general relationship between malnutrition and mortality began with the landmark work of Puffer and Serrano (1973) in Latin America. Those investigators found malnutrition to be the most serious health problem encountered, in terms of relationship to child mortality. Long-term prospective studies in several non-refugee populations by other investigators have shown that the most malnourished children, i.e., those in the lowest categories of several anthropometric measurements, including weight-for-height, height-for-age, weight-for-age and arm circumference, have a greater probability of dying when followed over time (Chen *et al.*, 1980).

In addition, death is a well-recognized outcome in individuals with severe and untreated deficiencies of vitamins A, B<sub>1</sub>, C and niacin (e.g., xerophthalmia, beriberi, scurvy and pellagra).

#### **Consensus on Malnutrition as a Risk Factor for Mortality Among Refugees**

A consensus statement which emerged from the participants at the ‘International Symposium on Health Care for Displaced Persons and Refugees’ at Georgetown University in December 1989 reflected this same view, listing malnutrition first among the principal causes of refugee mortality and ‘adequate food rations (both quality and quantity)’ first on the list of priority interventions (Georgetown Declaration, 1990).

Earlier, we had surveyed senior health staff in seven non-governmental agencies with extensive recent experience in refugee emergencies (Nieburg, Toole and Waldman, 1989). The goal was to help identify major preventable mortality causes among refugees, in order to help set priorities for effective future action.

All respondents included malnutrition as a 'primary or contributing factor in many, if not most, child deaths'. Three other causes (measles, diarrhoea and acute respiratory illness) were also listed by all respondents. Data from other sources clearly indicates that, in comparison to outcomes among better nourished children, higher fatality rates can occur among already malnourished children who get any of these three types of illnesses.

#### **Direct Relationships Between Quantity of Rations Provided, Malnutrition Rates and Mortality Rates**

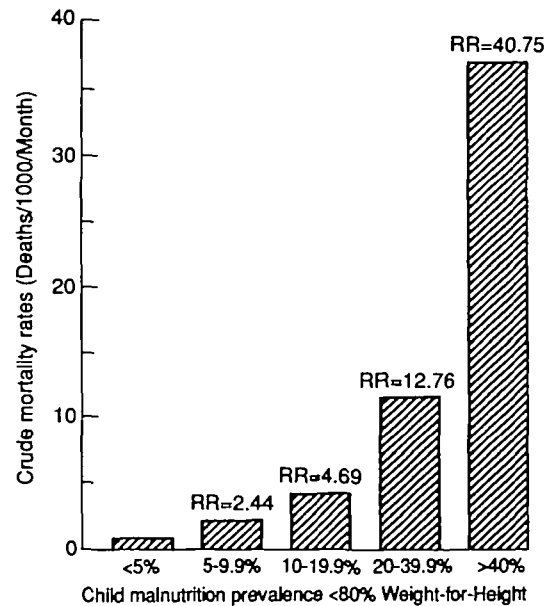
Several years ago we reviewed and compared crude (overall) mortality and child (< 5 years) malnutrition data from the relief operation for Cambodian refugees entering Thailand in 1979–1980 with data from the relief operation for Tigrayan refugees entering Sudan in 1984–85 (Toole, Nieburg and Waldman, 1988). Data were analysed in terms of malnutrition and mortality rates at various times after the initial refugee influx. We found that both mortality and malnutrition rates among refugees in Thailand fell rapidly within six weeks to two months of the beginning of the influx, while in Sudan, both mortality and malnutrition rates fell much more slowly and, in fact, remained very high for the first eight months after refugee influx began. In general, mortality and malnutrition rates fell in parallel in each place, implying a relationship between the two conditions. Finally, it is important to note that the rapid fall in both malnutrition and mortality in Thailand was associated with delivery of a ration of approximately 2500–2600 kcal per person/day while the rations in the Tigrayan camps in Sudan never reached 2000 kcal/person/day anytime in the first five months of the relief operation. Parenthetically, recommendations for a 'rehabilitation ration' at the beginning of relief operations (Brown and Berry, 1987), although rarely utilized, implicitly recognize that a malnourished population, by analogy with a malnourished individual, needs more food to recover from malnutrition.

#### **Relationships Between Malnutrition and Mortality Among Refugee Populations**

Having identified strong hints about the existence of a malnutrition–mortality relationship both in individuals and in populations, we then attempted to quantify this relationship in refugee populations. We wanted to know if a particular difference in malnutrition rates among a group or groups of refugees was reliably associated with a difference in mortality in the same groups. Using data from published sources, from our own unpublished field investigations and from unpublished data generously provided by Epicentre and MSF, we examined the malnutrition–mortality relationship in a slightly different way. We first examined the strength of the relationship between malnutrition, defined as the proportion of children under five years who were malnourished, and mortality, defined as the number of deaths/1000 population/month. Statistically, the relationship was strong ( $p < 0.001$ ), indicating in yet another

Figure 1

Crude mortality rates and rate ratios (RR) by child malnutrition prevalence in 42 refugee populations in Asia and Africa, 1984–1988



way that higher child malnutrition rates in refugee populations were associated with higher mortality in these populations. We then grouped the populations on the basis of their rate of child malnutrition and calculated a weighted average of mortality rates within each group. We found progressive increases in mortality rates with increasing ranges of child malnutrition rates, indicating, for example, that populations with malnutrition rates in the 20–39.9% range had mortality rates more than 12 times that of populations with malnutrition rates less than 5%. These data suggested that mortality rates in refugee groups could be roughly predicted—or assumed—based on their prevailing malnutrition rates.

#### At Higher Levels of Malnutrition, the Mortality-Malnutrition Relationship Becomes Less Clear

Using data available from a refugee camp in Sudan surveyed twice in 1985, we were able to show that mortality may hide what would otherwise be an increase in malnutrition (Nieburg *et al.*, 1989). Using a census of the camp and standard nutritional survey methodology, the responsible agency found similar high levels of child malnutrition in terms of the proportion of children <80% and <70% of the weight-for-height references (WHO/CDC), in two surveys two months apart (Table 1). Thus, initially, the nutritional situation appeared serious but stable between the two surveys. However, by chance, numbers of deaths had

Table 1

**Distribution of Nutritional Status of Refugee Children  
<5 years old (<110 cm) at Fau I Camp, Sudan  
January to March, 1985**

	<i>Mid-January</i> → 179 deaths → (12.9%)	<i>Mid-March</i> (extrapolated)
Camp Population <5 years (<110 cm)	1386	1207
Survey Sample Size	240	363
Weight-for-Height Category (% of Reference Median)		
70–79% of median	19.2%	21.5%
(95% confidence intervals)	(14.0–25.1%)	(17.0–26.5%)
<70% of median	7.1%	6.9%
(95% confidence intervals)	(4.1–10.9%)	(4.5–9.9%)

been counted by another agency in that same camp and, with those numbers, we were able to determine that nearly 13% of children under five years old in the camp had died in the two months between surveys. Our explanation for the lack of change in the proportion of malnourished children in this interval, at a time when camp rations were also known to be inadequate, was that the most malnourished children, who were dying at a faster rate than the less malnourished, were being replaced by previously normal children who were themselves becoming malnourished. In effect, death was preventing an increase in the number and proportion of the more severely malnourished, thus masking an increase in the prevalence of malnutrition. These data indicate that when nutritional status is already poor, and mortality rates perhaps already high, anthropometric data alone are not sufficient to monitor a population's nutritional status: mortality data must be taken into account.

#### **Fatal Vitamin and Mineral Deficiency Diseases have Occurred**

To persons from industrialized countries, the term—and perhaps the concept of—vitamin deficiency brings to mind advertisements for dietary supplements for children, old people and athletes. However, several different severe vitamin deficiency diseases encountered in current or recent refugee situations are clearly fatal forms of malnutrition if prolonged or untreated. Occurrence of these diseases was not surprising when actual dietary vitamin content was considered (Figure 2).

**Severe vitamin A deficiency or xerophthalmia:** Although the relationship between mortality and mild or moderate deficiency of vitamin A is a matter of current investigation, the association between the severe form of vitamin A deficiency (xerophthalmia) and mortality is clear (Sommer, 1982). Rations

**Figure 2**  
**The ABCs of Refugee Micronutrient Deficiency**

Vitamin	Deficiency	Death?	Problem (Example)	IATRO?
A, retinol	xerophthalmia	yes	Sudan, 1985	++
B-1, thiamine	beriberi	yes	Thailand, 1980–83	++
B-3, niacin	pellagra	yes	Malawi, 1990	++
C, ascorbate	scurvy	yes	Ethiopia, 1989	–

provided to refugees (grain, oil, milk powder or other protein source) often contain insufficient or no vitamin A. Outbreaks of xerophthalmia, a clear sign of severe vitamin A deficiency at the population level, have been reported in several recent refugee situations, most notably in Sudan in 1984–85 (Pizarello, 1986), when already severely malnourished refugees were fed a vitamin A-free ration. Of particular interest in this regard is the fact that vitamin A requirements rise with caloric input. Thus, the provision of food without vitamin A to refugees whose malnutrition includes vitamin A deficiency is likely to precipitate a more severe form of the deficiency, including blindness. (This was the original basis for the inclusion of vitamin A in skimmed milk powder intended for developing country use.)

Severe vitamin B-1 deficiency or beriberi: Epidemic beriberi was noted on several occasions in the Cambodian refugee camps in Thailand in the early 1980s, always associated with a diet based on polished (processed) rice, which, in contrast to the undermilled rice used to cure these outbreaks and prevent others, has essentially no vitamin B-1 (CDC, 1983). More recently (1991–92), beriberi has been reported from Liberian refugee camps in Sierra Leone. If unrecognized and/or untreated, death from cardiac complication frequently occurs. As with vitamin A, needs for vitamin B-1 depend on the metabolic rate; thus, a malnourished person being nutritionally rehabilitated has a higher risk of suffering beriberi than his still starving counterpart.

Severe vitamin C deficiency or scurvy: Epidemic scurvy has been reported on several occasions from refugee camps in the Horn of Africa (Desenclos *et al.*, 1989). Because the ‘normal’ refugee ration has no source of vitamin C, these epidemics, often involving thousands of persons, were not surprising. The evidence linking scurvy to deaths among refugees remains indirect; however, scurvy is an ultimately fatal disease if untreated.

Severe niacin deficiency or pellagra: Epidemic pellagra has most recently been reported in Mozambican refugees in Malawi (CDC, 1991). This potentially fatal disease occurred among persons with access to rations clearly deficient in niacin and virtually disappeared when niacin-containing foods were re-introduced into the ration.

In addition to these four diseases, other preventable deficiencies with potentially serious outcomes may occur in people being fed the ‘normal’ refugee



ration. For example, zinc deficiency is associated with growth retardation, delayed recovery from malnutrition and compromised immune function from which a fatal outcome is possible. In fact, zinc deficiency may explain in part the increased severity of infections noted in these populations. Not only does the 'normal' refugee ration not contain sufficient zinc, but the complex carbohydrate phytate, present in large quantities in most grains, can interfere with absorption of what little zinc may be present in other dietary components. We currently do not have sufficient information to judge the importance of zinc deficiency for refugee populations. Iron deficiency is another widespread problem among refugees, whose 'normal' diet in many situations contains little or no iron. The grain-related phytates which interfere with zinc absorption interfere with iron absorption in a similar manner. Iron deficiency has now been linked to impaired psychomotor development in early childhood and to irreversible learning disabilities (Dallman, 1990); its toll among refugees is not yet known.

#### **Mechanisms Which Could Help Explain the Association of Malnutrition and Mortality**

To this point, we have not explicitly stated that the high malnutrition rates seen among some refugee populations are actually the cause of the associated high mortality. It is possible that this association of refugee malnutrition and excess refugee deaths is really a function of some third factor which is related both to malnutrition and to mortality. For example, one might speculate that the relief agencies or operations that are unable, for whatever reason, to provide adequate rations are also unable, for the same reasons, to provide access to adequate basic health care and that the higher mortality rates are actually a function of this lack of health care rather than the inadequate rations. However, the extensive non-refugee data on the malnutrition-mortality link suggests that the association between these two adverse outcomes is real. We have no reason to suppose that the same association would not hold true for refugees.

As recently emphasized by Toole and Waldman (1990), it is not the type of infections that occur among refugees that is responsible for the observed excess mortality but rather the greater incidence (frequency) and severity of these infections. Although admitting that other factors such as crowding, lack of adequate water or sanitation or failure to provide vaccine could be partly responsible for the increased frequency of these infections, those authors linked the increased disease severity to the various types of malnutrition which have been observed recently among refugees.

#### **The Importance of Examining the Food supply-malnutrition-mortality Relationship in the Context of Refugee Well-being**

Malnutrition results from access to an amount of calories and/or micronutrients less than what is needed in particular circumstances. The nutrient amounts



needed in various circumstances (maintenance, recovery from malnutrition, pregnancy, growth, etc.) to prevent malnutrition-related mortality and severe morbidity are known with reasonable precision and have been published and widely disseminated as guidelines. Thus, the fact that ration inadequacies (and resulting malnutrition, illness and mortality) continue to occur beyond the immediate emergency phases of international relief operations suggests that factors in addition to accepted scientific and humanitarian norms may be playing roles in the ration selection process.

### Conclusions

1. Preventable excess mortality among refugees has been associated with malnutrition by many data sets and by several lines of reasoning. By analogy with a large body of well-documented data from non-refugee investigations, there is good reason to believe that the association is causal.
2. Current ration provision practices, which sometimes result in providing qualitatively or quantitatively inadequate food to refugees, have been associated with preventable malnutrition. Recently-documented problems which have been observed in epidemic fashion include severe energy-protein (calorie) malnutrition and several forms of severe and sometimes fatal vitamin deficiencies. Current practices of providing refugee rations are thus sometimes associated with preventable excess mortality.
3. Other potentially serious problems of refugee malnutrition (e.g., deficiencies of zinc or iron) remain to be explored.
4. The persistent occurrence of post-emergency phase excess mortality and other severe nutritional problems in refugees, despite the existence of accepted international norms and agency guidelines for preventing these problems, suggests that factors other than technical and humanitarian ones sometimes play important roles in decision-making about ration adequacy. These additional factors need further investigation.

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