



## Part D

# Interpreting the findings

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This section is intended to guide you through the process of interpreting the findings from your assessment. You need to interpret the findings from your causal analysis, anthropometric and mortality surveys together in order to develop appropriate recommendations. The first chapter in this section should guide you through this process. The second chapter provides some guidance on how to develop recommendations based on your interpretation of the situation. It also suggests who you need to present the information to. Finally, Chapter D outlines the most important elements of a nutrition assessment report.



# Chapter D1

## Interpretation of results

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Once you have analysed the anthropometric and mortality data from your survey you will have results that include an estimate of the prevalence of both moderate and severe acute malnutrition and the under-five mortality rate (U5MR) and/or crude mortality rate (CMR) (Chapters B3 and C3). You will also have constructed a causal framework of malnutrition and a seasonal calendar based on the specific context of the affected population (Chapter A5). The next challenge is to draw together these three groups of information to reach judgements about the severity of the situation. This involves addressing the following three questions:

1. Is the prevalence of malnutrition 'typical' for the population in the current season?
2. Is the mortality rate 'typical' for the population in the current season?
3. How serious is the situation?

The interpretation of the results is probably the most difficult part of an emergency nutrition assessment because there is no standard method for interpreting either mortality or nutrition data, and there are many different factors to consider at the same time. However, a proper interpretation of the results is crucial if you want to make appropriate recommendations.

### **D1.1 Is the prevalence of malnutrition typical or not?**

In theory all children under five years of age should grow at the same rate. The prevalence of wasting in the National Centre for Health Statistics (NCHS) reference population is, by definition, 2.3%. This means that the prevalence of wasting should be about 2.3% globally and any prevalence higher than this should be considered abnormal.<sup>1</sup>

In most of the areas where emergency nutrition assessments are conducted, the prevalence of wasting is higher than 2.3% because children have inadequate diets and are exposed to poor health and care environments. This means that the prevalence of wasting in emergency-affected populations is nearly always higher than the prevalence in the NCHS reference population.

In an emergency nutrition assessment we are looking at the difference in the population's nutrition situation as compared with a typical time. It is important

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<sup>1</sup> Note that this prevalence is for wasting only and does not include oedema.

to know whether or not the situation is typical for the population at the given season. Clearly, any prevalence of wasting significantly above the 2.3% level is not satisfactory and warrants further investigation. However, in some populations the prevalence of malnutrition may always be elevated above the 2.3% level and, although this is not ideal, expensive emergency programmes (for example, specialised feeding programmes) to alleviate the situation may not be justified unless the prevalence of wasting is substantially above the 2.3% seen in the reference population. Instead, it may be more useful to advocate for other types of programme which may improve the long-term situation.

### Geographical variation

Differences in the prevalence of malnutrition found across the world can be explained by differences in the immediate, underlying and basic causes of malnutrition (see Chapter A1). Differences in any of these factors will affect the population's nutrition status. In practice, this means we find different levels of malnutrition according to factors like agro-ecological zone and access to health facilities. If there are variations in, for example, the health environment in two otherwise similar populations, we would expect to find a difference in their nutrition status. Similarly, populations living in an area where food security is always a problem will usually have higher rates of malnutrition than a population in a food secure area (assuming other factors are equal). This means that it is important that you compare your results with results of previous surveys from the same place, otherwise differences will not be possible to interpret.

#### Example D1.1

In January 2002 two nutrition surveys were undertaken in different parts of Ethiopia. The results of the assessments are shown in Table D1.1. You can see that the prevalence of global acute malnutrition was much higher in Wollo than in Wolayita, even in a relatively good year (in terms of agricultural production) for both areas.

**Table D1.1** Results of nutrition assessments undertaken in Ethiopia in January 2002

	<b>Dessie Zuria Woreda, South Wollo, Amhara</b>	<b>Lowland areas of Wolayita Zone, SNNPR</b>
<b>Prevalence of global acute malnutrition (<math>&lt;-2</math> z-scores and/or oedema)</b>	11.6% (95% CI 8.8–15.1%)	4.4% (95% CI 2.5–6.4%)
<b>Prevalence of severe acute malnutrition (<math>&lt;-3</math> z-scores and/or oedema)</b>	0.8% (95% CI 0.2–2.3%)	0.4% (95% CI 0.0–0.9%)

### Seasonal variation

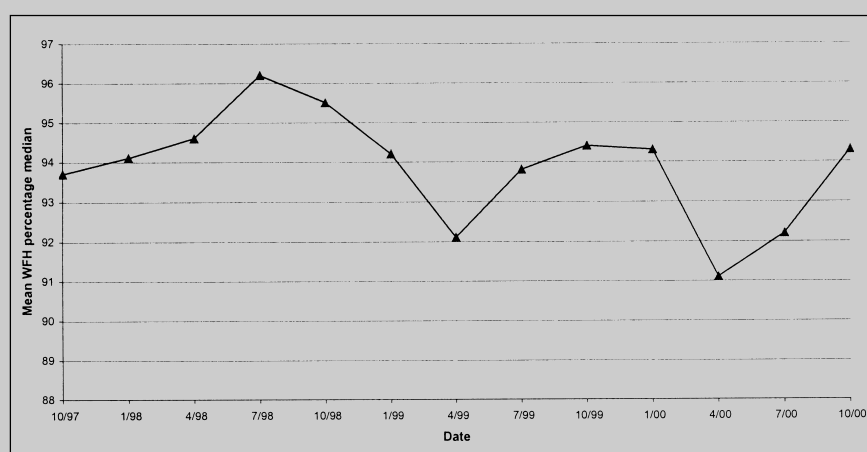
Examples of seasonal variation in acute malnutrition are found in almost every rural population. Towards the end of the hungry season, before the harvest in agricultural populations there is typically an increase in the prevalence of malnutrition. In pastoralist areas the hungry season is normally at the end of the dry season when milk availability is low and animals are in poor condition. It is important to consider what is normal in terms of food security for a given season. Similarly, disease patterns differ with the seasons and some diseases (such as malaria and diarrhoea) are normally more common at certain times of year.

#### Example DI.2

The graph in Figure DI.1 shows the results of nutrition surveys conducted in the highland areas of Wolayita (Ethiopia) over four years in different seasons.

Population mean WHZ from the highland areas is shown for the different surveys. You can clearly see that the mean declines around April every year, and that it peaks in October. These changes in the population mean nutrition status corresponds to the agricultural calendar in Wolayita. The population harvests around September so that they are generally (except in very bad years) better off in October. The hungry season is between January and June when the population is waiting for the green maize harvest. When the sape rains come (usually in October and November), the hungry period is made better by the sweet potato harvest (April/May), but when the sape rains fail and there is no sweet potato harvest, there is a decline in the population's nutrition status around April.

**Figure DI.1** The results of nutrition surveys conducted in the highland areas of Wolayita over three years in different seasons (Save the Children UK, 2000a)



Seasonal differences in the prevalence of malnutrition mean that when you have calculated your prevalence you need to compare them with previous survey results from the same season if possible, to find out whether or not they are normal. If you can't compare your results with earlier surveys in the same season then you need to take into account the possibility that any change in nutritional status is a typical seasonal change rather than an unusual change due to a health or food security problem.

### Example D1.3

You have undertaken three surveys 30 months apart in District B and you have been asked to interpret the findings of the third survey. The main harvest in this area is normally due in April. The anthropometric results of the surveys are given in table D1.2.

**Table: D1.2** Anthropometric results of surveys in District B between September 1999 and January 2001

	<b>Global acute malnutrition (<math>&lt;-2</math> z-score and or oedema)</b>	<b>Severe acute malnutrition (<math>&lt;-3</math> z-score and or oedema)</b>
September 99	7.3% (4.6–10.2%)	0.3% (0.0–0.8%)
September 00	6.8% (4.7–9.7%)	0.3% (0.1–0.7%)
March 01	13.0% (9.1–16.1%)	1.2% (0.7–1.8%)

If you looked only at the data in table D1.2 it would be difficult to properly interpret the results of the March 2001 survey. You can't tell whether or not the increase in malnutrition is due to seasonal differences – because the hungry season for this population is in March – and therefore that the prevalence is relatively normal for District B at this time of year, or, alternatively, whether the prevalence of malnutrition is particularly high because of an epidemic or a very bad year in terms of food security. If, however, you had data from another nutrition survey conducted in March then you would be able to interpret the results more easily. Without seasonal baseline data you need to collect more information on the context and causes of malnutrition in order to understand the anthropometric results of a survey.

### DI.1.1 Using a local classification of malnutrition

The ideal way to assess whether or not a situation is 'typical' in terms of the prevalence of malnutrition is to compare the current situation with local baselines.<sup>2</sup> Ideally, baseline data provide estimates of the prevalence of malnutrition in different seasons in a 'typical' year. From this information, we can determine what is a 'typical' prevalence of malnutrition for a given time of year in a certain population. We can then decide whether or not the current nutrition status of a population is typical, or better, or worse than typical. This distinction between being concerned with the absolute level of malnutrition and the change in a population's nutrition status, helps you to plan a better intervention.

#### Example DI.4

In the late 1980s, Save the Children UK set up a Nutrition Surveillance Programme (NSP) to monitor the nutritional situation of the population living in the most drought-affected agricultural areas of Ethiopia. Nutrition assessments were undertaken regularly (every two to three months) in five different geographical areas for about ten years. This meant that data on the nutritional status of the population was available in both good and bad years. The results of these surveys have recently been analysed in order to produce baseline prevalences of malnutrition for the different seasons in the different areas (Table DI.3 below shows the results from two areas).<sup>3</sup>

**Table DI.3** 'Baseline' prevalences of malnutrition in North Wollo and Wag Hamra and North Shewa by season (taken from the results of the NSP surveys in 1996)

	Post-harvest (December– February)	Early belg rains (March–May)	Late belg rains (June– August)	Kremt rains (September– November)
<b>North Wollo and Wag Hamra, 1996</b>	4.8–6.7%	5.7–7.7%	5.9–7.9%	6.9–9.0%
<b>North Shewa</b>	3.1–4.8%	4.2–6.0%	4.9–6.8%	4.8–6.7%

Save the Children UK closed the NSP in 2001 and only undertakes nutrition surveys on an ad hoc basis in Ethiopia now. The baseline prevalence is extremely useful when trying to decide whether or not the ad hoc survey results are 'typical' for the area or not. For example, a survey in North Wollo in the post-harvest season of 2003 estimated the prevalence of acute malnutrition at 11%.

<sup>2</sup> The Sphere Project (2004) *Humanitarian Charter and Minimum Standards in Disaster Response*.

<sup>3</sup> For more details on how this was done see: Save the Children UK (2004) *An analysis of Save the Children UK's Nutritional Surveillance Programme dataset in some of the most drought prone areas of Ethiopia, 1995–2001*, on the CD-ROM that accompanies this manual.

The baseline prevalence at this time of year is 4.8%–6.7%. Thus, the survey result of 11% is abnormally high and warrants further investigation and/or a response.

Information on local norms or baselines may be difficult to obtain because the data must be collected over a number of years and in different seasons, following a standard methodology so that the results from the different surveys can be compared. Usually such data are collected in nutritional surveillance systems, which are generally expensive to set up and require technical expertise. However, if the data are available it can be very useful. Section A2.2 and Appendix S1 suggest possible sources for pre-emergency anthropometric data.

Many nutrition assessments are undertaken during emergencies. This means that many agencies' survey results are not providing baseline information, but instead information about a population at a bad time. This is not true of all surveys. Some agencies undertake surveys regularly and will have data from typical years which can be considered useful as baseline data. However, you should be very careful when comparing your results with earlier results to make sure you find out what the context was in the earlier surveys. In practice, this means you have to read the previous survey report.

### Comparing like with like

When you are comparing two surveys to assess the trends in malnutrition of a given population, make sure that the surveys:

- 1 **covered the same population** The sampling frame can vary considerably between surveys, for example, national demographic and health surveys (DHS) often exclude the most inaccessible or insecure areas, which may be the very areas where you are conducting your assessment. You should also ensure that there have not been any major migrations in or out of the survey population or significant mortality that could affect the comparability of the population. For example, excess mortality among children under five years of age distorts the age structure of the population. This affects the comparability of results between surveys. If, as a result of high mortality, the proportion of children under five in the population has fallen, then anthropometric results from this group cannot reliably be compared with a population with a normal demographic structure. This is why it is always important to check the age breakdown of your survey population (see subsection B3.4.1 for more on this).
- 2 **used similar methodologies** (representative sampling methods, measuring, same definitions of malnutrition (percent of the median or z-score, same age groups, etc): For example, you should not directly compare percent of the

median results with z-score results. It is often wrongly assumed that malnutrition expressed in percentage of the median or in z-scores is more or less the same. In reality, large differences can be found between the results expressed in percentage of the median and results expressed in z-scores. Typically, the prevalence of malnutrition is higher in z-scores than in percentage of the median (usually about 1.6 times as much)<sup>4</sup> (see also subsection B1.4.2). The differences between z-scores and percentage of the median appear to be particularly important in areas with a low prevalence of kwashiorkor, and in populations with long, thin statures (for example, Somali, Dinka and Turkana populations).

#### Example D1.5

A survey in 1993 in Bardera town (Somalia) and the adjacent internally displaced person (IDP) camp, found that of the 1,835 household members included in the sample survey only 8% were children under five years of age. Sixty-two per cent of the children in this age group had died in the previous nine months (so originally children under five had made up about 18% of the population). Among the children less than five years only 3% were 0–11 months old: the death rate among the infants had been especially high. Because of the high mortality rates among the younger age groups it was thought that the anthropometric survey results could not be compared to previous surveys.

Once you have obtained a relevant survey you can then start to compare your current results with earlier surveys' results and decide whether or not the nutrition of the population is typical, better or worse.

Big differences between the WHM and WHZ results can sometimes give cause for concern in survey results (see also subsections B1.4.2). These differences can be seen graphically in the shape of the distribution, which tends to be taller and narrower than the reference distribution. These differences do not usually reflect errors in the survey findings but can show that if the situation deteriorates further there could be a dramatic impact on the prevalence of malnutrition, because a high proportion of the population is at risk.

<sup>4</sup> 66 datasets from Save the Children UK anthropometric nutrition surveys were analysed to review the methods of sampling, analysis and interpretation of such surveys and their effect on the estimation of the prevalence of malnutrition. The prevalence estimated using WHZ was used as the gold standard. WHM was found to underestimate the global prevalence of malnutrition by an absolute difference of 5.2%. On average, the prevalence based on WHZ was 1.62 times that of the prevalence based on WHM. This difference was slightly less for moderate malnutrition, 4.4%, while for severe malnutrition there was little difference between the two measures, 0.8%.

**Example B3.3**

The results shown in Table B3.2 and Figure B3.1 come from a survey conducted in Ethiopia in an arid area inhabited by a nomadic pastoral Somali population. The survey was conducted at the end of the dry season. The population faces regular food and water shortages during the hungry season.

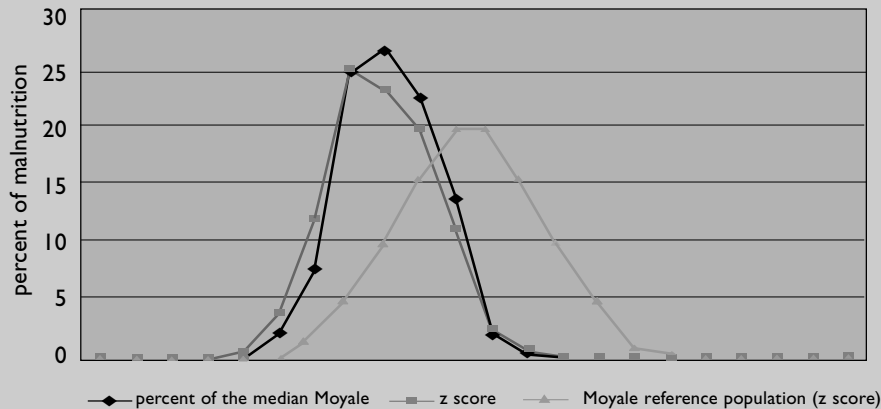
**Table B3.2** Results of a nutrition survey in Moyale Woreda, Liban Zone

<b>Prevalence of global acute malnutrition (&lt;-2 z-scores and/or oedema)</b>	17.1% (95% C.I. 14.3–19.8%)
<b>Prevalence of global acute malnutrition (&lt;80% median and/or oedema)</b>	9.5% (95% C.I. 7.7–11.2%)
<b>Prevalence of severe acute malnutrition (&lt;-3 z-scores and/or oedema)</b>	0.8% (95% C.I. 0.3–1.3%)
<b>Prevalence of severe acute malnutrition (&lt;70% median and/or oedema)</b>	0.1% (95% C.I. 0.0–0.3%)
<b>Crude mortality rate (CMR)</b>	0.73/10,000/day (95% CI 0.23–1.23)
<b>Under-five mortality rate (U5MR)</b>	1.83/10,000/day (95% CI 1.23–2.43)

Despite the high prevalence of global acute malnutrition in z-scores, both the prevalence (z-scores and percentage of the median) of severe acute malnutrition and the mortality rates were typical. In addition, the prevalence of global acute malnutrition defined by percentage of the median and/or oedema, was not excessively high. The population was facing a difficult hungry season, but was not starving. People were not selling more livestock than usual at the end of the dry season. Camel prices were good. The situation was considered to be serious, but not critical. Thus it was decided to not implement selective feeding for the time being, but to carefully monitor the development of the rains and the food security situation over the next three months.

Note that Figure B3.1 opposite shows the distribution of global acute malnutrition defined by z-score and percent of the median for Moyale Woreda. The children between the two lines on the left of the graph are the ones defined as malnourished by the z-score but not the percent of the median. It is because this curve is so steep compared with the reference population that the difference between the prevalence rates are so high.

**Figure B3.1** Distribution of malnutrition in Moyale Woreda, Ethiopia according to WHM and WHZ compared with the reference



### Statistically comparing the level of malnutrition between two surveys

In order to see if there has been a change in the nutritional situation of a population, you need to compare the prevalence of malnutrition between two surveys. A common mistake is to report a change in nutrition status without any evaluation of whether the observed change is real, or merely a sampling artefact. These guidelines strongly recommend the use of statistics to test for a difference between the two surveys' results before any conclusions on trends are drawn from the figures presented.

The simplest way to determine whether two survey results are significantly different is to look at the CIs for each survey. If the CIs around the prevalence of malnutrition do not touch or overlap, then you can conclude there is a statistically significant difference between the two prevalence surveys. Example D1.6 shows how this can be done to compare the prevalence of vaccination coverage between two surveys conducted at the same time of year. Usually, when the CIs overlap, the difference is not statistically significant. However, in some cases even if the intervals do overlap a statistical difference may exist. Checking for this difference requires special statistical tests for which the following information is needed for each survey: the prevalence, sample size and design effect or standard error.<sup>5</sup> The test can then be calculated using the spreadsheet (prevdifference.xls) on the CD-ROM attached to this manual.

<sup>5</sup> These are automatically calculated in CSAMPLE within EpiInfo.

**Example D1.6**

The rates of measles vaccination from two different surveys are presented in Table D1.4. A measles campaign had been conducted during the period between the two surveys. Was the measles campaign successful?

**Table D1.4** Results of measles vaccinations from two surveys

	<b>April 2000 (n = 850)</b>	<b>April 2001 (n = 823)</b>
<b>Prevalence of measles vaccination (as confirmed by card or mother)</b>	15.5% (95% CI 8.2–23.1%)	48.5% (95% CI 37.0–60.1%)

Yes, we can see that there has been a significant improvement in the measles vaccination rate between the two surveys because the 95% confidence intervals do not overlap. However, the rate in April 2001 was still lower than the internationally recommended rates (90%).

**D1.1.2 Using a global classification of malnutrition**

Global variation in the prevalence of malnutrition makes it extremely difficult to design a classification of population nutrition status which is widely applicable. What is considered a very high rate of malnutrition in one area may be 'typical' in another. Several agencies, including the WHO, have attempted to classify rates of acute malnutrition according to alert stages when the situation ceases to be typical. The WHO classification of the severity of malnutrition rates in a population is presented as an example in table D1.5 (WHO, 2000).

**Table D1.5** The classification of the severity of malnutrition rates in a population according to WHO (WHO, 2000)

<b>Severity of malnutrition</b>	<b>Prevalence of wasting (<math>&lt;-2</math> z-scores )</b>
Acceptable	$<5\%$
Poor	5–9%
Serious	10–14%
Critical	$\geq 15\%$

Unfortunately, the WHO classification has the following faults:

- a) The classification does not include oedema. Oedema is a sign of severe malnutrition and must be included in any classification of acute malnutrition.
- b) The classification does not take into account the severity of the causes of malnutrition and the risk which these might pose for future rates of malnutrition or mortality.
- c) The highest cut-off point is a prevalence of 15 per cent less than  $-2$  z-scores. In many parts of Africa the prevalence of acute malnutrition is above 15 per cent at the end of the hungry season, but this does not necessarily mean that the situation is so critical as to warrant an emergency nutrition response if the harvest is predicted to be normal or good.

Classifications used by other agencies (including Médecins Sans Frontières and Concern) take points (a) and (b) into account, but all the published classifications suffer from one major drawback: a tendency to over-simplify the interpretation. A classification like the one above ignores the causes of malnutrition and mortality (eg, epidemics or poor future food security), which will influence the way you interpret the anthropometric result. The classification also omits the assessment of trends in anthropometric status, which make up an important part of the interpretation of a nutrition survey.

## DI.2 Is the mortality rate typical or not?

The same basic principles apply to mortality rates as to malnutrition prevalence when considering whether or not they are typical. Rates should be considered in the light of the non-emergency rates in the same population and the season.

As with malnutrition, global classifications are typically used. A crude mortality rate (CMR) of 1/10,000 per day is often taken to indicate an emergency situation (this assumes a doubling of the baseline situation in the absence of baseline data), while rates of 2/10,000 per day are taken to indicate a severe situation.<sup>6</sup> Under-five thresholds are 2/10,000 per day and 4/10,000 per day respectively.

Ideally, locality-specific baseline mortality rates would be available for comparison purposes because mortality rates, like malnutrition, vary according to season and area. However, in most places baseline mortality data will not be available.

The table below gives region-specific CMR and U5MR averages and emergency thresholds. The average baseline CMR for the least developed countries is 0.38 deaths/10,000 people/day. We recommend using this table as a

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<sup>6</sup> For example, UN Standing Committee on Nutrition, 2004, and UNHCR, 2000

guide to classifying the stage of alert with regard to mortality, but remember that the classification is a general one and not specific to any country or season.

**Table D1.6** Baseline reference mortality data by region (The Sphere Project, 2004)

<b>Region</b>	<b>CMR (deaths/ 10,000/day)</b>	<b>CMR emergency threshold</b>	<b>U5MR (deaths/ 10,000 U5s/ day)</b>	<b>U5MR emergency threshold</b>
Sub-Saharan Africa	0.44	0.9	1.14	2.3
Middle East and North Africa	0.16	0.3	0.36	0.7
South Asia	0.25	0.5	0.59	1.2
East Asia and Pacific	0.19	0.4	0.24	0.5
Latin America and Caribbean	0.16	0.3	0.19	0.4
Central and Eastern European Region/CIS and Baltic States	0.30	0.6	0.20	0.4
Industrialised countries	0.25	0.5	0.04	0.1
Developing countries	0.25	0.5	0.53	1.1
Least developed countries	0.38	0.8	1.03	2.1
World	0.25	0.5	0.48	1.0

Because no confidence intervals are available for the baseline rates in table D1.6, we cannot statistically compare these rates with those obtained in an emergency assessment.

### **D1.3 How serious is the situation?**

The severity of the situation can only be judged when the three groups of information gathered in the assessment – the prevalence of malnutrition, mortality rate and causes of malnutrition are analysed together.

#### **D1.3.1 Triangulating malnutrition, mortality and causes data**

Having reached this point you should have an understanding of the most important causes of malnutrition resulting from the emergency (Chapter A5) and an understanding of whether or not the malnutrition prevalence and mortality rates are typical for the population. Now you need to assess the plausibility of your findings. This involves seeing if the results tell the same story or whether certain questions remain unanswered.

Table D1.7 gives a broad, although not comprehensive, description of the possible scenarios you may encounter during interpretation. The table should help you to decide whether your information is plausible. You should decide which situation (1–4) your assessment findings fall into, according to whether or not the mortality and malnutrition findings are typical, and then review the

possible reasons for the situation in the table and compare these with your findings from the causal analysis. As was discussed in Chapter A2, your analysis of the causes of malnutrition needs to take into account ongoing interventions addressing the causes and should be focused on the gaps in intervention. Remember also that at this stage we are interested in the major causes of malnutrition resulting from the emergency, rather the ongoing problems which the community faces in non-emergency times.

**Table DI.7** Possible combinations of mortality and malnutrition rates and likely causes

	High rates of mortality	Typical rates of mortality
<b>High prevalence of malnutrition</b>	<p>①</p> <p>Likely causes:</p> <p>Acute food insecurity and failure to cope</p> <p>High levels of infection arising from displacement or uncontrolled epidemic</p> <p>Major disruption to care environment such as displaced bottle-feeding population</p>	<p>②</p> <p>Likely causes:</p> <p>Acute food insecurity</p> <p>Disruption to care environment resulting from damaging coping strategies</p> <p>No major disease outbreaks</p>
<b>Typical prevalence of malnutrition</b>	<p>③</p> <p>Likely causes:</p> <p>High rates of infection not typically associated with malnutrition (eg, malaria or meningitis epidemic)</p> <p>Mortality directly caused by conflict or acute disaster (eg, earthquake)</p> <p>Possible outbreaks of micro-nutrient deficiency</p>	<p>④</p> <p>Either no major causes of malnutrition or mortality resulting from the emergency, or causes which have yet to have an impact on malnutrition and mortality</p>

**Example of situation ①** In Malha rural council in Darfur, Sudan, a nutrition assessment was conducted in October 2003. It showed a prevalence of global acute malnutrition of 25% and 6.1% severe acute malnutrition and an under-five mortality rate of 2.6/10,000/day. The area had been affected by drought for three consecutive years and throughout 2003 parts of North Darfur were affected by conflict, which caused considerable displacement and reduced trading opportunities and access to markets.

**Example of situation ②** In 2001 in a camp for internally displaced persons (IDPs) in Eastern Ethiopia, the IDPs had not had access to a general ration for

2–3 months and were unable to get sufficient amounts of food from other sources. The prevalence of global malnutrition was extremely high (around 30%). However, the U5MR was relatively low (1.3/10,000/day) because an international NGO was operating a very efficient therapeutic feeding programme in the camp. This programme prevented children from dying, but because the general ration was inadequate the prevalence of moderate malnutrition remained high. Moreover, many children who were discharged as normally nourished from the therapeutic programme were re-admitted a few months later as their families were unable to provide them with sufficient food to prevent them from becoming malnourished again. Recommendations from this report included an urgent need to improve the general ration.

**Example of situation ③** In Kohistan District, Afghanistan in 2001. The prevalence of acute malnutrition was estimated at 7%, which was considered typical of the area. However, the U5MR was elevated at 5.9 deaths per 10,000 per day. Members of the survey team had noticed the widespread prevalence of vitamin C deficiency disease, locally known as Seialengia (black legs). In some of the villages the deficiency disease was estimated to have affected up to 10% of the population. The team conducted a dietary investigation and found that the population had had access only to very limited sources of vitamin C in the months prior to the survey. Recommendations included vitamin C supplementation and the provision of complementary foods such as pulses, oil and blended/fortified foods for the population. It is likely that diseases other than scurvy (such as diarrhoea and acute respiratory infection – ARI) also contributed to the elevated mortality in this population.

**Example of situation ④** In Malawi in December 2001 a survey was conducted in Salima District. This showed rates of malnutrition of 9.3%, which was considered to be fairly typical for the time of year since it was the pre-harvest season. However, prices of maize were rising incredibly rapidly (much more so than usual) and becoming too expensive for people to afford. Food security assessments showed that this was likely to continue at least until the harvest. There were reports that people were starting to migrate to towns, which was normally only common in very bad years. While the nutrition assessment indicated that at the time of the survey malnutrition rates had not risen unusually high, given the prospects for the following months, rapid rises in rates of malnutrition were expected.

### D1.3.2 Issues to consider during triangulation

#### High mortality rates and low rates of malnutrition<sup>7</sup>

The idea that high mortality rates can mask a deteriorating nutritional situation is widely accepted and is often referred to in nutrition assessment reports. The argument is that if the severely malnourished children die, and the survivors are the better nourished, the malnutrition rate may stabilise or even improve because of the drop-out phenomenon. This concept of 'replacement malnutrition' and the associated 'survivor bias' is often quoted when people encounter situation 3 described above.

Originally, the research to support this idea came from two cross-sectional nutrition surveys of refugees living in camps in east Sudan. The two surveys recorded similar rates of relatively high (but not critical) malnutrition over a two-month interval, but high rates of mortality had been recorded. The authors argued that the deceptive appearance of stability in nutritional status in the face of such high levels of malnutrition might be explained by ongoing nutritional deterioration ('replacement malnutrition') among surviving children.

In fact, recent research has shown that mortality rates have to be very high before this phenomenon can be observed. This is because in an emergency context infant and child deaths are not limited to the severely or moderately malnourished; deaths also occur among those who are not malnourished. A recent analysis of 266 nutrition surveys has shown that food insecurity and famine equally affect all individuals within a defined population – this means that everyone gets more wasted in the emergency (Golden and Grellety, 2002). The research found that the WFH distribution shifted to the left in emergencies, but that the shape of the distribution remained normal.

The most recent research suggests that the replacement malnutrition/survivor bias phenomenon will only be seen in populations with a very elevated CMR – maybe at a CMR of more than 10/10,000/day. Interestingly, the U5MR in the Sudanese camps in the original study was 21/10,000/day so the conclusion drawn by the authors was correct. However, you should not invoke survivor bias as the explanation for situation 3 unless mortality rates are very high.

#### Determining causality

It is important to remember that when you are analysing and interpreting the results of a cross-sectional survey it is not possible to prove causality. For example, if you find a high rate of malnutrition and there are reports of a measles outbreak you cannot be 100% sure that the malnutrition is due to the measles outbreak.

When you have quantitative data gathered in your survey it is possible to find out whether certain causes (such as the prevalence of diarrhoea) are associated with being malnourished, although this is relatively complex if you surveyed

<sup>7</sup> Adapted from Young H (2004) *Nutritional Assessment: progress and remaining challenges*, draft.

your population using cluster sampling and cannot easily be done on EpiInfo. But it is not possible to conclude that diarrhoea actually caused the malnutrition, only that the malnourished children had more diarrhoea. Equally, if you find that a population has abnormally high rates of diarrhoea and is also acutely food insecure you can't say that one factor is a more important cause of malnutrition than the other. You can only state that both are present and are likely to have caused malnutrition.

### **Levels of severe malnutrition**

The prevalence of severe acute malnutrition is an important indicator because it tells you how many very malnourished children there are, and how many children are at high risk of mortality. If you have a high level of severe malnutrition and no measures in place to treat it you would expect an elevated U5MR. The proportion of wasting which is severe will increase as the prevalence of global wasting increases.

### **Using age breakdown of malnutrition to triangulate with causes**

In Chapter B3 we stressed the importance of presenting anthropometric data by age group (subsection B3.8.2). This is because looking at the prevalence of malnutrition in different age groups can help with your interpretation of the causes of malnutrition.

Normally, the prevalence of malnutrition tends to be higher in the 6–29 month age groups than in the older age groups, because the younger groups are beginning on complementary foods or stopping breastfeeding and are more susceptible to disease. It may therefore be useful to aggregate the data into two age groups (eg, 6–29 months and 30–59 months) so that the sample of each age group is bigger and you have more statistical power to compare prevalence in the two groups (see subsection D1.1.1). Higher than normal levels of malnutrition among younger children may indicate a high burden of infection, while an equal level of malnutrition among all ages may indicate acute food insecurity.

The differences observed may promote certain programmatic responses focusing, for example, on a certain disease (such as diarrhoea). In any analysis of the age-specific prevalence of malnutrition, however, it should be remembered that the reason children aged 6–59 months are surveyed is to inform us about the situation in the whole population rather than to focus response on specific age groups of children under five.

Usually, the prevalence of malnutrition in boys and girls is similar. If there is a difference between the sexes then you need to investigate why this difference exists.

### If the data do not triangulate

If when you try to bring the different types of data together you cannot make sense of the story, you should consider the following points:

1. **Bias.** Is it possible that bias has been introduced into your data? Refer back to section B2.9 and subsection B3.4.2 in consideration of this point.
2. **Time frames and populations.** Keep in mind that the anthropometric results refer to children aged 6–59 months (although they are usually thought to be a proxy for the rest of the population), the mortality results refer to everyone, and the causes of malnutrition refer to everyone but may include special investigation into groups facing special nutritional risk. The anthropometric survey measures the situation on the day of the survey, although rates of acute malnutrition at any point in time will reflect the causes of malnutrition present in the preceding period. Mortality rates refer to the recall period of the survey (not the situation on the day of the survey) and the causal analysis includes long-term as well as acute causes of malnutrition. Remember that a subsection of the population may be very severely affected by the emergency and identified in the causal analysis, but you may not pick this up in your anthropometric and mortality surveys if you did not design your surveys accordingly.
3. **Misjudging the major causes.** It is not easy to judge the extent to which a cause of malnutrition will impact on rates of acute malnutrition and mortality or how long it will be before a particular cause has an impact. Refer back to the process you went through in deciding the major causes and review whether, in retrospect, your decisions were correct.
4. **Missing information.** It is possible you failed in your causal analysis to identify a cause of malnutrition that is important. Return to the causal framework and review whether you really did fill all the information gaps.
5. **Acknowledge the inconsistency.** If after all these checks you are still not able to make sense of your data then you need to include a section in the report which states this problem and identifies the new information which would inform the findings of the assessment.

### D1.3.3 Reaching conclusions

You now need to take your triangulated data and decide how serious the situation is. The extra dimension which needs to be added at this point is the seasonal calendar, explained in Chapter A5. This calendar will forecast the future and indicate whether the situation is about to get better, or worse or stay the same. This is a critical piece of information in deciding how serious the situation is.

If the causes of malnutrition or mortality are not permanent, the situation is likely to be less serious. For example, if the prevalence of malnutrition is

untypically high for the time of year because of a bad year, but the harvest is due in a month and people will be able to start to eat again, then the situation will be much less serious than for a population who will not get access to a harvest for another six months. Likewise if the population has had high rates of mortality and malnutrition due to a measles outbreak but vaccination coverage is high due to a successful immunisation campaign which took place two weeks before the survey, the situation will be much less serious than if no immunisation campaign had taken place. In a situation where mortality is high and malnutrition rates are typical, the cause of mortality and whether it is permanent will be important in deciding how serious the situation is. If mortality was sudden and widespread as a result of an earthquake or massacre, and if these events were unlikely to reoccur then the situation will be less serious than if the mortality was due to an uncontrolled epidemic. Finally, if your results show that malnutrition and mortality rates are typical but that the causes of malnutrition are likely to get worse and more intense over the months following the survey then the situation could be serious.

Of course in many situations it may be impossible to predict what will happen next – eg, if insecurity is the major basic cause or if future harvests depend on a rainy season which has not yet begun. In these situations, while a spontaneous improvement may be possible, it is better to concentrate on the short term and identify how urgently assistance is required, if at all.

### Summary

- There is no standard recipe for interpreting nutritional data.
- Using the global classifications for the severity of the situation can result in judgements which do not adequately take the context into account.
- In order to be able to correctly interpret anthropometric and mortality data from an emergency nutrition survey, it is necessary to:
  - determine whether the prevalence of malnutrition and the mortality rate are typical or not
  - triangulate the findings with the causes of malnutrition to decide whether the story which the data are telling seems plausible
  - decide how serious the situation is by examining your triangulated findings in the light of the prospects for improvement or deterioration gathered from your seasonal calendar.