Ethiopian
Early Warning System

GUIDELINE ON EMERGENCY NUTRITION ASSESSMENT

Early Warning Department
Disaster Prevention and Preparedness Commission
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Contents

Introduction

The Disaster Prevention and Preparedness Commission (DPPC) is the government agency in Ethiopia responsible for coordinating and implementing disaster management, including nutritional emergencies. The first Guidelines on Nutritional Status Data and Food Relief were published in 1990 and re-published in 1995. These guidelines served as the standard guideline for nutrition surveillance programmes in the country for all the actors involved in emergency programmes. However, many new advances in the field of emergency nutrition assessment have occurred since the earlier guidelines were developed. Advances have included nutrition survey methodologies, the parameters used for comparing nutrition status, and the classification of alert stages for the determination of severity of malnutrition at population level. Unfortunately, nutrition guidelines developed elsewhere do not specifically take the Ethiopian situation into consideration and are, therefore, difficult to use at field level.

In order to make the standard of nutrition surveys in Ethiopia compatible with the current internationally accepted standards, and to make the methodologies suitable for use in the Ethiopian context, there was a need to develop new guidelines for emergency nutrition assessments. Accordingly, in April 2001, the DPPC established a nutrition task force at a national level. The task force consisted of government institutions, non-governmental organisations (NGOs) and United Nations (UN) agencies working in the field of nutrition, and was chaired by the Early Warning Department of the DPPC. This manual has been produced through the collaborative efforts of the working group.

These guidelines aim to offer advice on the collection, analysis and interpretation of nutrition data in Ethiopia. They also guide the use of this information, by technical field staff and managers, for planning relief operations. The guidelines should help to standardise all emergency nutrition assessment efforts within the country and serve as a standard tool for all organisations working in the field of emergencies in Ethiopia.

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Early Warning Department
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Glossary of acronyms

AAH/ACF	Action against Hunger/Action contre la faim
BOA	Bureau of Agriculture
CMR	Crude mortality rate
CSA	Central Statistical Authority
DA	Development agent
DHS	Demographic and Health Survey
DPPC	Disaster Prevention and Preparedness Committee
DPPB	Disaster Prevention and Preparedness Bureau
EGS	Employment generation scheme
ENCU	Ethiopian Nutrition Co-ordination Unit
EPI	Expanded Programme on Immunisation
EU	European Union
EW	Early warning
FEWS	Famine Early Warning System
GFD	General food distribution
GMP	Growth Monitoring Programme
HFA	Height-for-age
IDP	Internally displaced person(s)
IDR	Institute of Development Research
IGADD	Inter-Government Authority on Drought and Development
ILRI	International Livestock Research Institute
MCH	Maternal and child health
MoA	Ministry of Agriculture
MoH	Ministry of Health
MSF-B/CH	Medecins sans frontiers Belgium/Switzerland
MUAC	Mid-upper arm circumference
NGO	Non-governmental organisation
NPDPM	National Policy on Disaster Prevention and Management
NSP	Nutrition Surveillance Programme
PA	Peasants' Association
RRC	Relief and Rehabilitation Committee
SC UK/US	Save the Children UK/US
SERA	Strengthening Emergency Response Abilities
SFC/SFP	Supplementary feeding centre/supplementary feeding programme
TFC/TPF	Therapeutic feeding centre/therapeutic feeding programme
U5MR	Under-five mortality rate
UN	United Nations
UNEUE	United Nations Emergencies Unit for Ethiopia
UNHCR	United Nations High Commission for Refugees
UNICEF	United Nations Children's Fund
WFA	Weight-for-age
WFP	World Food Programme
WFH	Weight-for-height
WHM	Weight-for-height median
WHO	World Health Organisation
WHZ	Weight-for-height z-score
WVI	World Vision

Chapter 1

The causes and development of malnutrition in Ethiopia

Responding to malnutrition in a community requires a thorough understanding of its underlying causes. Simply measuring the amount of malnutrition is not sufficient. This chapter aims to provide an explanation of the causes and development of malnutrition in Ethiopia. An overview of causal factors such as access to food, adequate health services and disrupted social and care environments will be given. A description of the process leading from food insecurity to famine in Ethiopia is also presented.

1.1 Nutrition and malnutrition

Adequate nutrition is the means by which people thrive, maintain growth, resist and recover from diseases and perform their daily tasks. When nutrition is inadequate, vulnerable populations are likely to become malnourished. Malnutrition includes a wide range of clinical disorders in which an individual's physical functions are impaired.[1] Common consequences of malnutrition include growth failure, decreased resistance to disease and reduced ability to work. Pregnancy and lactation may also be affected.

In recent years the multi-factorial nature of malnutrition has been recognised. It is not just the result of energy and/or protein deficits,[2] but also a combination of vitamin and mineral deficiencies. Thus the term protein-energy malnutrition is no longer used. The correct term to employ is 'multi-nutrient malnutrition', but for the sake of simplicity we have just used the term 'malnutrition' in these guidelines.

The two most extreme forms of malnutrition are marasmus and kwashiorkor, though milder forms of malnutrition are much more widespread. Malnutrition among children is characterised by growth failure, wasting (thinness) or stunting (shortness), or a combination of both.

Definitions of kwashiorkor and marasmus

Kwashiorkor classically presents with bilateral pitting oedema beginning in the lower legs and feet, which may become more generalised (trunk, "moon" face, hands, arms). This is coupled with micronutrient deficiencies (vitamin A deficiency, iron deficiency, etc) and an apathetic disposition. Hair changes may occur (the hair becomes blonde, sparse or thin), as may widespread de-pigmentation and areas of cutaneous hyper-pigmentation on the torso and limbs. This may be accompanied by peeling of the skin's surface (desquamation). Kwashiorkor carries an extremely high risk of serious systemic or localised infections.

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[1] Malnutrition includes overnutrition (obesity) and undernutrition. These guidelines focus exclusively on undernutrition as this is by far the most common type of malnutrition in Ethiopia. Therefore malnutrition means undernutrition in these guidelines.

[2] The estimated average daily per capita energy requirements for a typical developing country population is 2070 kcal, rounded up to a value of 2,100 kcal. The energy should come from a mixed diet of protein, carbohydrate and fats (WHO, 1985).

Marasmus exhibits itself as a progressive loss of subcutaneous fat and muscle. The child becomes very thin. The condition can rapidly deteriorate with the onset of other illness such as diarrhoea, respiratory infections, measles, etc.

Kwashiorkor and marasmus are not mutually exclusive, they can occur at the same time. Such cases are called marasmic-kwashiorkor cases.

Figure 1.1 Two malnourished children: one with oedema (kwashiorkor) and one without oedema (marasamic)

Specific micro-nutrient, or vitamin and mineral deficiencies do exist in Ethiopia. Well known examples include vitamin A or iodine deficiencies which lead to bitot's spots and goitre or cretinism respectively. However, these guidelines will not describe how to assess such nutrient deficiencies. Instead, the reader is referred to other technical manuals.[3]

1.2 Causes of malnutrition

The objectives of most emergency nutrition assessments include trying to understand what the causes of malnutrition are. It is extremely important to understand the causes of malnutrition in order to plan and undertake an appropriate response or intervention.

In the past, malnutrition was thought to be a medical problem with a single cause: protein deficiency. The 'protein gap' as it was known, was thought to be the most widespread nutritional problem and was cured by high-protein foods. By the mid-seventies, energy intake became a key issue as the interaction between energy and protein was recognised. This raised social and economic issues around access to food by the poor, and malnutrition was no longer viewed just as a medical problem to be treated. Poverty, and the conditions associated with it, were recognised as the overriding causes of malnutrition.

In the late 1980s, the public health significance of vitamin A deficiency, iron deficiency anaemia and iodine deficiency was widely recognised. The focus switched from the overall energy content of the diet to dietary quality. Malnutrition is clearly associated with poverty, but this is not simply due to a shortage of the staple food, it also results from a lack of variety in the foods eaten.

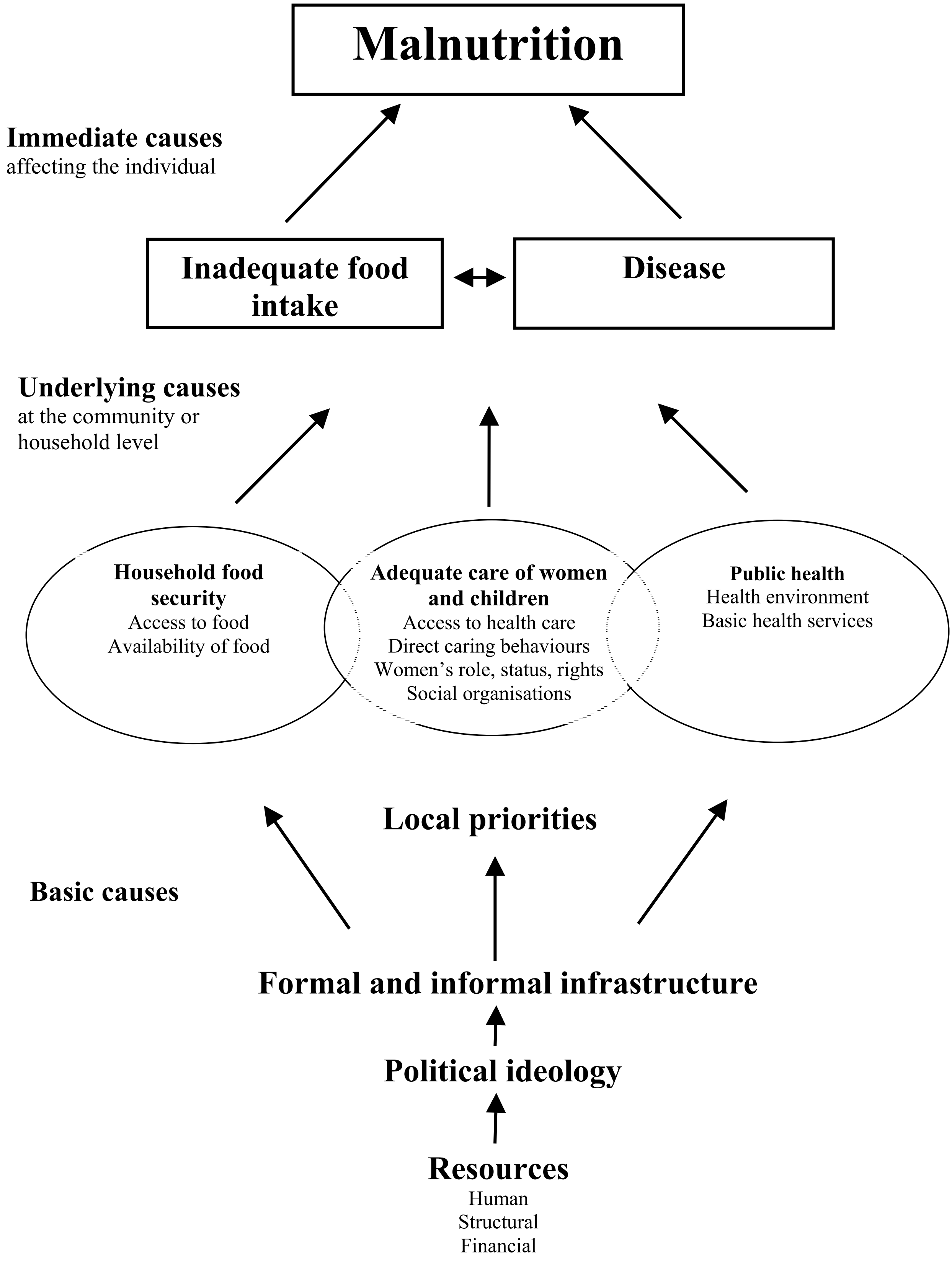
The underlying causes of malnutrition can be described with the help of a model, developed by United Nations Children's Fund (UNICEF), which shows the various factors and how they are inter-linked (see Figure 1.2). The UNICEF conceptual framework is a useful starting tool for the analysis of the causes of malnutrition. It distinguishes between causes which operate at different levels of society; starting with the individual and the household, and working backwards to include the community, district or region and country. This model should form the basis of any causal analysis of malnutrition in Ethiopia.

The model shows inadequate food intake and infectious disease as the two "immediate causes" of malnutrition. These immediate causes are influenced by a wide range of "underlying causes" that operate at the household and community level. The underlying causes are grouped into three clusters: household food security, basic health services combined with the health environment, and adequate care of women and children. A third level of "basic causes" are: potential resources, the environment, economic structures, and the political and ideological superstructure.

The UNICEF framework is an important tool to help us assess what is causing malnutrition in a particular population and, in turn, plan interventions to improve the situation. The cause of malnutrition should always determine the intervention. For example, if the malnutrition appears to be related to a problem with household food security, then a food-based response will be most appropriate. If the malnutrition is due mainly to an infectious disease, then it would be more appropriate to respond with a public health intervention.

[3] For example, WHO (2000)

Figure 1.2 The UNICEF conceptual model of the causes of malnutrition

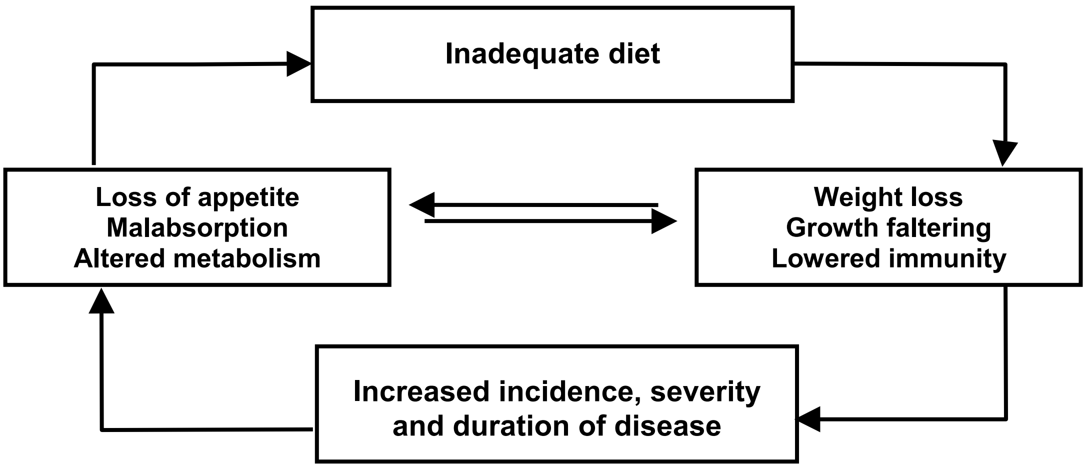


1.2.1 The immediate causes: nutrition and infection

Malnutrition starts either with the failure of an individual to acquire enough food to eat, or with ill health. Health and nutrition are closely linked. Deficiencies in energy, protein and vitamin A in particular, are associated with a lowering in immunity. This means that malnourished children will suffer increased incidence, severity and duration of diseases like measles and diarrhoea. Death rates among children who are severely malnourished are about six times greater than among those who are healthy and well nourished in the same population, and twenty to fifty times greater than the rate in rich and prosperous countries, (Young, 1992).

In addition to the effect of nutrition on disease, the presence of disease leads to further malnutrition, through malabsorption of nutrients, altered metabolism, loss of appetite and by affecting feeding practices. Thus, the relationship between malnutrition and infection is circular and cyclical as seen in Figure 1.3.

Figure 1.3 The malnutrition/infection cycle (adapted from Tomkins and Wastson, 1989)



Effect of measles and diarrhoea on growth status

Fever increases energy expenditure by ten to fifteen per cent for each one degree celsius rise in body temperature. Measles profoundly decreases appetite, and children may reduce their food intake for several weeks following infection. Either of these two factors can lead to dramatic weight loss and wasting.

Measles occurring in poor environments is associated with growth faltering, vitamin A deficiency, and immune suppression. The immune suppression can persist for up to four months after infection, which partly explains the particular risk of respiratory and diarrhoeal complications of measles and the relatively greater severity of the disease in poor communities. Measles and diarrhoea appear to act synergistically: greater growth deficits are found in children among whom measles is complicated by diarrhoea.

Repeated attacks of diarrhoea are associated with poor nutrient absorption and considerable nutrient losses in the faeces. Both lead to reduced weight gain or even weight loss, which in some children may cause malnutrition. After diarrhoea most children quickly regain weight and ‘catch-up’ their previous losses.

Effect of growth status on measles and diarrhoea
The most important mechanisms that bring about increased infection among the severely malnourished are decreased resistance as a result of selective immunologic changes, and changes to intestinal function.

Severe malnutrition is associated with a high prevalence of measles as a result of severely decreased resistance. In moderate, or mild malnutrition, however, there is little evidence of an important role for nutrition in the first stage of the illness; environmental, climatic, and behavioural factors seem more important. As complications of measles develop, the role of nutrition becomes more important, especially in relation to recovery rates and duration of diseases.

It is important to remember the relationship between health and malnutrition when undertaking an emergency assessment. If there has been a recent epidemic of either measles or diarrhoea it is likely that the children's nutrition status will be poor. Food interventions, however, may not necessarily be the correct response. Instead it may be more useful to look at health or hygiene interventions.

It is equally important to remember that children who are severely malnourished are more susceptible to diseases such as measles and diarrhoea. For this reason, all children in feeding programmes should be vaccinated against measles and every precaution to avoid the spread of diarrhoeal disease should be taken. Furthermore, as measles causes vitamin A deficiency and measles is more severe in vitamin A deficient children, all measles vaccinations should be accompanied by vitamin A supplementation.

1.2.2 The underlying causes of malnutrition

The three groups of underlying causes interact with each other. In particular, the care of children is heavily influenced by the food security of the household and by access to health services. For example, if a mother is not able to access appropriate weaning foods for her young children it will be very difficult for her to provide adequate care. Alternatively, if health services are very far from a village and Expanded Programme on Immunisation (EPI) services are unavailable, it may be difficult for the community to ensure that its children are immunised.

Food security
A widely used definition of food security is "access by all people at all times to enough food for an active healthy life". This definition focuses on the availability of food and the ability to acquire it. Thus, what is important for a household is its level of ability to secure adequate food, (either through its own food production or by purchasing food), in order to meet the needs of all its members.

The ability of a household to obtain food depends on a wide range of factors. Figure 1.4 below is a simplified, generalised flow chart showing how household food intake is the result of a range of possible activities, each influenced by other factors. It should be noted that these factors do not constitute an exhaustive list of how households obtain food. Also, every situation is unique and the interrelationships between the various factors will vary, and are likely to be complex. For example, rainfall patterns affect food availability, which will affect market prices, etc.

Basic health services and the health environment
The health environment influences exposure to infectious disease. Environmental factors that increase exposure to disease include: limited water supply, poor sanitation, a crowded household with many young children, contaminated water, unhygienic food preparation and a hot and dusty

dry season. Camps for internally displaced people or refugees which are set-up very quickly, often have many of these characteristics.

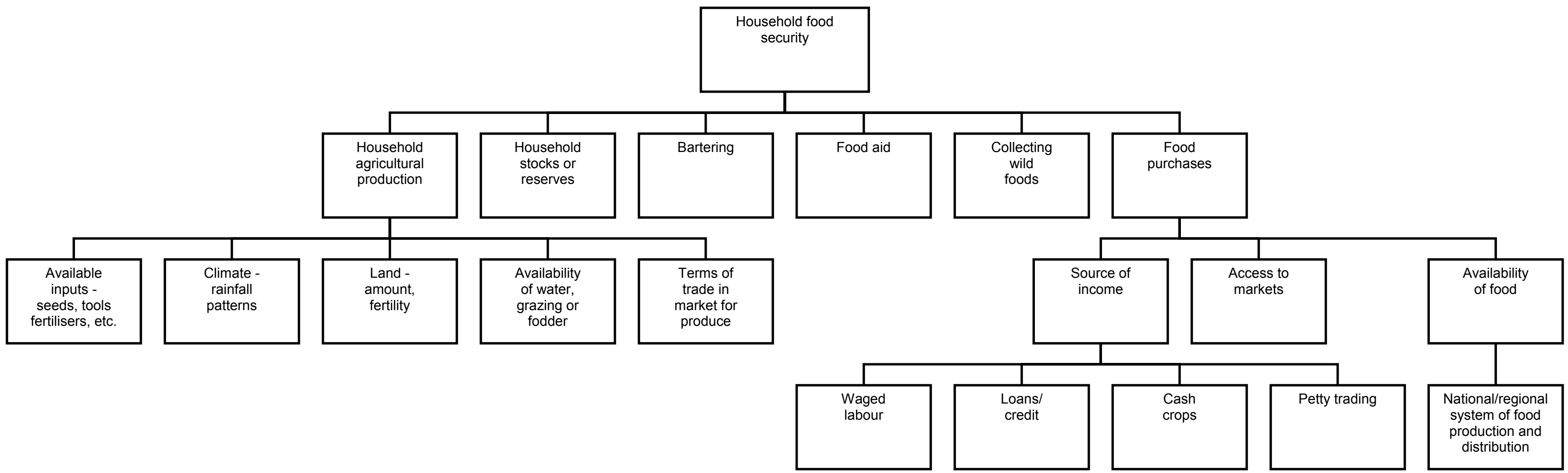
Disease treatment is influenced by the provision of, and access to, local health services. Inadequate or late treatment places a child at increased nutritional risk by prolonging disease. This may occur if local health services are understaffed or have a limited supply of essential drugs. Alternatively, health care services may be well developed but too expensive for poorer groups in the community to access. Attitudes to health care (which may be affected by education and cultural beliefs) can influence a community's willingness to make use of available services.

Caring practices

Child care and appropriate feeding practices are needed for good nutrition and health. The care of the child is affected by a wide range of behaviours which in turn affect child nutrition. The direct care of the child by members of the family, particularly the mother, is important. For example, breastfeeding patterns will affect the child's nutrition status. Of equal importance, however, are behaviours which indirectly affect child care. This may include, for example, the support given by the family or community to the adult members of the family, behaviours which influence how the household food supply is shared among its members, or attitudes to modern health services, water supplies and sanitation.

Often the care of children is closely linked to the situation of women. If the status of women is low they may have little control over the resources within the family. Consequently, although they may have the main responsibility for child-rearing, they do not have the resources to carry it out as they would like. Additionally, the educational status of women has been shown to have a great impact on children's growth in Ethiopia: women who have more formal schooling are more likely to have better nourished children (CSA and ORC Macro, 2001).

Figure 1.4 A broad description of the factors influencing the food available to an agricultural household (adapted from Young, 1992)



1.2.3 Basic causes of malnutrition

Beyond the level of the household, in the village or region, or at the national level, there are numerous other factors that influence what food the household is able to obtain and household members' health, and therefore indirectly influence nutrition status. These factors are the basic causes of malnutrition. For example, a child's health will be affected by the availability and quality of healthcare in the woreda. Food security will be affected by political policies on food aid, etc. Caring practices may be determined by the amount of education available to women.

Socio-economic issues, including the political and economic structure of a country or region, will in turn influence many of the factors described above. For example, the Gulf States' ban on the importation of livestock from the Horn of Africa had a negative impact on the terms of trade for livestock in the Somali region of Ethiopia in 1999/2000. In turn, this had negative effects on the food security of pastoral and agro-pastoral communities in the region, because they could not obtain as much income or food from the sale of their animals.

Political and socio-economic factors can also, of course, positively influence the nutrition status of the household. For example, educating school children about health, nutrition and sanitation will improve the nutritional situation in the long-term. Building roads will eventually lead to increased market access, and building and staffing hospitals and clinics will contribute to improved health care in an area.

1.3 Developing a local causes of malnutrition framework

While studies demonstrate that most of the variation seen in malnutrition in Ethiopia is according to agro-ecological zone, it is important to recognise that food intake is also influenced by how a community lives, or their livelihood. In order to mount an appropriate response, an understanding of the causes of malnutrition as they relate to livelihoods is essential.

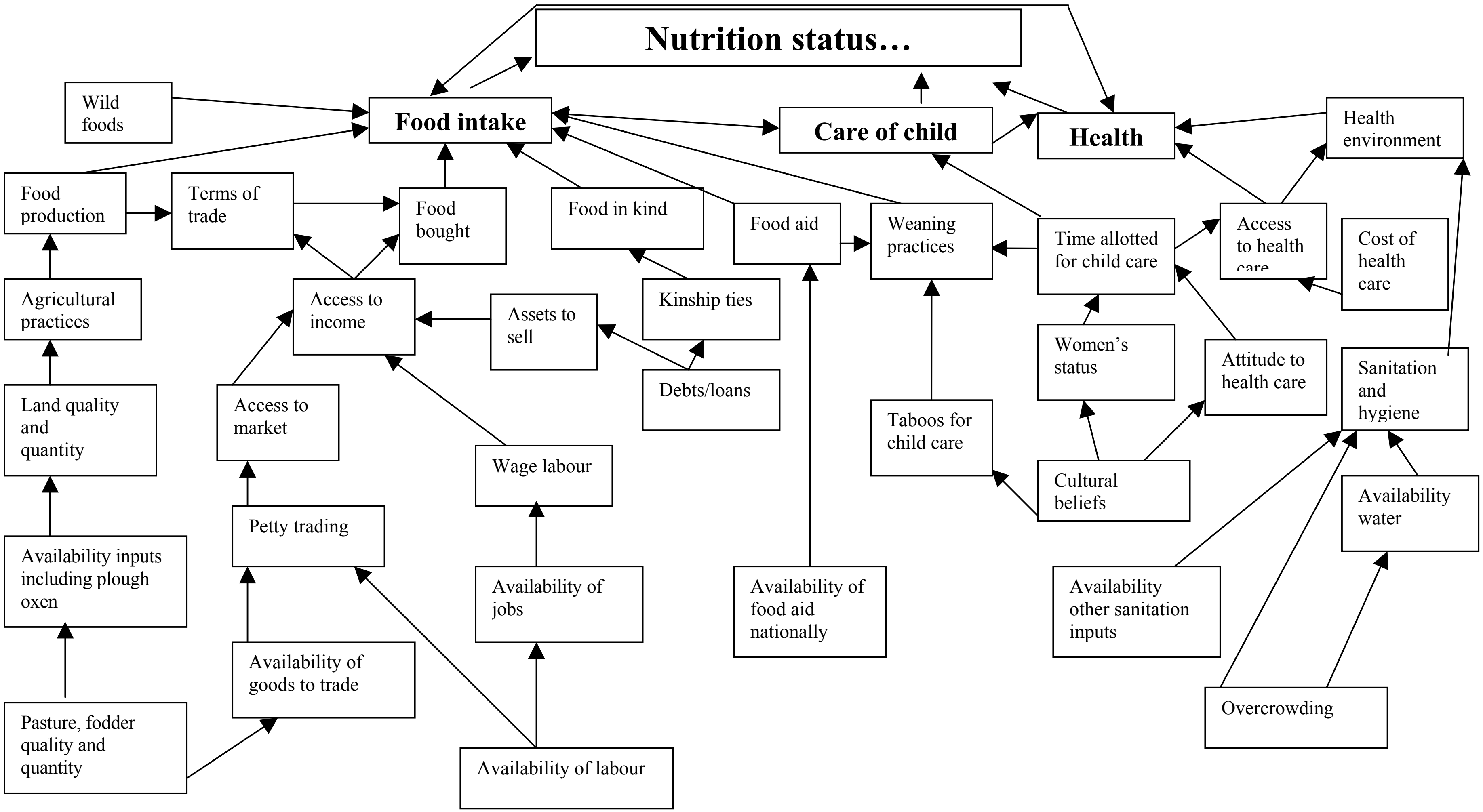
Before starting a nutrition assessment it is useful to consider what the potential causes of malnutrition in the survey area are. A flowchart of the local causes of malnutrition can be designed. This will help you devise appropriate questionnaires for your survey and, eventually, plan an appropriate response.

Example 1.1 The causal pathway for malnutrition in a highland agricultural area

Figure 1.5 shows the factors that commonly affect the nutrition status of a child in highland agricultural areas. Several basic causes are listed in the box at the bottom of the figure. These will affect more than one of the underlying causes of malnutrition

For example, the size of a household will affect the availability of labour for both farm and off-farm work. Household size will also affect how a mother can care for her children — if she has a large family it may not be necessary for her to collect water, so instead she could spend time caring for her youngest children. On the other hand, an over-crowded household may have a poorer health environment than less crowded households. A population's level of education influences all of the underlying causes of malnutrition. For example, education may affect agricultural practices, people's ability to get off-farm work and women's status and caring practices, as well as attitudes to health care and sanitation. Similarly, climate, infrastructure and overall levels of poverty also affect all of the underlying causes of malnutrition in highland areas.

Figure 1.5 Causal pathway for malnutrition in a highland agricultural area (for example, Wollo or Wag Hamra)



Basic causes affecting food intake, child care and health
Poverty (asset base), climate (rainfall, etc), size of household, maternal education, infrastructure

1.4 Food insecurity and famine

In Ethiopia, as in many African countries, food insecurity and famine[4] are not new phenomena. The earliest recorded famine in Ethiopia was in 242 BC. More recent famines have occurred in the 1970s, 1980s and 1990s. The country suffers from a structural food deficit most years. Drought has often been the trigger causing famine, although in parts of the country, war and conflict have played a major role. Understanding food insecurity in Ethiopia is a relatively complex task: there are different types of food insecurity, and more than one type is often present at the same time.

The section below outlines some of the different types of food insecurity found in Ethiopia. More detailed information on this subject can be found in Webb et al (1992) and DPPC (2000a-g).

1.4.1 Different types of food insecurity in Ethiopia

Two types of food insecurity are commonly distinguished in Ethiopia:

- **Chronic food insecurity:** this is when a household is continually unable to meet the food needs of its members. The children who live in a household that is chronically food insecure are more likely to be malnourished than children who live in a food secure household.
- **Transitory food insecurity:** this occurs when a household faces a temporary problem in meeting the food needs of its members. Transitory food insecurity is short-term. It focuses on intra- and inter- variations in household food access.

Transitory food insecurity can be further divided into two types:

- **Temporary food insecurity:** this type of food insecurity is for a limited time and is due to unforeseen and unpredictable circumstances. For example, a drought can cause a decrease in food production and hence temporary food insecurity. An economic crisis resulting in price increases and inflation, which leads to a decrease of purchasing power, can affect the food security of both rural and urban populations.
- **Cyclical (seasonal) food insecurity:** this type of food insecurity occurs in a regular pattern and is determined by seasonal factors. In many parts of Ethiopia, people experience a seasonal period of food shortage — "the hunger gap". For agriculturalists, this is usually before the harvest season when the previous harvests grain stores are nearly finished and market prices are high. For pastoral populations, the hunger gap is often at the end of the dry season when grazing areas are scarce or when livestock disease outbreaks occur. Significant weight loss can be seen during the hunger gap, resulting in increased prevalence of acute malnutrition. Although this period of food scarcity can be negative for health and income, the situation is temporary and the majority of the households are able to return to normal as the situation improves.

Malnutrition can occur when any of the different types of food insecurity are present. This manual is concerned with emergency nutrition assessments, which in general assess acute malnutrition. Acute malnutrition is more usually associated with transitory or acute food insecurity than with chronic food insecurity. Most of the users of this manual will probably undertake nutrition surveys

[4] In these guidelines, famine is defined as extreme, geographically concentrated food-consumption shortfalls that result in loss of body weight and a rise in mortality. The key symptoms of famine include sharp shortfalls in food consumption (even when starting from low levels in absolute terms), increased reliance on foraged foods that are unusual to the diet, irretrievable disposal of productive assets, community dislocation (increased distress migration and out-migration of entire families), and a jump in excess mortality above "normal" rates due to undernutrition (Webb et al, 1992).

when there is temporary food insecurity in an area. Often this temporary food insecurity will be found in chronically food insecure areas. This may complicate the analysis of the situation — does a seasonal, and expected, decrease in food security warrant an “emergency” response?

In order to know how to intervene when a nutrition problem has been identified in an area, it is necessary to know what is normal in terms of food security for a certain area in a given season. Thus, when undertaking a nutritional survey, it is important to take into account the usual and seasonal fluctuations of food security in the survey area. (This issue is discussed more thoroughly in Chapter 8).

1.4.2 The development of famine from food insecurity

Famines do not develop overnight in Ethiopia. In general, households facing regular episodes of food insecurity have developed complex coping mechanisms for dealing with these events. Although coping strategies vary with local conditions, there is a common pattern in the sequence of responses. As the severity of food insecurity increases, the household responses becomes progressively more threatening to their livelihoods. Eventually, when a household’s coping mechanisms have run out, food consumption shortfalls result in loss of body weight and a rise in mortality[5]. At the population level this is known as famine.

It is important to understand the development of food insecurity into famine when undertaking a nutrition assessment, as this can inform the decisions about which interventions should be used and when. Interventions at the final stage — famine — will be very different from interventions at earlier stages of food insecurity.

The development of famine from food insecurity can be described through three stages of food insecurity, which are summarised in Figure 1.6.

[5] In some situations food consumption and body weight may decrease before all coping mechanisms run out. Indeed, reducing food intake is a common coping mechanism in itself (see below).

Figure 1.6 Stages of food insecurity and coping mechanisms

Sequential use of strategies	Examples of strategies	Characteristics of strategies
Stage one ***Insurance mechanisms***	• changes in cropping and planting practices (eg, attempt meher planting with arrival of kremt rains) • sale of excess or weak livestock • livestock diversification for pastoral populations • increased mobility for pastoral populations (long distance travel to grazing areas) • changes in consumption levels (eg, reduce meal frequencies/smaller quantities eaten) • change in diet (eg, collection of wild foods) • use of inter-household transfers and loans • reduction of caring support to the community (relatives and neighbours) • increased petty commodity production • migration in search of employment • sale of unproductive assets (eg, jewellery, furniture, charcoal) • reduction of expenditures on health care and education • termination of contractual agreements for poor children/poor children sent to rich relatives) • termination of yerbee agreements (return of animals to their owners).	• risk minimising • low commitment of domestic resources • reversible (in principle) • low mortality.
Stage two ***Disposal of productive assets***	• sale of productive assets (eg, large livestock and agricultural tools) • large-scale slaughtering of productive livestock • short-term renting of farmland • increased credit from merchants or moneylenders • reduction of current consumption levels • prolonged migration (men do not return from seasonal migration) • further cuts in use of health and education services, also cuts in water and firewood use • reduction of support to the non-productive members of households • marginalisation of non-productive individuals (eg, orphans, beggars, etc) • community structures collapse; skilled and educated people (eg, health staff) migrate.	• risk absorbing • high commitment of domestic resources • less reversible • increased risk of morbidity and mortality.
Stage three ***Famine***	• long-term renting out of remaining assets (eg, house, land) • severely reduced consumption levels • distress migration of whole household.	• risk taking • irreversible • high morbidity and mortality.

The stages of food insecurity are defined by the extent to which people are able to endure reduced access to food. People adopt a range of strategies (coping mechanisms) in order to deal with the reduction of food availability and access. As the process continues towards the later stages, coping mechanisms become exhausted and the priorities of the individual and community shift towards survival. The sequence of events also depicts the increasing irreversibility of actions taken: desperate actions such as the wholesale slaughter of productive animals have very serious consequences for future production.

In terms of mortality, the model above shows that as the degree of food insecurity progresses to famine, mortality rates increase (along with rates of malnutrition). At the other end of the model, when there is a food insecure situation and people are still able to utilise insurance strategies, the mortality risk is lower.

The three stages of the model are further elaborated below. Every situation is different and the speed of progress through these stages can vary greatly depending on the nature (or origin) of the crisis, its context, the range of coping strategies available and adopted and the aid which is delivered.

Stage one: insurance mechanisms

During this first stage, the responses developed by the population are reversible and, in principle, should not harm their future productive capacity. People plan in advance to minimise the effects of food shortages and the risks of production and to preserve their productive assets. The first priorities are normally to preserve resources and current livelihoods.

Naturally the strategies that people undertake depend on what options are available to them in "normal" times and how much these can be expanded during the hunger gap. Available options will depend on their livelihood systems. People in different socio-economic groups, who are dependent on the same livelihood system, will respond differently in times of stress.

Insurance strategies are generally characterised by diversification of activities, longer working hours and a focus on increasing income and limiting expenditure. In many cases these responses result in the reduction of the household's caring capacity for non-productive members. For example, when men migrate to the city for temporary work, women become the household heads and they may have more agricultural work to do and less time to care for children. In some areas (such as Borena) older people may decrease their food intake during times of food shortage, thus increasing their risk of illness.

Not all insurance strategies are used only on a temporary basis. Some populations in Ethiopia have had to change their livelihood systems permanently in order to have sufficient insurance against food insecurity. Examples of this include pastoralist groups in certain parts of Somali Region who are moving to agro-pastoralism as rain patterns change and pastoralism becomes more difficult to depend upon.

Stage two: disposal of productive assets

During this stage, the situation is unexpected or unusually severe. A food crisis has developed. The insurance strategies developed by households are over-stretched and gradually they are forced to use strategies that reduce their productive assets and threaten their future livelihoods.

The features of a food crisis differ according to the situation:

- **In times of peace:** Prolonged or repeated droughts, flooding, outbreaks of disease among large livestock, economic crisis, chronic political instability, etc will gradually force the population to use strategies that threaten their future livelihoods. The community's normal insurance coping mechanisms become over-stretched, and inadequate for responding to the severity of the crisis. These kinds of crises are known as slow-onset crises.

- **In times of conflict and war:** Populations face a sudden reduction in food availability due to the destruction or looting of crops and livestock, the collapse of markets (causing shortages of essential items) and the large reduction of waged income. People can be forced to leave their homes, losing everything. These types of crises are known as fast-onset crises. In general, fast-onset crises are associated with social breakdown and deterioration of the health environment. A food crisis linked to a conflict situation is usually more severe than a food crisis occurring in a stable context, partly because of the population movements involved. During war and conflict, aid is often difficult to transport and distribute to those in need and can be diverted by armed groups or political powers.

At this stage, households or individuals are obliged to develop new strategies to meet their food needs. As all surpluses are sold and all possibilities for increasing resources by diversifying activities are exhausted, people have to sell the goods that are essential for their future livelihoods. As a result the population's future potential for recovery and rehabilitation decreases rapidly.

In a food crisis, the prevalence of acute malnutrition and mortality rates are usually elevated. The community's health environment often deteriorates at this stage if, for example, people have less money to visit health centres. This increases the risk of infection and in turn, an increased risk of mortality is seen in even moderately malnourished individuals.

Stage three: famine

The final stage in coping, which may become inescapable if famine conditions persist in the absence of external aid, involves the disengagement of all normal livelihood systems. At this stage people focus purely on survival. The diet of most households is dominated by unusual "famine foods" (roots, leaves and rodents) and they are obliged to sell or rent out their remaining assets, including homes, fields and clothes. If they are still able to do so, many households leave their villages in search of assistance from distant relatives or at a relief camp.

In this final stage, families are completely destitute and people have reduced their consumption levels so far that they are losing significant amounts of weight. As a result they become very ill and start to die. Famine is characterised by excess mortality and high malnutrition in all age groups of the population. If people move to camps then they lose their autonomy and become dependent on food aid for their immediate survival. Mortality rates are often extremely high at such camps because of over-crowding and poor health environments.

The combined effects of insufficient food intake and poor health environment are important factors leading to famine and death among severely and also among moderately malnourished people.[6] In fact, the majority of deaths (in terms of absolute numbers) occurs amongst individuals who are moderately malnourished. One of the main underlying causes of famine mortality is deterioration in the health environment. In addition to adequate provision of food, access to curative health care, environmental sanitation and shelter can avert many deaths.

In many cases famine is linked to war and consequent population movements. However, famine situations can also be a sign of inadequate relief assistance during the food crisis stage. Populations are often wholly dependent on the Government by the famine stage. Relief assistance may have been too little or too late earlier on. Alternatively the relief was not well targeted, organised or co-ordinated, or was diverted by armed groups. These factors may, in turn, be linked

[6] Definitions of severe and moderate malnutrition are provided in Chapter 3. Severe malnutrition is simply a more extreme form of malnutrition than moderate malnutrition.

to serious resource constraints or other factors, such as high insecurity or political unwillingness to address the problem (at international, national or local level).

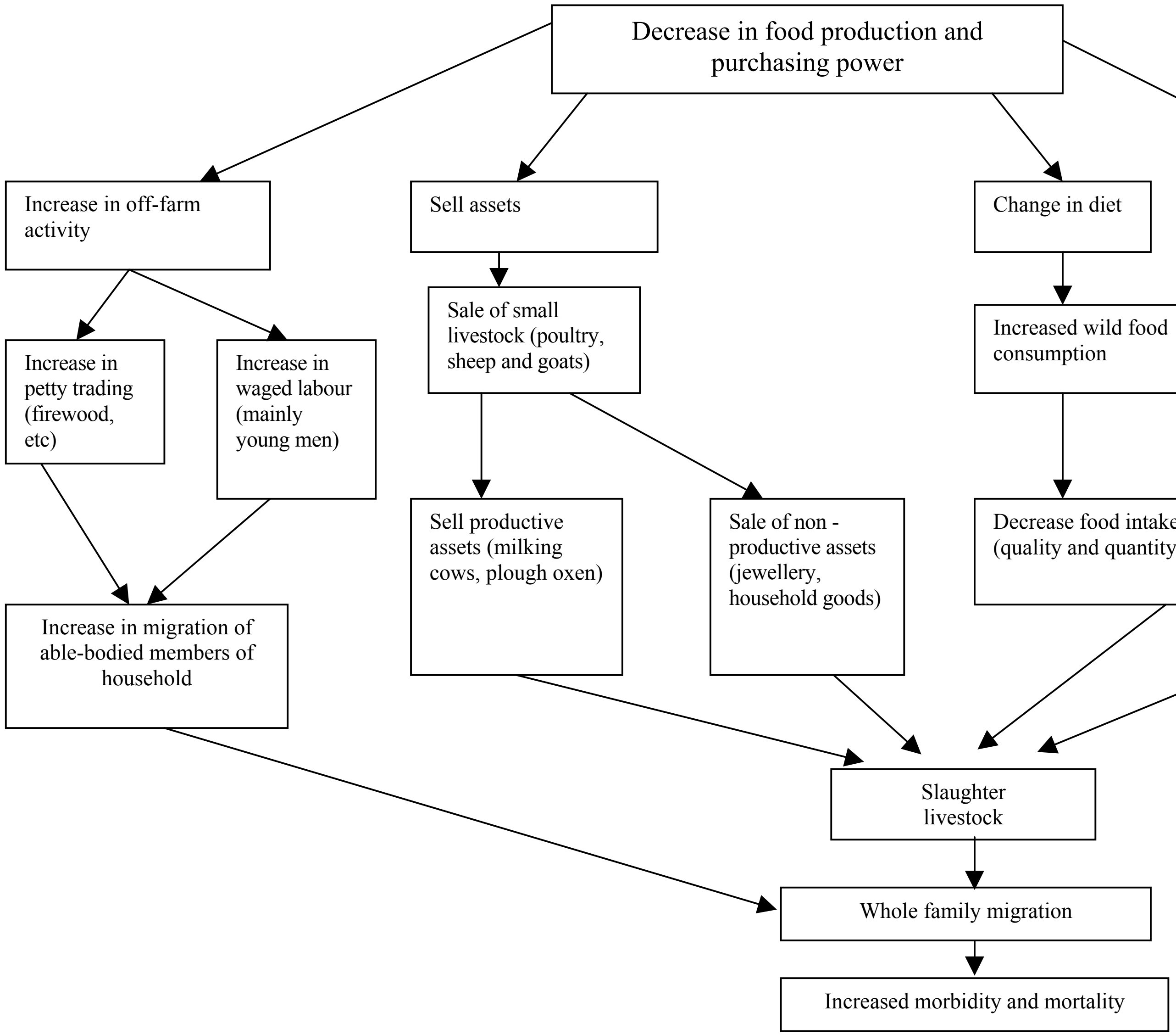
1.4.3 Ethiopian examples of the development of food insecurity and famine

The coping mechanisms employed during the development of famine from food insecurity will vary according to agro-ecological zone and the shock that caused the food insecurity.

Example 1.2
Figure 1.7 is a flowchart showing the coping mechanisms employed during the development of famine in a highland agricultural area such as South Wollo. This flow chart describes what happens if no relief is provided to the area.

Other descriptions of famine development in Ethiopia can be found in various reference texts (Sen, 1997; Webb et al, 1992).

Figure 1.7 Coping mechanisms employed during the development of food insecurity to famine in a highland agricultural area (for example, Wollo)



Summary of main points in Chapter 1

- In order for nutrition interventions to be effective, the causes of malnutrition must be understood.
- The UNICEF framework should be used to assess the causes of malnutrition when undertaking an emergency nutrition assessment in Ethiopia:
    - The immediate causes of malnutrition are inadequate food intake and disease.
    - The underlying causes of malnutrition are inadequate household food security and care of women and children and a poor health environment.
    - The basic causes of malnutrition are socio-economic, including the political and economic structure of a country or region.
- It is useful to construct a local causes of malnutrition flowchart before undertaking a nutrition assessment. This will help you design a relevant questionnaire, and eventually, plan an appropriate response.
- Several stages can be defined in the process leading from food insecurity to famine. These stages are important indicators of what response will be appropriate for a nutritional emergency.

Chapter 2

The use of nutrition data in Ethiopia

The objective of this chapter is to explain how nutrition data will be used by the DPPC as part of its strategy to prevent food insecurity and famine. The first part of the chapter describes Ethiopia's current early warning systems. This is followed by a description of how nutrition data can realistically be used by the DPPC. The final part of the chapter assesses possible ways to integrate nutrition assessments into the current early warning systems.

2.1 The early warning system in Ethiopia

Although the history of famine in Ethiopia is ancient, the use of early warning (EW) systems to predict or prevent wide-scale disasters is a relatively new concept. The Relief and Rehabilitation Commission (RRC) was formed in 1974 in response to the famine in the early 1970s, and in 1976 an EW system was established. However, Ethiopia suffered another major famine in 1984/85. Since the 1980s a great deal of support has been devoted to developing EW systems. These efforts continue and have resulted in the creation and development of EW systems at global, national, regional, and sub-national levels.

2.1.1 EW information collected by the Government

According to the National Policy on Disaster Prevention and Management strategy (DPPC, 1993), the objectives of the EW system are to provide assessments of food prospects within the country and to detect (as early as possible) the likelihood of deterioration in food security or, in worse case scenarios, impending disaster. The EW system should be able to determine the magnitude of the problem and likely impacts upon the population. The EW system should also formulate contingency plans and develop trigger mechanisms to identify when to address these problems before they reach unmanageable levels.

The EW system's parameters are wide. It includes various types of data collection and analysis such as: estimates of crop production, crop conditions, pasture conditions, prices and supplies of agricultural and non-agricultural commodities, livestock conditions, rainfall data and pest and disease data. Information on human health, water supplies, income and food sources and unusual behaviour patterns is also collected. An inventory of food grain stocks within the country is kept.

Through the analysis of the monitoring data, the system is responsible for producing the following reports:

- monthly reports about crop activities, livestock condition, epidemic outbreaks, nutritional status of vulnerable groups, impact of precipitation on crops and livestock and grain price trends
- quarterly reports on crop prospects, livestock condition, epidemic outbreaks, nutrition status, market situation, magnitude of food shortages and measures taken for mitigation
- seasonal reports providing final pictures regarding food situations and prospects (including the multi-agency meher pre-harvest assessment)
- disaster area assessment reports when necessary.

It is not possible to give a more detailed description of the Government's entire EW system here. Instead, the reader is referred to DPPC (1993, 2000a-h) and Chapman and Desta (1998).

2.1.2 EW information collected by non-governmental agencies

Contributions to EW efforts are not limited to government agencies, but also include efforts made by non-governmental agencies, which can be sub-divided into UN agencies, international NGOs and local NGOs. These organisations influence the decision-making process mainly through advocacy. The contribution of, and reliance placed on, information generated by the non-governmental agencies varies widely. Some agencies play a prominent or influential role in EW, while others are simply adding to the generation of information on an ad-hoc basis.

It is not possible to describe all the activities undertaken by non-governmental agencies in this report (again the reader is referred to Chapman and Desta, 1998). However, it is useful to note that the UN Emergencies Unit for Ethiopia (UNEUE) and World Food Programme (WFP) are particularly active in collecting and collating EW information. UNICEF also collects and analyses EW and nutritional surveillance data, particularly in Somali Region, Afar and Tigray.

USAID's Famine Early Warning System (FEWS) and the EU's local food security unit are also very active. These agencies contribute to the seasonal crop assessment missions as well as releasing their own monthly reports on the food security situation.

Various NGOs also contribute to early warning through data collection in their areas of operation. Though important, the information from NGOs tends to be localised. It is often difficult to compare reports originating in different areas due to differences in methodology, etc. There are just a few NGOs which have EW programmes, including Save the Children UK (SC UK) and Save the Children US (SC US) , World Vision International (WVI) and CARE. Action against Hunger (AAH or ACF), Concern and Medicines Sans Frontiers Belgium and Switzerland (MSF-B and MSF-CH) contribute nutritional monitoring reports when deemed necessary. Other NGOs may collect specific data in certain geographical areas. NGOs often participate in the seasonal joint assessments. Additionally, they are often the first to produce reports in their areas of operation when there is a deterioration in the food security situation. In more recent years, a number of local NGOs have also been formed and are involved in monitoring activities.

2.1.3 Additional generation of EW information

There are several forums for sharing EW information in Ethiopia, including the Early Warning Working Group, the Food Security and Agricultural Committee and the DPPC Nutrition Meetings. Some forums concentrate on geographical areas, for example the Region 5 Working Group, and others on livelihood systems, for example the Pastoral Working Group.

There are a number of research projects and research institutions that contribute valuable information to the EW system, for example the Strengthening Emergency Response Abilities (SERA) project. There is also work done by the International Livestock Research Institute (ILRI), the Inter-Governmental Authority on Drought and Development (IGADD) and the Institute of Development Research (IDR).

2.1.4 What is the current role of nutrition data in Ethiopia's EW system?

Nutrition data[7] is currently collected by the DPPC[8] in emergency situations. The Federal DPPC undertakes nutrition surveys in problem areas as part of emergency assessments. This data is used to confirm a problem and advocate for a response.

The DPPC/DPPB does not, however, systematically collect nutrition data as part of the EW system. Several questions on malnutrition and mortality are included in the monthly woreda EW formats. However, given that no measurements of nutrition status are made, and that the information is subjective, this data is not regarded as objective nutrition data.

This does not mean that the DPPC/DPPB never uses nutrition data for EW purposes. In some areas other Government[9] or UN agencies, or NGOs collect nutrition data and the DPPC may use this as background or supporting information. For example, World Vision and Concern collect nutrition data on an on-going basis in their operational areas. This is shared with the DPPC for EW purposes.

The Ethiopian Nutrition Co-ordination Unit (ENCU), which is housed in the DPPC, collects and collates reports and results from nutrition surveys undertaken all over the country by different agencies. The results are entered into a database, which can be used by any agency with an interest in nutrition.

Nutrition data is also sometimes used as background information during the DPPC's annual multi-agency pre-harvest assessment. The data is generally used to triangulate other evidence, or assess relative severity. Hence, although nutrition data alone is not routinely used to predict annual food aid needs, the data may be used in conjunction with other information.

2.2 What is the potential role of nutrition data in Ethiopia's EW system?

The EW system in Ethiopia aims to target assistance in a timely and systematic manner, and to identify priority areas when required. Nutrition data clearly has a valuable role to play in such a system.

Table 2.1 outlines, very broadly, the type of nutrition information that the DPPC's planners need in order to forestall the development of famine, and the requirements for using the data properly. The table divides the EW system into four stages (A-D) for convenience. These stages are not recognised by the DPPC as official stages in the EW system, but are used here to simplify the explanation. Furthermore, the stages described cannot be viewed completely separately; overlap exists between all the stages.

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[7] In its broadest sense, nutrition data can mean surveillance or continual monitoring of the many factors that affect or reflect nutritional status, such as rainfall, food production, food prices, food intake and anthropometric data. In its narrowest sense, nutrition data consists only of anthropometric data. For the purposes of this manual, nutrition data is considered as the systematic monitoring of anthropometric or nutrition status data, on the assumption that it is interpreted in the context of other socio-economic, health and food production data.

[8] Currently, most of the responsibility for nutrition assessments lies with the Federal DPPC. However, in the future, as decentralisation continues, the Regional DPPB will have more responsibility for EW and nutrition data. Eventually, all responsibility for nutrition assessments will lie with the Regions, although funding decisions will still be made at the Federal level. Given this situation, this document will refer to both the DPPC and the DPPB.

[9] In some regions the MoH collects nutrition status data through surveys. In particular, the MoH in Tigray and Region 5 are currently actively involved in undertaking nutrition surveys. It should be noted that the objectives of MoH surveys vary and they may not always be useful for EW purposes.

The discussion below will focus on three areas

- why this type of information may, or may not, be useful in the Ethiopian context
- how to obtain and use this information
- why the DPPC/DPPB has, or has not, chosen to collect and use the information.

Table 2.1 How the DPPC can use nutrition data in the future

Stage of EW system	What planners need to know	Type of nutrition data needed	Who will collect the nutrition data	DPPC's needs/requirements
A **Predict potential food insecurity and food aid needs**	• food availability, food aid needs in different parts of the country • vulnerable population groups: who, where, how many?	• historical data from previous surveys set in context	• DPPC • NGOs • other agencies	• functioning nutrition database at the ENCU accessible to all people involved in EW • strong relationship between ENCU and other EW actors in DPPC • strong relationship between ENCU and other agencies involved in nutrition surveys
B **Monitor deteriorating food security**	• is earlier prediction of food insecurity realistic?	• change in nutritional status of population from "normal"	• NGOs • other agencies	• functioning nutrition database at the ENCU • other agencies must pass their data to ENCU database
C **Confirm an emergency or advocate for a response**	• has a bad food security/health situation passed undetected? • is the situation out of control?	• emergency nutrition assessments (of vulnerable population in order to compare it with a "normal" situation for given season)	• DPPC • NGOs • other agencies	• DPPC must have physical and technical expertise to undertake nutrition surveys in assessments • functioning nutrition database required to provide baseline data or benchmarks against which to measure scale of emergency • other agencies must give their results to the ENCU
D **Assess impact of intervention**	• is enough being done to stop future deterioration? • has the situation stabilised?	• before and after surveys around an intervention	• NGOs • other agencies	• functioning nutrition database at the ENCU • other agencies must give their results to the ENCU

2.3 Stage A: the use of nutrition data to predict food insecurity and food aid needs

Planners can use nutrition data to profile which populations are potentially the most food insecure after a certain shock. This is useful when we need to predict which parts of the country may face food insecurity and malnutrition after a certain event. Historical information about rates of malnutrition in various areas of the country after droughts, pest infestation, or other shocks, provide planners with an indication of what has happened before, and give an indication of what might happen again.

Example 2.1
SC UK has nutrition and food security survey data which show that if the sape rains fail between October and December in Wolayita, there will be a decline in the nutrition status of highland populations the following year, unless relief is provided. This is because the sape rains are required for the sweet potato crop, and sweet potato is an important part of the household diet between April and June in these areas (SC UK, 1999; 2000).

This kind of historical information can be useful to planners because if they know that the sape rains have failed in Wolayita, they can predict that there will be food shortages in the area. Using the historical nutrition information they can see how many people were affected and how badly they were affected. Together with up-to-date population figures, they can use this information to help predict future needs.

Historical data can be used to identify areas that have poor nutrition status on a regular basis, that is, areas where the population is chronically malnourished, as well as areas prone to sudden drops in nutrition status during bouts of food insecurity of a transitory or cyclical nature.[10] Maps or profiles of vulnerability to malnutrition are therefore a useful part of an EW system.

One note of caution should be made to people who are planning to use historical nutrition data to help them predict future needs: do not use the nutrition data alone. Other information is also required to back up the prediction. It is especially important to assess when the nutritional crisis occurred and whether or not relief has been given.

Example 2.2
You are part of the team working on the DPPC's multi-agency assessment mission in November in a woreda in Wag Hamra and you find a survey which reported a high level of malnutrition in June. You would know that the population in the woreda had experienced nutritional problems before. However, before recommending that large amounts of food are required in this area you should find out why and when the problem started, whether or not relief had gone into the area since the survey and whether or not there had been an improvement in the situation since June (for example, a harvest).

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[10] Like food insecurity (see Chapter 1), malnutrition can either be chronic (long-term) or acute (short-term) or both. These distinctions are described more fully in Chapter 3.

2.3.1 What does the DPPC/DPPB need in order to use historical nutrition data?

In order to use historical nutrition data to predict food insecurity and food aid needs, the DPPC needs:

(a) a functioning, up-to-date database containing the following information:

- historical nutrition survey data (estimates of prevalence of malnutrition, numbers of people affected, location of people affected)
- data on the cause of malnutrition for each survey (ie, food security or health, and if food security then what type of shock — drought/pest infestation, etc)

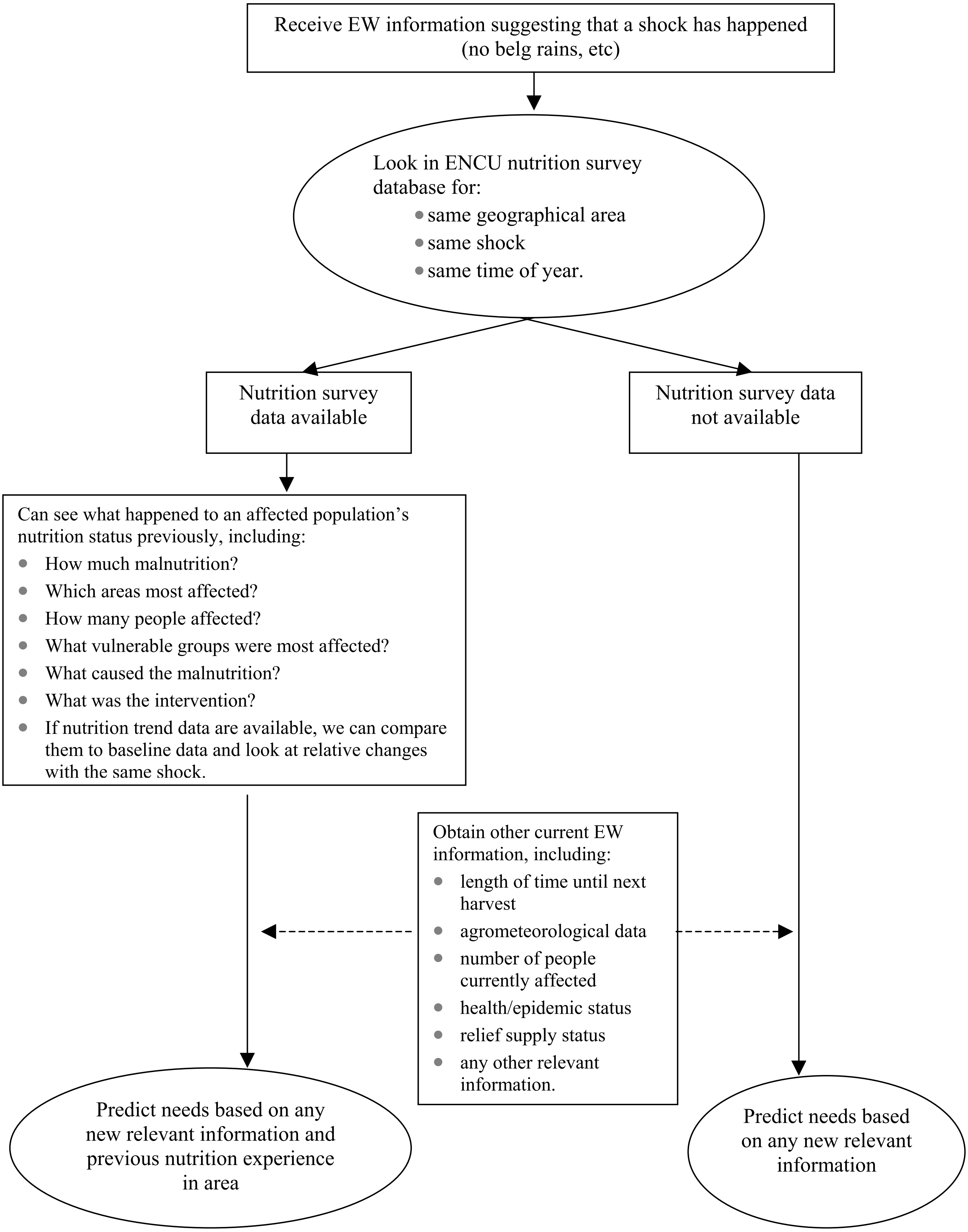
(b) a method for translating nutrition survey data into food aid needs. This is already available in the RRC nutritional guidelines for food relief rations (RRC, 1989).[11]

The historical data alone will obviously not be sufficient to predict food needs, but in conjunction with other more up-to-date information on population size, relief supplies, length of time to next harvest, etc, the historical data can be very useful to planners. Figure 2.1 provides an outline of how the DPPC's planners might use historical nutrition data.

In order for the DPPC's nutrition survey database to function, all agencies working in nutrition in Ethiopia must (a) undertake nutritional surveys with comparable methodologies, and (b) give their survey reports to the ENCU.

[11] The DPPC plans to revise these guidelines in the near future.

Figure 2.1 How EW relief planners can use historical nutrition data



2.4 Stage B: the use of nutrition data to monitor deteriorating food security

The use of nutrition indicators in a surveillance system is still being debated. This debate is important for the DPPC/DPPB as it influences the decision about whether nutrition status data collection should be incorporated into the EW system on a regular basis, or only on an "as-needed" basis. Current thinking on this idea is described in some detail below.

A combination of conceptual concerns and practical experience has led a number of health and nutrition professionals to argue that it is not possible to use nutrition status data operationally to monitor deteriorating food security. The argument against using nutrition status data for this purpose is based on six main points:

1. Nutrition status is viewed as a late indicator and once nutrition status has deteriorated, a food crisis is almost certainly well underway. This is largely based on the belief that families will resort to reducing food intake only when threatened with destitution, and will sell assets at much earlier stages of the crisis.
2. A variety of factors can contribute to a decline in nutrition status, in addition to a food scarcity problem. Two significant factors are an increased prevalence of disease and increased labour demands. Therefore, a deterioration in the nutrition status of a population does not necessarily mean a food shortage problem (Shoham et al, 2001). For example, an outbreak of measles could explain a sudden deterioration in nutrition status (see Chapter 1).
3. The relationship between mortality and malnutrition is not a clear one and shows different associations in different contexts. Therefore, it is not necessarily correct to estimate needs on the basis of nutrition status data alone (Lawrence et al, 1994). Nutrition status data may fail to show a decline in situations where high mortality rates and/or high migration rates occur (see Chapter 8).
4. Nutrition surveillance systems are expensive to implement and require a certain level of expertise for implementation and interpretation.
5. Some communities may refuse to take part in nutrition surveillance programmes, particularly if they do not perceive any benefits from the programme.[12]
6. In some communities, children are protected from reducing food intake while other population groups may be more greatly affected (for example, older people in Borena Zone). Therefore, the nutrition status of demographic groups other than young children (such as older people), may be a more sensitive indicator of the change in the nutrition situation.

These arguments suggest that nutrition surveillance data may not necessarily be a suitable early warning indicator of a "food shortage problem", other than acting as an "alarm bell" when it is used as one indicator among many.

On the other hand, the main argument for using anthropometric status data is based on the opinion that a change in nutrition status can serve as a proxy indicator of access to food. In turn, access to food reflects the likelihood of famine as well as current levels of stress and, consequently, can be used as an early warning indicator (Kelly, 1992). The arguments that support this view are summarised below:

[12] An NGO working in Korahi Zone in Somali Region was forced to give up its surveillance system as the population refused to allow their children to be measured. The community was used to being measured for a survey and then receiving food, but in this case the surveys were for monitoring and surveillance purposes only and so no food was distributed.

1. It is well recognised that many communities deal with an annual hungry season by reducing the size and frequency of their meals. Therefore, it is likely that reducing food intake is also a characteristic coping-strategy during periods of extreme food scarcity (see Chapter 1).
2. While there are differences in associations between mortality and under-nutrition in different areas, the knowledge that low anthropometric status carries some increased risk of mortality regardless, would suggest that nutrition status data can be used as an early warning and targeting criterion, albeit between communities of similar environments.
3. The conceptual difficulties constrain the interpretation and effectiveness of all types of data used as proxies for consumption or access, such as agro-meteorological or socio-economic data. For example, many factors such as taxes, transport, export demand and government intervention affect grain prices and, therefore, changes in grain prices may not necessarily reflect problems of food scarcity. Thus nutrition data are not alone in causing difficulties with interpretation.

These arguments suggest that if nutrition status data is collected on a representative sample, and where the data is collected in the context of other information, such as information on mortality and coping mechanisms (including migration rates), then nutrition data is likely to be a useful indicator for EW.

These two main lines of argument are important for defining the potential role that anthropometric data may have in the DPPC/DPPB's EW system. In fact, the agency views nutrition status data as a relatively late indicator of a food security "problem" in comparison with other socio-economic and agricultural data. Thus the agency's main use of nutrition status data is for verifying a nutrition-related problem (which they already know exists) and for advocating to the international community for an emergency response.

2.4.1 Can the DPPC/DPPB routinely collect nutrition status data to monitor deteriorating food security in Ethiopia?

In order to decide whether anthropometric surveillance is worth the time and money, it is necessary to consider what benefit is obtained from it. If the use of the information can improve the cost-effectiveness of relief operations, then the efforts and expense are worthwhile.

Routine collection by the DPPC/DPPB of objective nutrition data to monitor deteriorating food security is not practical. This decision is based on past experience of a number of different methods (see Annex 1 for a full discussion of this point). Growth monitoring programmes, longitudinal anthropometric data systems, community-based sentinel site systems and repeated cross-sectional surveys have all been tested in Ethiopia, but none is currently practical for the DPPC to undertake.

Instead, it may be more appropriate for the DPPC/DPPB to undertake rapid nutrition assessments on an "as-needed" basis in an emergency situation. This thinking represents a change since the previous guidelines, when it was advocated that nutrition data should be collected on a regular basis in order to monitor any deterioration in the food security situation (DPPC, 1995).

It is important to note that this does not mean that the DPPC/DPPB will not use other agencies' nutrition data to assist in monitoring food security in some areas. This information is useful to the DPPC/DPPB and will continue to be so. However, the DPPC/DPPB itself will not collect nutrition data on a regular basis.

2.5 Stage C: use of nutrition information to confirm an emergency or advocate for a response

No set of information is completely fool-proof and food insecurity can develop without being predicted or detected. In addition, some early warnings of food insecurity pass without action being taken, if resources are not forthcoming. A safety-net system is advisable so that food insecurity can be caught in these cases, albeit late. Information for advocacy, to ensure a prompt reaction to late identification, or to negotiate with donors for assistance, needs to be objective and easily understood.

Nutrition data are ideal for this role. Nutrition status data, if collected according to international standards on a representative sample of a population and interpreted in the context of other socio-economic, health and food production data, is seen as an objective measure of need in an emergency. In times of food insecurity and famine, weight loss among children is a useful proxy indicator for the general well-being of the entire community. Malnutrition is closely linked to conditions of poverty, and weight loss in children is strongly associated with access (entitlements) to food and health care (see Chapter 1).

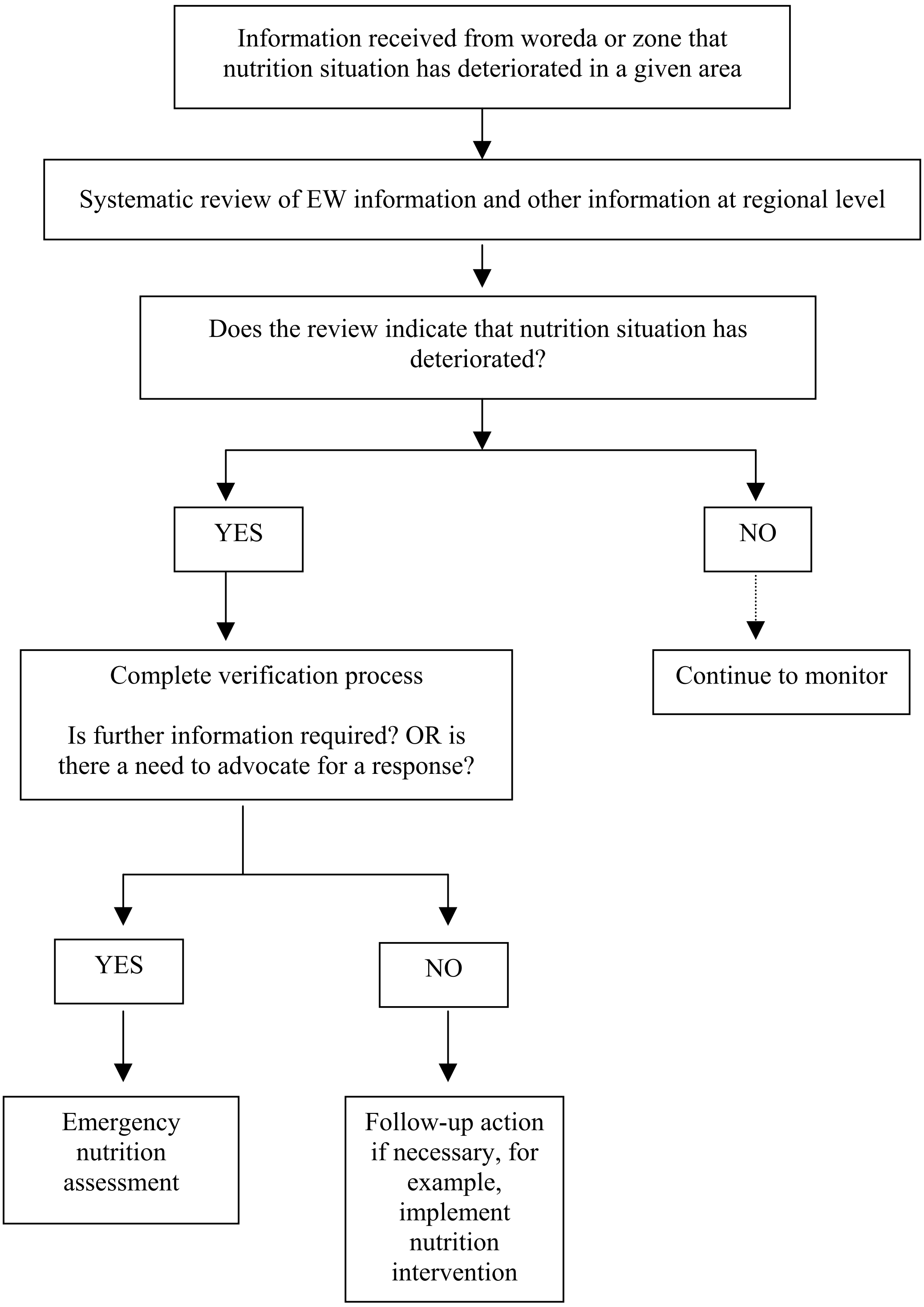
Another potential use for nutrition data in an emergency is to assist in targeting relief. The DPPC believes that nutrition information can be used to prioritise specific areas at the woreda level for relief. For example, a meher-dependent area could be prioritised over belg-dependent areas, if nutrition data showed that the population in the meher areas was more severely affected by a drought than belg areas.

2.5.1 The decision to undertake an emergency nutrition assessment – the trigger mechanism

Figure 2.2 outlines how the DPPC/DPPB plans to make decisions about when to undertake an emergency nutrition assessment. In the future it is anticipated that the decision will be made at the regional level, after receiving information from the woreda or zone that there is a problem. The region will, however, inform the Federal DPPC about what is happening at all times: there should be constant communication between all levels of the agency.

It is recommended that the DPPB representatives participate in the completion of a causes of nutrition framework for a specific woreda, about which they are concerned, based on analysis of monthly or seasonal EW information. It is probable that, bearing in mind the expense, this process will require a brief visit to the woreda. The need for a visit to the woreda will be determined by the context and the degree of the emergency, but any visit will clearly need to be timely.

Figure 2.2 Trigger mechanism, or decision making tool to help decide when to undertake a nutrition assessment



A selection of indicators could be used to complete the verification process. The indicators will include underlying and basic causes of malnutrition, as well as some operational issues such as access and resources. The indicators will be, to some extent, context-specific, and will be based on knowledge from different existing information sources, including data from the EW system, baseline food economy studies and the SERA project. Examples of indicators could be grain prices, livestock health, rainfall, etc.

When undertaking emergency nutrition surveys it will be important to take into account the different agro-ecological, or household food economy[13] zones. This information should assist in improving the targeting of responses. This may involve some surveys being undertaken across woredas, for example, in South Wollo's highland belg food economy zone. Other surveys may focus on one particular woreda. These issues are discussed further in Chapter 4.

2.5.2 The need for baseline nutrition data

The objective of an emergency nutrition survey is to assess whether or not the population's nutrition status is abnormal, and therefore whether or not they need assistance. In order to interpret the findings of an emergency nutritional assessment, the results need to be compared either to a baseline prevalence of malnutrition,[14] or to a national or international benchmark of malnutrition.

Example 2.3
You undertake a survey in Wolayita Zone in January. You find a prevalence of 12% malnutrition. How do you know whether or not this is normal? You need to compare the results of your survey to previous surveys in the area that were undertaken at the same time of year, on the same population.

Nutrition status varies geographically as well as seasonally in many parts of Ethiopia, so ideally baseline information should be available at different times of year from different parts of the country.

The ENCU database should contain baseline nutrition survey information. However, as the DPPC will usually only undertake nutrition surveys during emergency situations, the baseline data will have to come from other agencies. Ideally, NGOs, the Ministry of Health (MoH) and other agencies will undertake some nutrition surveys in good, as well as bad years, so that the database will contain "normal" or baseline prevalences of malnutrition, as well as results from emergency situations. The use of baseline data is discussed extensively in Chapter 8.

2.6 Stage D: the use of nutrition data to assess the impact of interventions

There is broad-based agreement that nutrition data can be used, in conjunction with other indicators, to assess or monitor the impact of an intervention that has the objective of improving or stabilising rates of malnutrition. Comparable nutrition data should be collected before and after an intervention to check that the intervention is actually meeting its objective of improving the population's nutritional situation. It is clear that such monitoring must include information other

[13] A household food economy zone is a geographic area where households share similar sources for gaining food and cash income.
[14] Baseline prevalences are obtained by undertaking nutrition surveys in normal years. When an emergency assessment is undertaken the results can be compared to the baseline: this helps you make decisions about whether or not an intervention is required and also what type of intervention is required.

than nutrition data in order to (a) fine tune the intervention, (b) be sure that the intervention is acceptable to the population, and (c) help plan further interventions where necessary.

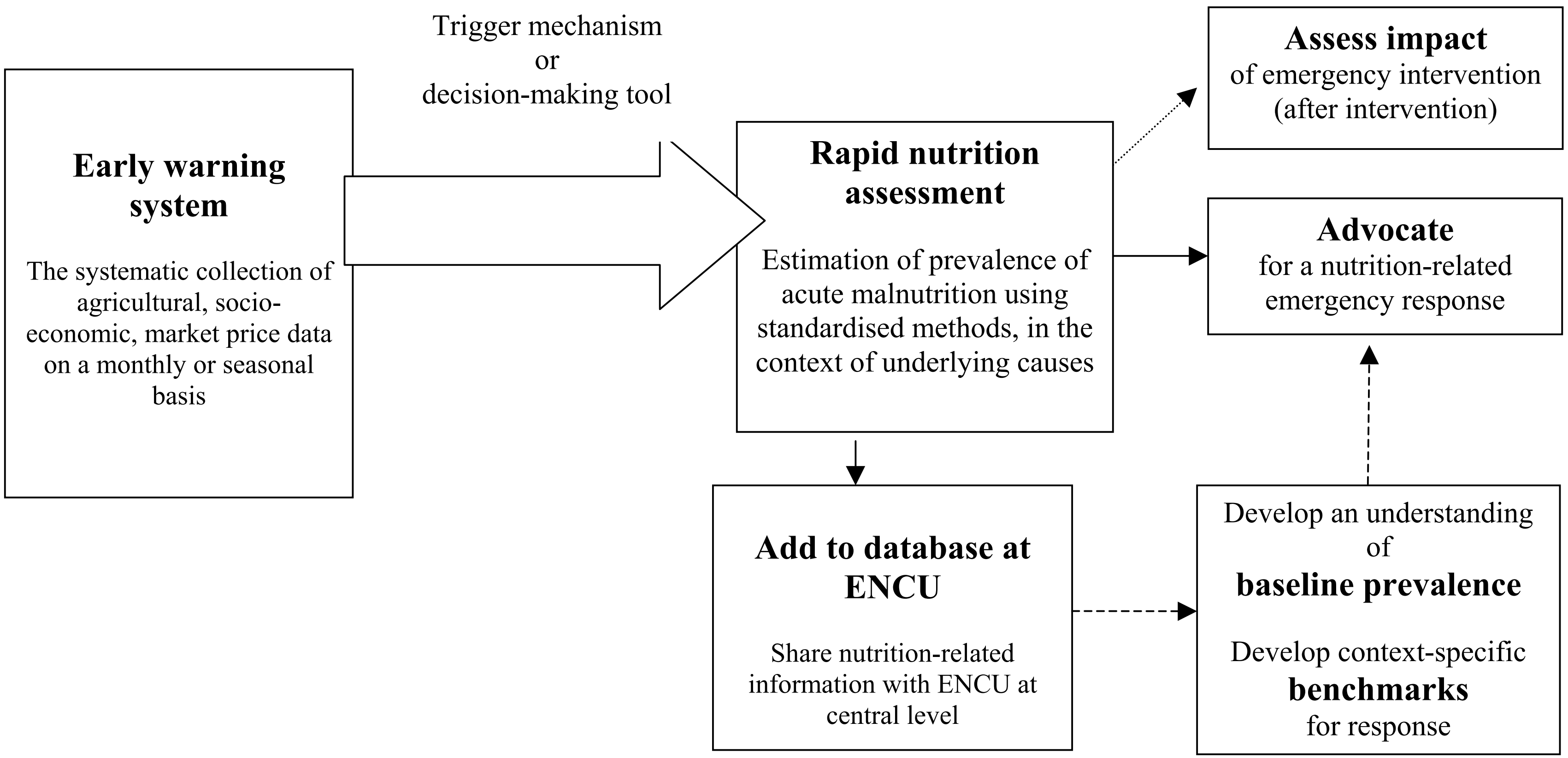
Currently, the DPPC does not collect nutrition data for these purposes. The agency does not have the capacity to do so. However, other agencies — particularly NGOs — are often required to undertake "before-and-after" surveys when they implement a nutrition intervention. Needless to say, reports of these surveys should be passed to the DPPC department of Aid Programme Co-ordination and Monitoring. In future, it would also be useful if the MoH, NGOs and other agencies pass these before-and-after survey results to the ENCU as well. This will assist the ENCU in building up the baseline prevalence data.

2.7 Integrating nutrition data into the EW system

Figure 2.3 provides a framework for integrating nutrition assessments into the DPPC's EW system.

- On going EW information is collected by the DPPC at regular intervals (both monthly at the woreda level and seasonally during the needs assessments). If information indicates that the nutrition status of a population may have deteriorated, then the decision-making tool, or trigger mechanism, is used to decide whether or not a nutrition assessment is required (this process is described above in Section 2.5.1).
- The DPPC/DPPB undertakes a nutrition assessment according to standard procedures. The assessment produces results estimating the prevalence of malnutrition in the survey area and a discussion on the causes of the malnutrition.
- A decision is made as to whether or not an emergency response is required. This will depend on many factors, including the "normal" nutrition status of the population for the area during the given season, (ie, what is the baseline prevalence of malnutrition in the area?) Other information, on issues such as the future food security prospects and resources available, is also necessary for deciding whether or not an emergency response is required (see Chapters 8 and 9).
- If an emergency response is required, the DPPC will use the survey results to advocate for resources to undertake an intervention.
- The results of any nutrition assessment undertaken by the DPPC/DPPB or NGOs and other partners must be passed to the central ENCU so that an understanding of baseline prevalences can be built up (see Section 2.3 above).
- Finally, the DPPC, or other organisations, should assess the impact of the intervention by undertaking another assessment at the end of the programme. If the intervention has been unsuccessful, it may be necessary to advocate for a different emergency response.

Figure 2.3 Framework for using data from emergency nutritional assessments



2.8 The importance of the DPPC's nutrition database

It is essential to note the importance of the ENCU's database. The database is used in all four of the EW stages described (see Table 2.1). Unless this database is properly maintained, much of the value of the nutrition surveys will be lost: the data will only be used to confirm or advocate an emergency situation.

In order for the database to function properly there are several extremely important factors that all organisations involved in nutrition in Ethiopia must agree on:

- the findings of all nutrition surveys must be comparable. Thus the method of assessment (or survey methodology) needs to be consistent and determine with some degree of statistical confidence, the true estimation of the prevalence of malnutrition
- the methods need to be timely
- the findings need to be considered in the context of wider food security and health information.

We will return to these issues in later chapters.

Summary of main points in Chapter 2

- Nutrition data has an important role to play in the prevention of large-scale famines in Ethiopia. It can be used in several different stages of the EW system.
- It is currently not practical for the DPPC/DPPB to collect nutrition data on a routine basis.
- In future, the DPPC/DPPB will undertake nutrition assessments only during emergencies: decisions about when to undertake nutrition surveys will be made by the DPPB.
- The ENCU's nutrition database is an important tool for the EW system in Ethiopia. All agencies working in the field of nutrition are encouraged to contribute their nutrition survey reports to the database.

Chapter 3

Anthropometric measurements and indices

As stated in Chapter 1, malnutrition is caused by a lack of nutrients resulting from ill health or inadequate food intake. Assessments of malnutrition using functional and metabolic tests are neither practical nor efficient in an emergency situation. Instead, anthropometric measurements (measurements of body proportions, such as weight and height) are used to give an approximation of the nutrition status of a population, or to monitor the growth and development of an individual.

At the individual level, anthropometric data is used to determine whether or not an individual is malnourished. In turn, this information may be used to decide whether or not the individual should be included in a supplementary feeding programme, or treated for severe malnutrition. The information is also used to decide when to discharge the individual from a feeding programme.

At the population level, anthropometric data is used either in a one-off survey to assess what proportion of a population is malnourished, or as a surveillance tool to follow the nutritional situation of a population. These types of information help planners to decide whether or not interventions are required at the population level (see Chapter 2).

This chapter describes the anthropometric measurements and indices that the DPPC recommends should be used in population emergency nutrition assessments. Anthropometric measurements are also used to admit and discharge individuals from supplementary and therapeutic feeding programmes/centres (SFPs/SFCs and TFPs/TFCs). Given that these guidelines focus on nutrition assessments, more attention will be given to use of anthropometric data for surveys than for SFP/TFPs. More information is available on the use of anthropometry for feeding programmes in the documents by MSF (1995) and the World Health Organisation (WHO, 2000), listed in the Bibliography.

3.1 Which age group?

This chapter will focus on how to measure acute and chronic malnutrition in children aged 6-59 months. Collectively, the anthropometric measurements of children aged 6-59 months may be used to compare different populations, or to make comparisons of the same population over time. In times of food scarcity and famine, weight loss among children of this age group is a useful proxy indicator for the general health and well being of the entire community. Malnutrition is closely linked to conditions of poverty, and weight loss among children in a community is strongly associated with access (entitlements) to food and health care (see Chapter 1).

The anthropometric indicators used to assess acute malnutrition in adolescents, adults and older people have not yet been internationally agreed and so the measurement of malnutrition in these age groups is more problematic. In addition, because children aged 6-59 months are more vulnerable than other age groups to external factors (such as food shortages and illness), the nutrition status of these children is more sensitive to change than that of adults in many (although not all) populations. Therefore, for nutrition assessments in emergencies, it is usual to measure only children aged 6-59 months.[15]

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[15] This recommendation differs from that made in the DPPC's Guidelines on Nutritional Status Data and Food Relief. The old guidelines recommended that children aged 12-60 months be included in emergency nutrition assessments (DPPC, 1995). The current recommendation for 6-59 months is based on WHO's advice (WHO, 2000).

3.2 Measuring malnutrition: nutrition indices and indicators

By comparing the body measurements of a given child with those of healthy children of the same height or age, we can classify his or her nutritional status. For example, a child below a certain weight for a specified height, or age, would be considered malnourished.

3.2.1 Nutrition indices

Nutrition indices are a combination of measurements compared to a reference. In order to determine the nutrition status of an individual, his or her weight, height and age must be recorded. The presence of bilateral oedema should also be noted. Annex 2 describes how to measure height, weight, and oedema in children aged 6-59 months. Specifications for measuring equipment are also given. Annex 2 also describes how to train workers to obtain standardised measurements.

Information on a child's weight, height, or age alone does not give sufficient information to determine whether or not the child is malnourished. For example, information that a child weighs 10 kg is useful only when the height or age is given as well. Furthermore, the combination of weight and height make sense only when compared to a normal value, derived from a reference population.

When body measurements are compared to a reference value they are called nutrition indices. Three commonly used nutrition indices are weight-for-height (WFH), weight-for-age (WFA) and height-for-age (HFA).

Weight-for-height	reflects recent weight loss or gain. It is the best indicator of wasting and so is the indicator used for determining **acute malnutrition.**
Height-for-age	reflects skeletal growth, and is the best indicator of stunting. This is the indicator used for determining **chronic malnutrition**.
Weight-for-age	is a composite index, which reflects either wasting or stunting, or a combination of both. Rapidly changing WFA can be assumed to be the result of changing WFH, while low WFA among older children is more likely to be the result of low HFA. Hence this is the indicator used for determining **underweight.**

3.2.2 Nutrition indicators

Nutrition indicators are an interpretation of nutrition indices based on cut-off points. Whereas indices are simply a figure, indicators represent an interpretation of the indices. Nutrition indicators are used for making a judgement or assessment.

Standard cut-off points are employed internationally to define malnutrition in children aged 6-59 months. The cut-off points for nutrition indicators are derived from a reference population.

A nutrition indicator is a tool to measure the clinical phenomena of malnutrition. A good indicator is one that detects, as much as possible, those at risk (sensitivity) without including too many of those not at risk (specificity). A good indicator of malnutrition should also be functionally meaningful, in other words, a useful indicator will be related to the risk of morbidity and mortality.

3.2.3 The reference population curves

In order to assess malnutrition as defined by WFH, WFA and HFA, individual measurements are compared to an international reference value for a normal American child population (NCHS/WHO/CDC reference table, WHO, 1983). These reference values were calculated from data collected by the National Centre for Health Statistics (NCHS) in the United States in 1975. WHO adopted the NCHS references in 1980.[16]

An international reference is needed to allow comparison of nutrition status of populations in different parts of the world. There is evidence that relative growth patterns (WFH) in well-fed children in a favourable environment are reasonably similar in all ethnic groups, at least up to five years of age. The variation between ethnic groups is relatively minor compared with the large world-wide variation that relates to health, nutrition and socio-economic status.

Some countries have considered developing their own growth reference curves. However, this is a very costly and time-consuming process. In addition, in developing countries the reference curves will need to be updated regularly to take into account secular trends (increases in height between generations due to improved nutrition). WHO, therefore, recommends that one single international reference should be observed.[17]

The NCHS reference population should not be considered as reflecting an "ideal" nutritional status, but should be used as a tool to compare the nutrition status from different regions, or the nutrition status of one population over time.

The NCHS references for children aged 6-59 months can be found in Annex 3.

3.3 Expression of nutrition indices and indicators

Before reading this section make sure you are familiar with the basic statistics described in Annex 4.

Anthropometric indices or indicators can be expressed in terms of percentage of the median, z-scores, or percentiles.

3.3.1 The percentage of the median and reference population

The index of weight-for-height median (WHM) compares the weight of the measured child to the median weight of children of the same height in the reference population. The calculation of a WHM for each child is based on:

a) the child's weight
b) the median weight for children of the same height in the reference population

$$\text{percent median} = \frac{\text{actual weight}}{\text{median reference weight}} \times 100$$

[16] The NCHS reference has certain disadvantages. These include the fact that the references were drawn from measurements made only on US children (no other nationalities were included) and that most of these children were bottle-fed infants. It is now recognised that growth patterns of young children are different in breast-fed and bottle-fed children.

[17] WHO is in the process of developing new reference curves from a multi-country study involving only breast-fed children from different ethnic groups

Example 3.1
In a nutritional survey, a male child of 92cm weighs 12.1kg. In Table A3.1 (Annex 3) it can be seen that the median weight for a boy of height 92cm is 13.7kg.

$$\text{percentage median} = \frac{12.1}{13.7} \times 100$$

$$= 88.3\%$$

3.3.2 The z-score and reference population

A z-score is a measure of how far a child is from the median weight of the reference distribution for children of the same height, taking into consideration the standard deviation of the reference distribution. More technically, it is the deviation of an individual value from the median of the reference distribution. The calculation of a weight-for-height z-score (WHZ) for each child is based on:

a) the child's weight
b) the median weight for children of the same height in the reference population
c) the standard deviation for the distribution of weights in the reference population for children of the same height (because the standard deviation of a distribution increases as children get older, you need to use the standard deviation for the reference distribution of children of the same height).

$$\text{z-score} = \frac{\text{actual weight} - \text{median weight}}{\text{standard deviation for reference population}}$$

Example 3.2
In a nutrition survey, a male child of 84cm weighs 9.9kg. Referring to Table A3.1 (Annex 3) the reference median weight for boys of height 84cm is 11.7kg. From Table A3.2 (Annex 3) we can also see that the standard deviation for the reference distribution for boys of height 84cm is 0.908. Using these values you can calculate a z-score for this child in the sample.

$$\text{z-score} = \frac{9.9-11.7}{0.908}$$

$$= -1.98$$

3.3.3 Percentiles

The percentile is the rank position of an individual on a given reference table. Percentiles are based on the division of the distribution into 100 equal parts. The fiftieth centile corresponds to the weight that divides the distribution into two equal parts; with fifty per cent of weights being above the fiftieth centile and fifty per cent of weights being below it. Thus the fiftieth centile corresponds to the median. In a similar way you can define the tenth centile as being the weight under which ten per cent of the children of the reference population lie.

Percentile is not calculated for an individual child, rather the individual child is classified into the centile corresponding to his weight depending on the reference curves. Weight-for-age measurements are usually employed, not weight-for-height. Reference tables of percentiles of the NCHS references can be found in standard texts (for example, WHO, 1983).

Example 3.3

An 80cm tall child weighs 9.6kg — according to the reference tables this child falls between the 5th and 10th centiles of the reference distribution. This child is therefore classified as being between the 5th and the 10th centile weight-for-age.

The use of percentiles has a serious limitation for emergency assessments. Generally, reference curves expressed as centiles do not give values below the third centile. The majority of malnourished children lies below this limit. It is not possible to differentiate between moderate and severe malnutrition using percentiles.

Thus percentiles are used primarily for the "road to health" chart in growth monitoring and are not usually used in emergency assessments.

3.3.4 Mean weight-for-height percentage

The mean weight-for-height percentage (WFH percentage) is sometimes used as a way to describe the nutrition status of a population. The mean WFH percentage is the statistical mean of the individual WFH percentage values in a group. This indicates the overall nutritional status in the group.

$$\text{mean WFH percentage} = \frac{\text{sum of WFH percentage values in the group}}{\text{total number of children in the group}}$$

This indicator provides a summary of the nutrition status values of all children in the group. It provides an average figure and may be useful to compare the nutrition status of groups of children over time or between different groups of children.

The 1995 DPPC guidelines on nutrition status data and food relief recommended using mean WFH percentage to describe the nutritional situation of populations in Ethiopia. However, this indicator is not often used outside this country and, moreover, the relationship between the mean WFH percentage and mortality risk is not well understood. Thus the DPPC no longer recommends using only mean WFH percentage of malnutrition in emergency nutrition assessments. Percentage of the median and z-scores should always be reported and mean WFH percentage can be optionally reported.

3.4 Definitions of acute malnutrition in children aged 6-59 months

The WFH nutrition index is appropriate in emergency assessments because it reflects short-term growth failure or acute malnutrition related to weight loss (wasting). Thus WFH is the most commonly used nutrition index in emergency nutrition surveys in Ethiopia. This is because it can tell us about the current situation of the population. A further advantage of WFH is that it does not involve age. Age is often difficult to determine, especially in emergency situations. It is therefore unreliable in nutrition surveys. WFH is also used as a criterion for admission into and discharge from feeding programmes and to monitor the evolution of the nutrition status of a child enrolled in a feeding programme.

The presence of oedema should also be gauged during emergency assessments. Oedema is caused by the retention of water and sodium in the extracellular spaces. Bilateral pitting oedema (oedema on both feet) is the key indicator of kwashiorkor (see Section 1.1). Hence the presence of oedema on both feet indicates severe malnutrition. All children with bilateral oedema are regarded as being severely acutely malnourished, irrespective of their WFH. Oedema should, therefore, always be used as a criterion for admission into therapeutic feeding programmes.

Some agencies recommend mid-upper arm circumference (MUAC) as another indicator of acute malnutrition during emergencies. MUAC measures the muscle mass of the upper arm. It is a rapid and effective predictor of risk of death when below 110mm in children aged 12-59 months. However, there are drawbacks to using MUAC in emergencies. The chance of inaccurate measurement is high due to differing techniques, and, importantly, clear and agreed reference values to interpret the results do not yet exist.

Acute malnutrition is classified at the individual level as normal, acute moderate and acute severe malnutrition. At the population level, the prevalence of malnutrition is expressed as acute severe malnutrition and acute global malnutrition. Acute global malnutrition expresses the sum of acute severe malnutrition and acute moderate malnutrition.

Prevalence of acute global malnutrition	=	Prevalence of acute moderate malnutrition	+	Prevalence of acute severe malnutrition

Various different cut-off points, which employ different nutritional indices, are used to define acute malnutrition in children aged 6-59 months. The most commonly used cut-offs are defined below.

3.4.1 Weight-for-height cut-offs

The following cut-offs are used to define acute malnutrition according to weight-for-height measurements:

Table 3.1 Definitions of acute malnutrition using weight-for-height and/or oedema in children aged 6-59 months

Acute malnutrition using WFH	Percentage of the median	Z-scores	Oedema
Severe	< 70 %	<- 3 z-scores	Yes/no
	>70 %	>-3 z-scores	Yes
Moderate	< 80% to >= 70%	<- 2 z-scores to >= - 3 z-scores	No
Global	< 80%	<- 2 z-scores	Yes/no

- This means that any child with a WFH median less than 80 per cent or a WFH z-score less than -2 is defined as acutely malnourished.
- Children with a WFH median less than 80 per cent and more than, or equal to, 70per cent, or a WFH z-score less than -2 and more than, or equal to -3, are defined as moderately acutely malnourished.
- Children with a WFH median of below 70per cent or a WFH z-score of below -3 are defined as severely acutely malnourished.
- All children with bilateral oedema are severely acutely malnourished regardless of their WFH median or z-score.

These cut-offs can be used to diagnose whether or not an individual child is malnourished (and therefore should be admitted into a feeding programme), as well as estimating the prevalence of malnutrition in a survey.

Example 3.4
The child described above in Example 3.1 who had a WHM of 88.3% is not acutely malnourished because his WHM falls above the cut-off point for acute malnutrition. Likewise, the child described in Example 3.2 is not acutely malnourished because his z-scores is -1.98, which is above the cut-off. However, a child who had oedema or had a WHM <70% would be defined as severely acutely malnourished.

The cut-offs can also be used to estimate the prevalence of acute malnutrition in surveys. So, the proportion of children in the sample with WHM less than 80 per cent and/or oedema will give the global prevalence of acute malnutrition (prevalence of both moderate and severe acute malnutrition). Those with a WHM less than 70 per cent and/or oedema will give the prevalence of severe acute malnutrition. The proportion of children in the sample with a WHM above or equal to 70 per cent and less than 80 per cent and no oedema will give the prevalence of moderate acute malnutrition. The same is true of z-scores.

Example 3.5
A group of 905 children was measured in a survey. There was no oedema. Fifteen children had WHZ<-3 z-scores and 45 had WHZ<-2zscores and >=-3 z-scores.

$$\text{prevalence of severe acute malnutrition} = \frac{\text{number of severely malnourished children}}{\text{total number of children}} \times 100$$

$$= \frac{15}{905} \times 100$$

$$= 1.7\%$$

$$\text{prevalence of moderate acute malnutrition} = \frac{\text{number of moderately malnourished children}}{\text{total number of children}} \times 100$$

$$= \frac{45}{905} \times 100$$

$$= 5.0\%$$

$$\text{prevalence of global acute malnutrition} = \text{prevalence of severe acute malnutrition} + \text{prevalence of moderate acute malnutrition}$$

$$= 1.7 + 5.00$$

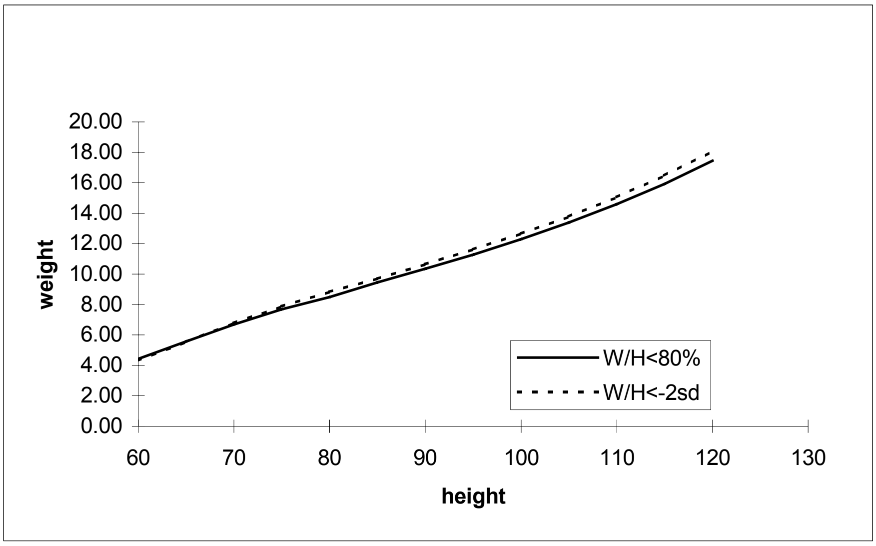
$$= 6.7\%.$$

3.4.2 Percentage of the median or z-scores?

Different children are categorised as malnourished depending on whether percentage of the median criteria or z-score criteria are used to define malnutrition. Figure 3.1 shows the cut-offs used to define acute moderate malnutrition according to WFH z-scores and medians. If z-scores are used to define malnutrition then a greater number of taller (older) children will be defined as malnourished than if percentage of the median is used.

Generally, if z-scores are used, the number of children classified as malnourished is higher than if the percentage of the median is used. For example, the experience of an agency in one African country showed that use of admission criteria in z-scores resulted in an increase of 40-60 per cent in the number of admissions compared to the use of the percentage of the median.

Figure 3.1 <80% WFH compared to <-2 z-scores WFH of the NCHS reference population



Why is there a difference between z-scores and percentage of the median?
The standard deviation of weight is different for different heights in the reference population. At a low height the standard deviation of weight is quite small, at greater heights the standard deviation of weight is greater. This means that children of different heights have different standard deviations of weight in the reference population.

When you calculate the z-score you take into account three factors — the median measurement, the actual measurement and the standard deviation for the specific measurement. So, the z-score takes into account the variation in the standard deviation. When you calculate the percentage median you only take into account two factors — the median measurement and the actual measurement. The percentage median does not take into account the variation in the standard deviation.

What this means is that the z-score is more statistically valid than the percentage of the median. Using z-scores, a taller (older) child is as likely to be classified as malnourished as a shorter (younger) child. This is not true for percentage of the median. Thus WHO recommends the use of z-scores to measure children (WHO, 2000).

Reasons for the use of z-scores or percentage of the median
The concept of the percentage of the median is easier to explain than that of z-scores because it does not require knowledge of standard deviations. Percentage of the median is also easier to calculate. A further advantage of percentage of the median is that several recent studies have

shown that it is a better predictor of mortality than z-score. On the other hand, z-scores allow for more statistically valid estimates of the weight deficits. Percentage of the median therefore has more practical operational advantages, whereas the advantages of z-scores lies in their statistical precision.

- Nutrition survey results should be given in both z-scores and percentage of the median.
- Admission criteria for entrance to a feeding centre can be defined using either z-scores or percentage of the median, but percentage of the median is preferable (because of mortality risk).
- When you are making decisions about whether or not to intervene at a given prevalence of malnutrition, you should look at the prevalence of both severe and global acute malnutrition measured in terms of z-scores and/or oedema, in conjunction with other aggravating factors. This is discussed more fully in Chapter 8.

3.4.3 Mean weight-for-height percentage cut-offs

The mean WFH percentage cannot be used to define malnutrition in individuals. There are no internationally accepted cut-offs for mean WFH percentage, although the 1995 DPPC guidelines suggested that a mean WFH percentage of less than 90 per cent indicated that interventions were needed in a population. More recent work suggests that this cut-off may not be valid for all parts of Ethiopia, as the relationship between mean WFH percentage and mortality varies according to region and season. This is discussed further in Chapter 7.

3.4.4 MUAC cut-offs

As stated above, MUAC cut-offs have not yet been internationally agreed. This means that it is not straightforward to classify a child as either malnourished or not malnourished using MUAC.

However, the MUAC can be used for two purposes:

1. **Screening:** MUAC may be useful when screening for a targeted nutritional programme. This is because measuring MUAC is quicker than measuring weight and height. For example, when screening for a supplementary feeding programme, MUAC measurements can usefully be used to decide which children should be referred for weighing and measuring. So, during a screening, the MUAC of all children aged 12-59 months can be measured. Children with a MUAC more than 135mm are not considered at heightened nutritional risk and do not need to be weighed and measured. However, children with a MUAC of less than 135mm should be weighed and measured. The MUAC should not be used to assess the nutrition status of children less than 12 months old because MUAC increases on average one to two cm between the ages of 6-12 months.

The DPPC recommends that the MUAC only be used for initial screening to determine which children need to have their weight and height measurements taken.
MUAC is not recommended for children less than 12 months old as the MUAC changes rapidly at this time.

2. **Measuring trends:** MUAC measurements may also be useful when assessing trends. Repeated measures of MUAC in a geographical area, using a random sample of children (or measuring the same children each time), are useful to detect whether or not the nutritional situation is improving, deteriorating or staying the same. Some agencies, therefore, may wish to use MUAC to measure nutritional trends in their programme areas.

In addition, as MUAC is much faster to measure than WFH, MUAC measurements may also be used for very fast emergency assessments to gauge whether or not a full nutritional survey is required.

However, the DPPC does not recommend the use of MUAC for two other specific purposes:

1. **Nutrition surveys:** In general, the DPPC does not recommend the use of MUAC in an emergency nutrition survey because of the confusion about cut-offs. There is little Ethiopia-specific data linking MUAC cut-offs either to rates of mortality, or to WFH cut-offs. Thus it is unclear what prevalence of malnutrition defined by low MUAC is critical in Ethiopian populations, or at what point an agency should intervene.

All emergency nutrition surveys in Ethiopia should report the prevalence of oedema and low weight-for-height as defined by the percentage of the median and z-scores. The reporting of MUAC data is optional.

2. **Admission into Selective Feeding Centres:** Recent research has shown that children's MUAC is closely correlated with mortality in some circumstances. Indeed, several studies have shown that MUAC is a better indicator of mortality in either a community or a hospital for severely malnourished children, than weight-for-height. Some INGOs have, therefore, recommended that MUAC cut-offs be used as entrance criteria to emergency nutritional programmes. Unfortunately, different INGOS have recommended different cut-off points.[18] Given that the WHO has not yet recommended that MUAC be used as criteria for entrance into feeding programmes, the DPPC has decided to recommend only using weight-for-height and/or oedema criteria in Ethiopia. However, this decision may change in light of future research.

3.4.5 Classification of nutrition status amongst acutely malnourished individuals

Several different classifications of nutrition status have been suggested in the past. Currently, the most widely used classification of nutrition status is based on weight-for-height indices and oedema. Individuals who have low WFH are defined as marasmic. Individuals who have oedema have kwashiorkor. Individuals who are both low WFH and have oedema suffer from marasmic kwashiorkor. Table 3.2 shows this classification.

[18] The MUAC cut-offs recommended by ACF and MSF are given in Annex A2.4 for information purposes.

Table 3.2 The Waterlow classification of acute malnutrition based on WFH and oedema

	<-2 z-score or <80% median	**>=-2 z-score or >=80% median**
Oedema present	Marasmic kwashiorkor	Kwashiorkor
Oedema absent	Marasmic	Normal

This classification is important in emergency nutritional assessments because individuals with marasmic kwashiorkor have a higher risk of mortality than other groups and require immediate therapeutic treatment. When planning an intervention it is important to know what proportion of the population will need this type of treatment. All emergency nutrition assessments in Ethiopia should, therefore, present data based on this classification (see Chapter 7 for more details on this).

3.5 Definitions of chronic malnutrition in children aged 6-59 months

A child exposed to inadequate nutrition or bouts of disease for a long period of time will grow slowly. His or her height will be reduced, compared to other children of the same age who are not exposed to poor nutrition or disease, and so she will have low height-for-age (HFA). This is called stunting. Unlike wasting, the development of stunting is a slow, cumulative process. It may not be evident for some years, by which time nutrition may have improved (although, by two years of age, height deficits may be irreversible).

Stunting, or HFA, is a measure of chronic malnutrition (longer-term malnutrition) and is therefore not always useful for describing the current situation. The long time-scale over which HFA is affected, makes it more useful for long-term planning and policy development, than for emergencies. For example, it is useful for evaluating the effects of socio-economic change or development programmes in a certain place.

Apart from the fact that stunting represents chronic malnutrition, the very high levels of stunting in Ethiopia[19] also mean that it is not useful in emergency assessments, or as a screening tool for entrance into emergency feeding programmes. If the admission criteria for an emergency programme were determined using HFA, very large numbers would have to be included.[20]

For the reasons described above, emergency assessments usually do not assess chronic malnutrition. Before attempting to collect data on chronic malnutrition in an emergency assessment you need to think carefully about how useful it will be. Are you actually interested in the long-term, chronic deprivation of the area, or do you want only to know about the recent past? Also, remember HFA is only useful when exact ages are known (to the closest month). Incorrect age data will make the HFA data meaningless. In a population that does not know the ages of its children (as with many populations in rural Ethiopia), correct age data can be difficult to obtain and may take a long time to collect.

[19] The most recent Demographic Health Survey (DHS) estimated that some 55 per cent of Ethiopian children aged 6-59 months had low HFA (CSA and ORC Macro, 2001)
[20] The most commonly used HFA cut-offs are given in Annex A2.5 for information purposes.

3.6 Definition of underweight in children aged 6-59 months

Low WFA can be due to low WFH, or low HFA, or both. Therefore, WFA reflects both long-term malnutrition and recent malnutrition. Because of this mix, WFA is not useful for specifically assessing acute or chronic malnutrition. WFA is useful for individual growth monitoring of children using the "road to health" chart. WFA should not be used in either emergency nutrition assessments or as a criterion for the selection of children for feeding programmes.

WFA charts are available from the MoH.

3.7 Practical applications of anthropometric indicators

Anthropometric indicators have several different uses in children aged 6-59 months. Table 3.3 summarises the usual target population and cut-off points in relation to which activities are undertaken.

If you are planning an emergency nutritional survey, the most important point to note about Table 3.3 is that the prevalence of oedema and low WFH (as defined by the percentage of the median and z-scores) should *all* be calculated and reported.

Table 3.3 Different uses of anthropometry in children aged 6-59 months

Activities	**Target population**	**Cut-off points for malnutrition**
Emergency nutrition survey WFH + oedema	Populations 6-59 months OR 65-110 cm	WHM in z-scores and/or oedema Severe: <- 3 z-scores and/or oedema Global: < - 2 z-scores and/or oedema WHM in % of median and/or oedema Severe: < 70% and/or oedema Global: < 80% and/or oedema
Non-emergency nutrition survey HFA	Populations 6-59 months OR 65-110cm	HFA in z-scores Severe: <- 3 z-scores Global: < - 2 z-scores HFA in % of median Severe: < 70% Global: < 80%
MUAC screening for SFP or TFP	Individuals 12-59 months OR 75-110cm	< 135 mm
Admission criteria for TFP WFH or oedema	Individuals 65-110cm	WFH: < 70% (<-3 zs) and/or oedema
Discharge criteria for TFP WFH or oedema	Individuals 65-110cm.	WHM > 80% without oedema (two consecutive weighings)[21]
Admission criteria for SFP WFH	Individuals 65-110cm	WFH < 80% - 70% (<-2 - <-3 zs)
Discharge criteria for SFP WFH	Individuals 65-110cm	WHM > 85 % (two consecutive weighings)

[21] Children who are discharged from a TFP should always be registered in the SFP. If there is no SFP then children should not be discharged into the community until they reach 85 per cent WHM.

3.8 When to measure other age groups

Emergency assessments focus on children aged 6-59 months because, in general, the nutrition status of the under-five population has been shown to be a good proxy for the nutrition status of the wider community. In addition, children aged 6-59 months are often the most vulnerable section of a population and so most interventions are aimed at them. Surveys including other age groups are more complex and require greater technical expertise than surveys assessing only children aged 6-59months.

It is not always appropriate to assess malnutrition, or set up selective feeding programmes for older children, adolescents, adults or older people in emergency situations. However, there are some situations when it may be appropriate to consider assessing the nutrition status of other age groups. For example:

- if there is an increase in the crude mortality rate (CMR) compared to under-five mortality rates (suggesting that the over-five population is more vulnerable than the under-fives)
- if the prevalence of undernutrition is very high in the under-fives and is not due to a health problem mainly affecting that age group (suggesting that all sections of the population may be affected by malnutrition)
- if there is reasonable doubt that the nutrition status of young children does not reflect the rest of the population's nutritional situation. For example, in Borena Zone, where the cultural traditions of the population means that young child feeding has precedence over that of the parents and other age groups, it was suspected that older adults were particularly vulnerable to malnutrition
- if many adults or older children attempt to enrol in selective feeding programmes or present themselves at health posts
- if interviews with mothers at selective feeding programmes indicate that the nutritional situation of all age groups is deteriorating
- if believable anecdotal reports of adult or adolescent undernutrition are received
- if there is low coverage of food aid in dependant populations
- if the data are required as an advocacy tool to lever resources.

The DPPC recommends that emergency nutrition assessments should only include children aged 6-59 months. Other age groups should only be assessed for malnutrition if there is a specific reason to do so.

3.8.1 Pre-requisites for surveying other age groups

Surveys of other age groups should not be undertaken unless certain pre-requisites have been met:

- A thorough contextual analysis of the situation must be undertaken. This should include an analysis of the causes of undernutrition (see Chapters 1 and 8). Only if the results of this analysis indicate that the over-five population is vulnerable should a nutrition survey for this age group be considered.
- Data must also be gathered on other food security, nutrition, health, and economic variables. Nutrition information could include the results of assessments of children aged 6-59 months or other age or sex groups. Health data could include surveillance or survey data on the incidence of illness and death, especially illness and death due to those causes most closely associated with undernutrition, such as dysentery,

measles, cholera, malaria, or others. Economic analysis may include market surveys and prices, employment, and household income.

- Technical expertise must be available to ensure quality of data collection, adequate analysis and correct interpretation of results.
- The resource and/or opportunity costs of including other age groups in a survey should be considered.
- Clear and well-documented objectives of the survey should be formulated.

3.8.2 Indicators used to measure malnutrition in other age groups

There are no internationally accepted definitions of acute malnutrition using anthropometry in people aged more than 59 months. This is partly because ethnic differences in growth start to become apparent after five years of age. That is, a healthy 10 year old child from the highlands of Amhara Region may not grow in exactly the same way as a healthy Nuer child from Gambela. This means that it is difficult to use only one reference population to compare all ethnic groups. A further reason is that, in most circumstances, information on the nutrition status of the group aged 6-59 months is sufficient for planners to make their decisions and so, to date, there has been little research on defining malnutrition in other age groups.

In major nutritional emergencies, however, it may be necessary to include older children, adolescents or adults in nutrition assessments or nutrition programmes. Thus indicators of malnutrition for these age groups are sometimes necessary. Research on defining the most suitable indicators of malnutrition for people aged more than 59 months is currently being undertaken by several agencies. This information is liable to change in the next few years as more research is undertaken.

Given all the problems associated with measuring other age groups, the DPPC has decided that it is not appropriate to describe current techniques in these guidelines. Instead, information on how to measure height, weight, MUAC and oedema in older children, adolescents, adults and older people can be found in a separate document, available from the ENCU at the DPPC.

The DPPC strongly recommends that any agency wishing to measure malnutrition in people aged more than 60 months should consult the ENCU, WHO, UNICEF or other agencies (recommended by the DPPC) with technical expertise in this area before they start to assess nutritional status.

Summary of main points in Chapter 3

- Anthropometric measurements and indices are used to estimate the proportion of malnutrition in a given population, and also to admit and discharge individuals from Supplementary and Therapeutic Feeding Programmes.
- Emergency nutrition assessments in Ethiopia should focus on acute malnutrition as measured by weight-for-height and/or oedema, as this is the best reflection of short-term growth failure. In general, emergency assessments focus on short-term problems.
- All emergency nutrition assessments in Ethiopia should report the prevalence of low weight-for-height and/or oedema as defined by the percentage of the median and/or z-scores. The reporting of MUAC data is optional.
- Children aged 6-59 months are best measured in emergency nutrition assessments in Ethiopia because, in general, the nutritional status of this age group is a good proxy for the nutritional status of the wider community.
- Measuring other age groups is much more difficult. Information on how to measure older children, adults, adolescents and older people is available in a separate document held by the ENCU at the federal DPPC.

Chapter 4

Sampling Methodologies

This chapter outlines the most common types of sampling methodologies appropriate for use in Ethiopia. It is extremely important that appropriate sampling methodologies are followed to ensure that results of nutrition assessments are comparable both within Ethiopia and outside.

4.1 Fundamentals of sampling

4.1.1 Why take a sample?

If all the children aged 6-59 months from a given population were measured, we would get a precise picture of the nutrition status of the population. This is called a census, or exhaustive survey, and it is possible in a small population. However, an exhaustive survey is normally long, costly and difficult to carry out in a large population. Instead of surveying all the children, we normally survey only a sub-group of the population, called a sample, which “represents” the whole population.

Example 4.1
An estimate of malnutrition is needed for a population of about 2,000-3,000 people. We can estimate that about 18-20% of the population are children below five years of age (400-500). In this case it is possible to measure all the eligible children. This is called an exhaustive survey.

Example 4.2
If we measured all children aged 6-59 months in a particular woreda we would know the exact prevalence of nutrition in the woreda. Imagine the total population of a woreda is estimated at 159,000 — this means there are about 31,800 children under five. If we measured every single child aged 6-59 months we would complete an exhaustive survey or census. However, imagine the huge costs in terms of money and time needed to do this. In this situation it is much easier, cheaper and quicker to measure only a sample of the children and extrapolate the findings from this group onto the rest of the population.

4.1.2 The importance of representative data

The representativeness of a sample is essential. Only if a sample is representative can we generalise the information we learn from the sample group to the whole population. In other words, representativeness is the prerequisite for extrapolation of results observed for the sample, to the entire population.

In order for a sample to be representative of the population, the characteristics of the sample group must be similar to those of the total population. A sample that does not represent the population is “biased”. A sample is representative if each individual or household in the population has an equal chance of being included in the sample, and the selection of one individual is independent from another individual.

Example 4.3
If we measure the nutrition status of children in a health centre in a certain Peasants' Association (PA) will this be representative of all the children in the PA? No, probably not, as the children in the health centre are more likely to be ill and so their nutrition status will probably be worse than most of the other children in the PA. The sample would probably be biased to include more malnourished children.

Example 4.4
We want to know the prevalence of malnutrition in a woreda. If we only measure children in localities that are near to the road will the sample represent all children in the woreda? No, because we have not included the children who live far away from the road. Their nutritional situation could be better or worse — we do not know. Thus we need to measure children from all over the woreda to be sure that the sample is representative of all the areas of the woreda. If we only measure children living near the road then our survey will only be a valid description of the nutritional situation of children living near the road.

Only if a sample is representative can we generalise, or extrapolate, the information we learn from the sample group to the whole population.

4.2 Disadvantages of sampling: the importance of choosing a sampling frame before undertaking a survey

Sampling has some disadvantages. It often does not allow sufficient breakdowns, or cross-classification of data in the population, unless the sample was specifically designed to analyse the groups separately.

Example 4.5
If we take a sample of children from a zone it would not be possible to split the results of children from each woreda during the analysis. Thus it would not be possible to see differences in the prevalence of malnutrition between the woredas. If we need to know the prevalence by woreda then we must take a sample of the children in each woreda separately.

This means that before you design a survey you must consider which groups of people you want to estimate the prevalence of malnutrition for. You have to define your population or "sampling frame" as a first step.

If you think the rate of malnutrition in a particular area is higher in one group of people than another and that you expect to respond to their needs differently then you might want to undertake two separate surveys in the same area — one survey focusing on each group. In some cases you might need to do more than two surveys in the same area, if there are more than two distinct population groups, but remember, surveys cost time and money. You should only conduct more than one survey if there is a real reason to suspect that there is a difference in the rate of malnutrition, and you will be able to respond to the different groups differently.

Example 4.6
You think belg areas are worse affected by a rain failure than meher areas in a woreda in South Wollo, so you want to compare the prevalence of malnutrition in children living in the belg and meher areas. You will need to do two separate, comparable surveys in order to do this. However, before deciding to undertake two surveys, make sure that you are certain that the distinction between belg and meher is clear and that you will be able to respond to the two groups differently. In many areas in South Wollo, some farmers in the same PA are dependent on belg, others on meher and others on both, so it will be difficult to decide which locality belongs to which survey. Also, the woreda council often finds it very difficult to give assistance only to some localities in a PA and not others. Will the results of the survey help the authorities to target better? Is it really worthwhile undertaking two separate surveys?

Example 4.7
A new wave of refugees has just arrived from Somalia. There are now three groups of people living around Hartishek: residents, old refugees and new refugees. You think there are different rates of malnutrition in each group so you undertake three separate surveys. In this case, it would be relatively easy to separate out the three groups into three surveys. Also, it would make sense that new refugees will need different types of assistance from the old refugees or the residents (for example, they may well need shelter, pots and pans, etc).

Before you design a survey you must consider which groups of people you want to estimate the prevalence of malnutrition for. This means that you have to define your sample population or "sampling frame" as a first step.

4.3 Standard error, probability and confidence intervals

A further problem with sampling is that any figures derived from a sample are subject to sampling errors because there is only partial coverage of the entire population.

Data gathered from a sample population only provides an estimate of the true population value. You can only obtain the true population value through exhaustive sampling (by measuring every child). Hence, whenever a sample is drawn, there is a risk that it will not be truly representative and, therefore, that the results do not reflect the true situation. Inevitably, if a second sample is drawn from the same population, slightly different results are likely to be obtained. This risk is known as the standard error. In anthropometric surveys, the generally accepted standard error is five per cent. That is to say that if a hundred sample surveys were carried out on the same population, five would give results that were not representative of the total population.

When we undertake a survey, therefore, we calculate not only an estimate of the rate of malnutrition but also the range of values within which the real rate of malnutrition in the entire population almost certainly lies. This range is usually called the confidence interval (see Annex A4.2 for more explanation). In nutrition surveys we generally accept that a 95 per cent confidence interval is appropriate (ie, with a five per cent standard error). This means that we are 95 per cent certain that the true prevalence of malnutrition lies in the range given.

Example 4.8
We measure a sample of children from Legambo woreda and find the prevalence of malnutrition in our sample is 9.5% and that the range, or confidence interval, around this prevalence is 7.2-12.5%. We would then say that "the estimated prevalence of malnutrition in Legambo woreda is 9.5% (95% confidence intervals are 7.2-12.5%)". This means we are 95% certain that the actual prevalence of malnutrition in the children of Legambo lies between 7.2 and 12.5%.

4.4 Essential steps in sampling

Three main sampling methods are commonly used for emergency nutrition surveys in rural Ethiopia: simple random, systematic and cluster sampling. All three sampling methods use a highly ordered form of selection designed to eliminate observer bias.

The essential steps in obtaining a sample for any of the methods are as follows:

1. Define the population for which we need to know the estimate of malnutrition. This study population is also called the sampling frame. The sampling frame might be the children living in several localities, or a woreda, or a zone or a refugee camp. The results we obtain from our survey will only be valid for the sampling frame as a whole. If separate estimates are needed for ethnic or geographic subgroups, or other subdivisions of the sampling frame, each of them must be treated as a separate frame for which a separate sample must be constructed (Section 4.3). Therefore, the smallest subdivision on which information is sought should be determined at the outset. Remember, if different groups are not distinguished, it may be difficult to interpret survey findings later.
2. Obtain available population data. The best place to obtain population data for a woreda in Ethiopia is usually from the Woreda Council or Bureau of Agriculture (BoA). You may get zone population information from the Department of Planning. In refugee camps you should be able to get population data from United Nations High Commission for Refugees (UNHCR) or NGOs working in the camp. If no population data are available, for example for newly displaced people or refugees, a rough population estimate should be made by counting dwellings and estimating the number of people in each dwelling.
3. Choose the sampling methodology to be used. The required precision (reliability) should be identified and the necessary sample size determined accordingly.
4. Select the households or individuals to be examined.

4.5 Defining the sample size

The sample size is the number of individuals to be included in the survey to "represent" the population of interest. Obviously, the greater number of sites that are sampled, the more representative the sample will be.

We use standard calculations to define sample sizes. Detailed explanations of how to calculate sample size are given in Annex A4.3.

Three sampling methods commonly used in emergency nutrition surveys in Ethiopia

Simple random sampling: a sample base listing every individual and their location in the population is available. Individuals are randomly chosen from the list using a random number table.

Systematic sampling: a modification of a simple random sampling that consists of picking individuals or households at regular intervals "systematically", say every tenth house encountered during a house-to-house survey. There is no census list of the population, but the population is geographically concentrated and the dwellings are easy to find.

Cluster sampling: a sampling technique that organises a population into smaller geographical areas for which the population size is estimated. Clusters are randomly selected from these geographical units according to the proportional population size. Individuals are then selected within each cluster.

4.6 Simple random sampling

Simple random sampling is the best method — when it can be used — because you can measure fewer children and so it is quicker. An up-to-date list of all individuals or households in the population is required, with enough information to allow them to be located. Individuals are randomly chosen by (a) picking them out of a hat, or (b) using a random number table (see Annex A4.4).

Example 4.9
Simple random sampling might be useful if you go to a place where all the names of the children are known and recorded, for example, a nursery school. You could give each child a number and draw as many numbers out of the hat as you need. You could then call each child to be measured and/or interviewed.

In practice, in Ethiopia, a reliable population list is rarely available, and it is sometimes practical to use the following alternative procedure:

1. Determine the sample size (the number of children required, for example, 544 as shown in Annex A4.3.2).
2. Go to the area and make a list of all households with children aged 6-59 months.
3. Assign each household on the list an identification number.
4. Select the required households using a random number table. Alternatively pick household identification numbers out of a hat or plastic bag (if this type of selection is done in public the community can see how households are selected).
5. Visit all the households whose numbers were drawn. Do not visit any other households. No households should be substituted for any reason. In a nutritional survey, all children in the specified age group belonging to each of the selected households must be measured. This means if there is more than one eligible child in a household they should all be included in the survey.[22] If a child is not present at the time of the survey go back

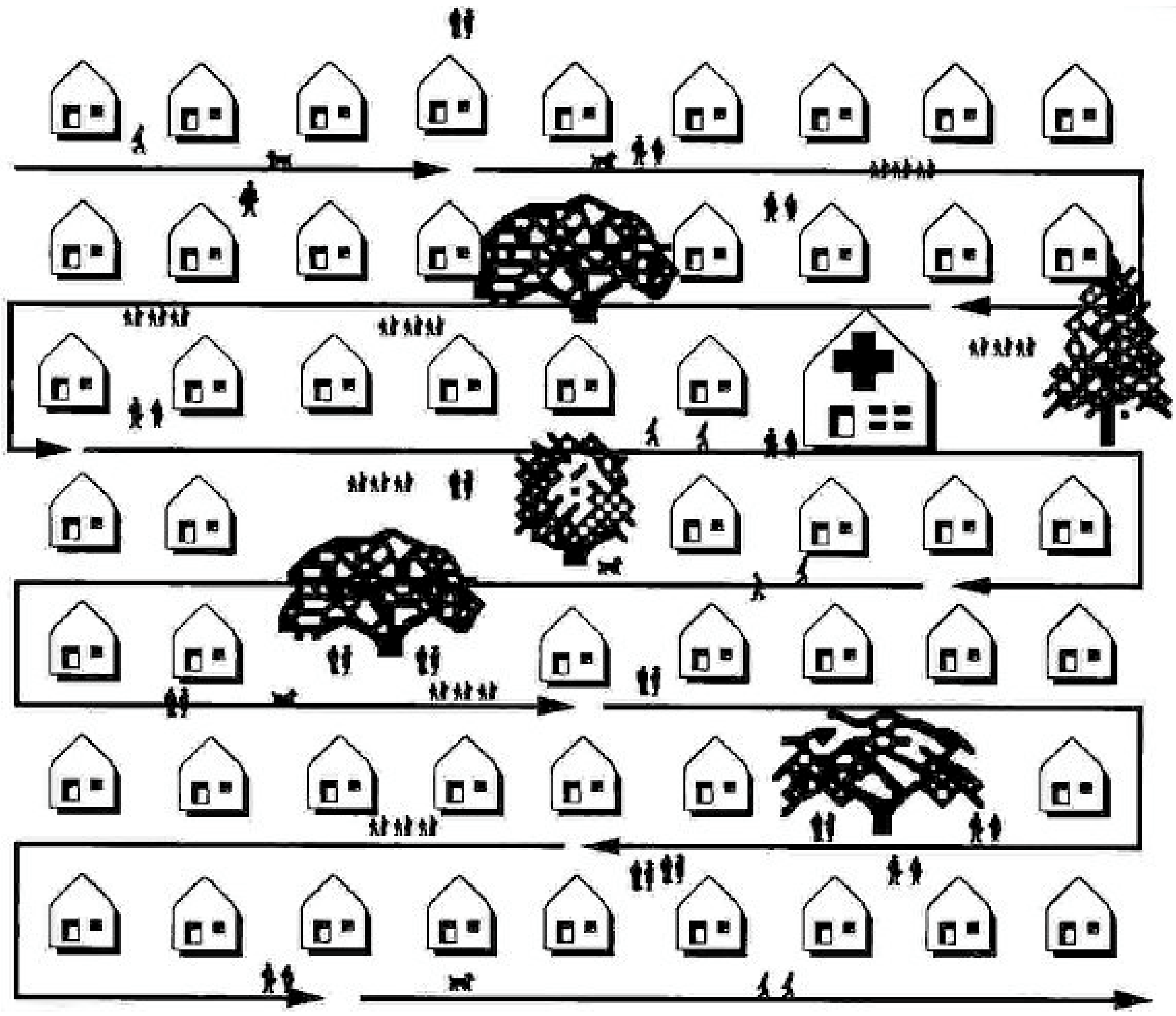
[22] Some agencies recommend only measuring one eligible child per household (if there is more than one child then one of them is randomly selected for measuring). However, this method is relatively time-consuming as you have to visit more households to get all the children you need. Thus the DPPC recommends measuring all eligible children in a household. WHO (2000) also recommends measuring all children in a household.

to the house later to find the child (you should continue to look for the missing children until you leave the survey area).

4.7 Systematic sampling

Systematic sampling eliminates the need for complete, up-to-date population data. But you need a relatively small geographic area, a reasonably accurate plan or map showing *all* households; and an orderly layout, or site plan which makes it possible to go systematically through the whole site.

Figure 4.1 Example of a community where systematic sampling is possible.



The procedure is as follows:

1. Determine the sample size (the number of children required, eg, 544 as shown in Annex A4.3.2). Alternatively, statisticians recommend that 450 is an appropriate sample size, no matter what size target population there is.
2. Obtain a map of the site and trace a continuous route on the map, which passes in front of every household.
3. Determine the number of inhabitants and the number of households (let us assume 50,000 people and 11,000 households as an example).

4. Determine the number of children aged 6-59 months in the population. The proportion of children in this age group is usually quite stable, around 20 per cent. However, in certain situations, when high juvenile mortality is suspected, the proportion can be smaller. In this case, the proportion of children has to be estimated from a rapid survey covering 30 households at random. (In our example, assume the proportion of children aged 6-59 months is 20 per cent, we have 10,000 children).
5. Determine the required number of households. The first step is to calculate the average number of children in each household. This figure is equal to the total number of children divided by the number of households: 10,000/11,000 = 0.9. Therefore, we need to visit 604 households (544/0.9) to complete the sample.
6. Determine the "sampling interval" by dividing the total number of households by the number that must be visited. In our example, if the total number of households is 11,000, the sample interval = 11,000/604 = 18.2. You should round down to the nearest whole number, therefore one household in every eighteen should be visited.
7. Select the first household to be visited. The first household is randomly selected within the sampling interval (1-18) by drawing a random number which is smaller than the sampling interval (see Annex A4.4 for more explanation). Assume the number drawn is "5", start with the fifth house.
8. Select the next household by adding the sampling interval to the first household selected (or counting the number of households along the prescribed route), for example, 5+18 = 23. Continue in this way (for example, visit houses 5, 23, 41, 59, etc) until the number of households required for the survey has been systematically selected.
9. Measure all children aged 6-59 months in the selected households. If two eligible children are found in a household include both. If no children are found in a house, go to the next house in the sample (by adding the sampling interval again). For example, if there are no children in house 23, then go to house 41 and continue looking for children there.
10. If a child is not present at the time of the survey go back to the house later to find the child (you should continue to look for the missing children until you leave the survey area). If you do not get enough children and you have finished going to all the houses you had planned to, then you should find a new sampling interval and start the process again until you have got enough children. For example, if you need another 40 children then you should find a new sampling interval: 11,000/40 = 275. You now need to visit every 275th household to find the remaining children.

It is important not to overestimate the proportion of children aged 6-59 months when calculating the sampling interval. If you do this the sampling interval will be too large and the total number of children measured will not be enough.

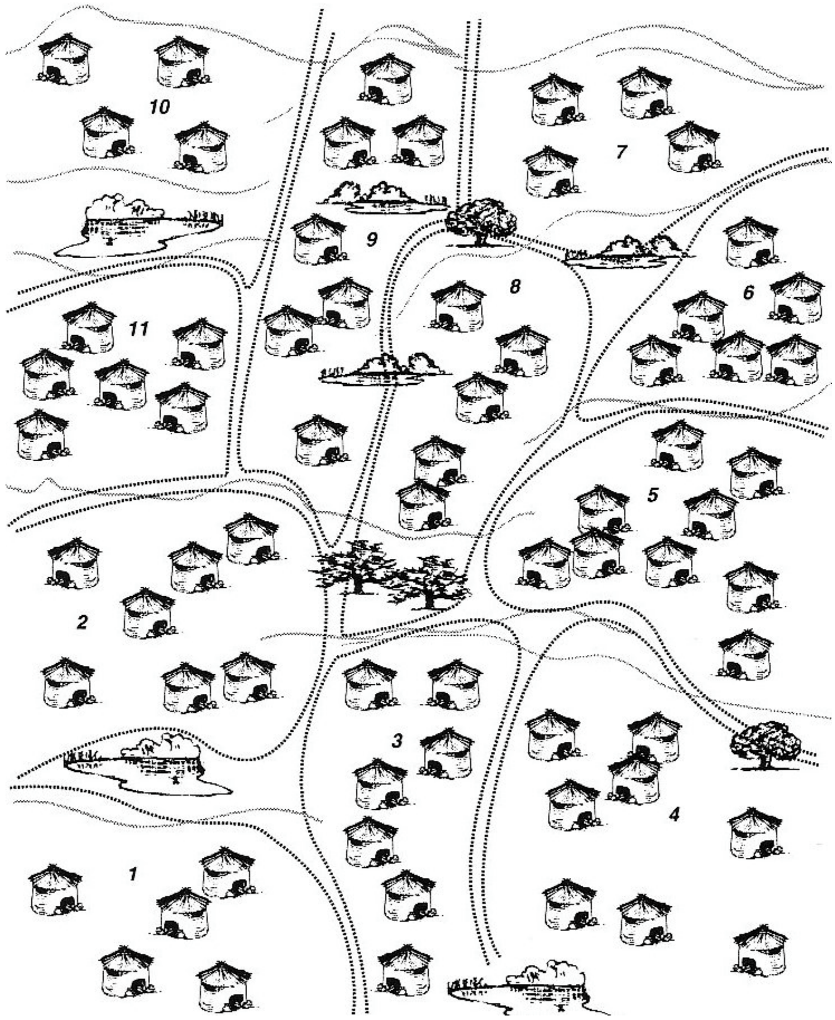
4.8 Two-stage cluster sampling

Two-stage cluster sampling is used in large populations, where no accurate population register is available and households cannot be visited systematically. This is very common in rural Ethiopia and so this method is the most commonly used. Another advantage of cluster sampling is that it is more convenient than simple random sampling, because a cluster design reduces the distance travelled by the survey team. The number of sites visited is equal to the number of clusters, unlike simple random sampling where every child could be located in a different place or site. The sampling is split into two stages:

Stage one	clusters, or sampling sites, within the total population are selected randomly
Stage two	an appropriate number of children are randomly selected within each selected cluster.

This two-stage process is applied separately to each population of interest — for each sampling frame. For example, if we need to know the prevalence of malnutrition for separate woredas, then we need to do this twice — once for each woreda.

Figure 4.2 Example of a community where two-stage cluster sampling is needed



The larger the number of clusters, the higher the probability that the sample will be truly representative of the population, because we will study more sites (see Section 4.5). This means that the more clusters there are, the smaller the confidence interval will be around the estimate of the prevalence of malnutrition and the more accurate our estimate of malnutrition will be.

In practice, physical constraints will limit the number of children that can conveniently be measured in a cluster and the number of clusters (or sites) we can visit. So we normally adopt the standard 30 by 30 cluster sampling methodology, recommended by WHO, (WHO, 2000). This means measuring 30 children in each of 30 clusters. This sample size (900 children) is usually adequate to detect the prevalence of malnutrition found in Ethiopia.

Readers familiar with the earlier DPPC guidelines (DPPC, 1995) may remember the recommendation in those guidelines to use 12 clusters of 50 children. Section 4.11 below explains why the DPPC has changed this recommendation.

Under normal circumstances, the DPPC recommends that all agencies adopt the standard WHO 30 by 30 two-stage cluster sampling methodology to undertake nutrition assessments in rural Ethiopia.

4.8.1 Stage one: selecting the cluster

The basic principle of this first stage (cluster selection) is that the relative size of a locality will affect the chance it has of being included the survey. Localities are allocated random numbers in proportion to their relative population size.

Cluster sampling requires the grouping of the population into smaller geographical units, like localities or PAs. The smallest available geographical unit is always chosen, as long as population data is available. So if locality (for example, gott, or olla, or genda) data is available, use these localities as the geographical unit. If locality data is not available, use PAs. If there is no population data, draw a map of the area and roughly divide the area into sections of about equal size, following as far as possible existing geographic or administrative boundaries. Each section should have at least 300 inhabitants.

When using cluster sampling, you should try to obtain population data for a small geographical unit, for example by PA or even by locality if possible.

Then follow this procedure:

1. Determine the sample size (the number of children required, usually 30 children in 30 clusters which is equal to 900 children for a cluster survey, see Annex A4.3.2).
2. Obtain the best available census data for each PA, locality, or section on the map. This is usually obtained from the Woreda Council or Ministry of Agriculture (MoA). In a stable population, such as a drought-affected region with little in- and out-migration, a census that is several years old may still be acceptable as a base for population proportionate sampling. However, in refugee situations where influx continues, reliable up-to-date counts are important for a valid sample.
3. Obtain the best available data about the number of under-fives in each locality or PA. In most circumstances, the total population rather than the population of children under five can be used to develop the sampling frame, since children form a relatively stable fraction of the population and the total population figures are usually easier to obtain. However, if you know that the proportion of under-fives varies from area to area, then you should try to collect accurate data on this.
4. Next, make a table with six columns (see below). The first column should include the name of each geographical unit (for example, locality, PA or section on map). These names can be in any order. The second column should contain the estimated total population of each unit. The third column should contain the estimated population of the children in each unit.

Geographical unit	Estimated total population	Estimated children 6-59 months	Cumulative population	Attributed numbers	Location of clusters
Locality 1	2,500	500			
Locality 2	1,000	200			
Locality 3	800	160			
Locality 4	3,250	650			
Etc…	…	…			
…	…	…			
Total	50,000	10,000			

5. Next add two more columns. The fourth column should contain the cumulative population of the children (obtained by adding the population of each unit to the combined population figure of the preceding units). The fifth column should contain the attributed numbers for each unit — the range of the cumulative population for each unit.

Geographical unit	Estimated total population	Estimated children 6-59 months	Cumulative population	Attributed numbers	Location of clusters
Locality 1	2,500	500	500	1-500	
Locality 2	1,000	200	700	501-700	
Locality 3	800	160	860	701-860	
Locality 4	3,250	650	1,610	861-1,610	
Etc…	…	…		1,611- …	
…	…	…			
			10,000	… -10,000	
Total	50,000	10,000			

6. Calculate the "sampling interval". In cluster sampling, the sampling interval is obtained by dividing the total population (or the estimated population of children) by the desired number of clusters, which is usually 30. In this example, the sampling interval is 10,000/30 = 333.
7. Determine the location of the first cluster. Its location is randomly chosen by selecting a number within the first sampling interval (1-333 in this example). The number can be randomly selected using a random number table, or from a bank note, etc. (see Annex A4.4 for further explanation). Let us assume that we chose 256 as our starting point. This number places the first cluster in "Locality 1" in our example because it has the attributed numbers 1-500.
8. Select the other clusters. Add the sampling interval sequentially to the starting number until 30 numbers are chosen. Each number chosen represents the population of a geographic unit. In this example, the first cluster is at 256 (Locality 1), the second cluster at 256+333 = 589 (Locality 2), the third cluster is at 589+333 = 922 (Locality 4), the fourth cluster is at 922+333 = 1,255 (Locality 4), etc. A large geographical unit may appear twice — two clusters are drawn in Locality 4 in our example. In the same way, a small geographical unit (smaller than the sampling interval) may not be selected — Locality 3 in our example.

Geographical unit	Estimated total population	Estimated children 6-59 months	Cumulative population	Attributed numbers	Location of clusters
Locality 1	2,500	500	500	1-500	1
Locality 2	1,000	200	700	501-700	1
Locality 3	800	160	860	701-860	0
Locality 4	3,250	650	1,610	861-1,610	2
Etc…	…	…	…	1,611- …	…
…	…	…	…	…	…
			10,000	… -10,000	
Total	50,000	10,000			30

Remember: never change a sampling site because it is too remote.

4.8.2 Stage two: selection of children in the clusters

Having identified the 30 clusters, a team of data collectors should go to the site of each cluster. Let us assume that we obtained locality level population data and have arrived at one of the selected localities.

At any given cluster, or locality, once discussions have been held with the local leader(s), the following procedure should be followed:

1. Go to the centre of the selected locality (ask local people for information).
2. Randomly choose a direction by spinning a pencil or pen on the ground and noting the direction in which it points when it stops.
3. Walk in the direction indicated by the pen, from the centre to the outer perimeter of the locality, counting the number of households along this line.
4. Select the first household to be visited by drawing a random number between one and the number of households counted when walking. For example, if the number of households counted was 27, then select a random number 1-27. If the number five was chosen, then the fifth household on the walking line is the first you should visit.
5. Go to the first household and examine *all* children aged 6-59 months in the household.
6. The subsequent households are chosen by proximity. In a locality where there is a high population concentration, proceed by always choosing the next house to the right or to the left (decide which at the beginning of the survey and stick to it). Continue to go to the left/right until the required number of children has been measured. The same method should be used for all clusters. However, if the locality has a very spread-out population, then proceed by simply choosing the nearest house. The nearest house is the one with the door nearest to the last house surveyed, whether it is on the right or left (this should save you a lot of time in an area where the dwellings are very spread out). Continue the process until the required number of children has been measured.
7. If there are no children under five in a household proceed to the next house.
8. All eligible children are included and thus should be measured and weighed. This means that all children in the last house should be measured even if this means exceeding the number required. If a child is not present at the time of the survey go back to the house later to find the child (you should continue to look for the missing children until you leave the survey area). If you cannot find a child then you need to replace it with another by continuing the sampling methodology. If a child has been admitted to an intensive feeding centre, the team must go to the centre and measure him or her there.

It is extremely important to follow this house-to-house method of selecting children if you are undertaking a random survey. If you just called for children to be brought to the centre of the locality, it is likely that some of the children could be missed. This could result in bias. In addition to preventing bias, the house-to-house method also allows you to ask household questionnaires at someone's home — this makes it easier to verify what they are saying (see Chapter 5).

9. If you run out of houses to measure in a locality and have not found sufficient children (that is, you have not found 30 children) then you should proceed to the nearest locality. When you arrive at the nearest locality you should repeat the process of spinning a pen and randomly selecting a house to start at (steps 1-8 described above). Proceed from house to house until you have measured sufficient children.
10. If a child is not present at the time of the survey go back to the house later to find the child (you should continue to look for the missing children until you leave the survey area).

Biases encountered by calling children to the centre of a locality

If you call for children to come to the centre of the locality to be measured many different types of bias can occur:

- the smaller children, who can be more easily carried, may be brought
- the older children may be more likely to come as they will be curious about what is going on
- sick, weak and most malnourished children may be left at home if the mother does not want to disturb them
- if there is supplementary food only for the most severely malnourished then only these children may be brought.

You cannot tell which type of bias will happen when you call children to the centre of locality, therefore you must go from house to house to find children.

It should be noted that cluster sampling does not completely fulfil the requirements of a representative sample. This is because several children are selected within a cluster by proximity and therefore the choice of a child is not independent from the choice of other children. Within each cluster, children will have a tendency to be more similar, as far as nutritional status is concerned. This phenomenon is called the "design effect". The design effect is taken into account when calculating the sample size (see Annex A4.3.2).

4.8.3 Adapting the second stage of the cluster method for Ethiopia

Often in Ethiopia good population data is only available at the PA level. It is very rare to be able to obtain locality level population data from the woreda offices. Sometimes an agency has been working in an area for a long time and has this information, but this is unusual. Unfortunately, PAs in some parts of Ethiopia can be very large and usually take several hours to walk across. In some cases, it may take a whole day to walk from the centre of the PA to the perimeter and back to the centre, when counting houses. Obviously this will waste a lot of time when you are conducting a survey. Instead of walking all the way across the PA and back to locate the starting house, it may be easier to randomly select a locality in a PA where you can start the survey.

Ideally, you would be able to select the locality according to the relative sizes of all the localities in the PA, so that you would be more likely to visit the bigger localities. To do this you need information about the number of households in each locality (obtain data from the PA leader). You would then select which localities to visit according to the method described in Section 4.8.1, that is by assigning clusters according to the population size. This may be quite complicated to do in the field if your team is not used to doing these calculations. If you think it will be too difficult for your team to do this, then you should follow the simpler method described below:

When you arrive in the PA, try to locate the PA leader or someone else in authority. Ask the PA leader to help you make a list of all the names of the localities in the PA — it is important this list is complete. Make sure that even the smallest, furthest away localities are included.

1. Give each locality a number.
2. Randomly select a locality using a random number table or by selecting a number from a hat.
3. Continue with the selection process until you have enough localities for the PA. In some PAs you may have selected more than one cluster and so need to select more than one locality.
4. Discuss with the PA leaders the distance of each locality from the centre of the PA and work out a sensible timetable to survey the localities you have chosen. Go to the first locality.
5. When you reach the selected locality continue with the method described in Section 4.8.2 (that is, walk to the edge of the locality, etc).

Remember the locality selection must be random. Do not choose the nearest locality for reasons of convenience. This method should only be used if there is no locality level population data available and the PAs are very large or very difficult to access, otherwise you should stick to the original method described in Section 4.8.2

4.9 Common constraints of cluster sampling in Ethiopia

This section will describe some common constraints encountered when using the cluster sampling technique in Ethiopia. Suggestions for how to overcome the constraints are also given.

4.9.1 Population scattered over a large area

This is a very common phenomenon, particularly in pastoral areas. Allow more time for travelling between sites. Perhaps also select more clusters (say 35) and a small number of children per cluster, to ensure that the same number is found in each site to prevent bias.

Example 4.10
You want to undertake a 30 by 30 cluster survey in a pastoralist area, but you have heard that the population lives in very small settlements, often with only 25 households in each locality. So, you decide to select 35 clusters (instead of 30) and will measure 25 children in each cluster. This will still give you a good estimate of the prevalence of malnutrition (with small confidence intervals), but will probably be more time-consuming than undertaking 30 clusters, as you will have to travel to more sites.

In some situations where the population is very spread out you may deliberately choose to undertake a survey without sampling certain sections of the population. You might chose to sample only the population that lives together in larger settlements, which would save you the time and money needed to get into the bush to the more scattered population. This would mean that you would not include the population estimates from the scattered area when you are originally selecting your sample (as described in Section 4.8.1). If this is the case, you must be very careful to remember to describe who you excluded from the sample in your report of the survey. You might also want to discuss what the nutritional situation is like in the areas that you did not sample (if you have any information on this).

Example 4.11
You want to undertake a 30 by 30 cluster survey in a pastoralist area. The pastoralists are either living in quite large settlements (over a hundred households) near the road where they are receiving relief food, or are very spread out in the bush, living in much smaller settlements (ten households). Time is limited and it is extremely difficult to travel in the bush. In this situation you may decide only to sample the population in the settlements — it will be just too time consuming to travel and find people in the bush. Thus you would only include the population estimates of people living in the larger settlements in your sampling frame, and all your clusters will be in these settlements. This should be clearly described in the assessment report. In your report you may be able to speculate that the condition of the people living in the larger settlements is better because they are receiving relief food, or that the people in the bush may be better-off because they are living off their animals. Alternatively you may not be able to speculate at all!

4.9.2 Population is very mobile

If you are attempting to undertake a survey in an area where the population frequently moves large distances, then it likely that you may arrive at a cluster and find that there is no-one there and no-one nearby. If you suspect that this might happen then you should select some extra clusters before you start the survey, so that if one cluster is deserted you can replace it with another one. Do this by selecting more than 30 clusters (say 33) right at the beginning of the sampling (see Section 4.8.1). You should plan to survey all 33 clusters. If however, it is not possible to survey one or more of them, there should still be at least 30 that have been surveyed. It is worth noting here that 30 clusters is the number determined by statisticians to be the best balance between representativeness and work load. Undertaking any more than 30 clusters results in a minimal improvement in representativeness and considerable extra work load, so you should only undertake 33 clusters if really necessary.

Example 4.12
An NGO tried to undertake a standard 30 by 30 cluster nutritional assessment in a pastoralist area of Somali Region. It obtained population data and selected 30 clusters according to the recommended method. Unfortunately, when it reached some of the clusters it could not find anyone as the population had moved on. It only managed to find people in 24 clusters and so had to abandon the survey results. If the NGO had selected 40 clusters at the start of the survey it could have replaced the “empty” clusters with reserves.

Remember that inappropriate changes to survey methods are liable to give misleading results. It is always better to have more clusters with fewer children in each than to have fewer clusters with more children in each.

4.9.3 Limited access to some areas because of insecurity or inadequate roads

If access is completely impossible, then a random sample of the area cannot be taken. The alternative is to take a sample of people who have recently left the area, for example, to attend a food distribution or health clinic, or a market day. If displaced people are arriving from a certain area then it is possible to assess them as they arrive, giving an indication of what the rate of malnutrition is in the area they have left. This type of surveying will give you a biased (unrepresentative) sample, and only a very rough indication of the true picture.

If access is possible only in some areas, you might chose just to draw your sample from the secure areas. This would mean that you would not include the population estimates from the insecure area when you are originally selecting your sample (as described in Section 4.8.1). If this is the case, you must be very careful to remember to describe who you excluded from the sample in your report of the survey. You might also want to discuss what the nutritional situation is like in the areas that you did not sample (if you have any information on this).

Example 4.13
You want to undertake a 30 by 30 cluster survey in a woreda with 30 PAs, but you know that three of the PAs are very insecure and you do not want to send your team into those areas. Instead, you decide only to draw your 30 clusters from the 27 secure PAs. Thus you will only sum the cumulative frequency of the population from the 27 PAs. In your survey report you will be sure to mention that the results are only representative for the 27 PAs.

Alternatively, if access is possible only in some areas, then you may want to do purposive sampling (see Section 4.10). This means that you will only be selecting representative localities from certain areas before you start the survey. Remember to report that your sample will not be representative of the whole area.

As long as you honestly record the sampling method you used in your assessment report it does not matter that the sample is biased — it is the best that you could manage at the time.

If an area is insecure from time to time then you should select some extra clusters before you start the survey so that if one cluster becomes insecure you can replace it with another one. Do this by selecting more than 30 clusters (say 33) right at the beginning of the sampling (see Section 4.9.2).

4.9.4 Variation in the rate of malnutrition is suspected

A cluster survey of the entire area will give you a single estimate of the rate of malnutrition and will not show you the differences within the area. Divide the area into smaller sections, according to where you think the differences are, and select 30 clusters from each of those areas. Alternatively, undertake purposive sampling of each different area (see Section 4.10).

4.9.5 No reliable data on population size

Use as many sources of information as possible to list all the known villages in the area to be surveyed. Estimate the relative size, based on local knowledge, and assign a relative score to each location (very big = 5, big = 4, medium = 3, small = 2, very small = 1). Use these estimates to select the required number of clusters randomly.

4.9.6 Limited time

Time is often the greatest constraint. There are no short cuts to getting accurate estimates of malnutrition. The only alternative is to reduce the size of the area surveyed. For example, instead of undertaking a cluster survey of a large area, make a survey in each of several smaller villages. Either measure all the children in the locality, or, if the localities are large, do systematic sampling. Localities may be chosen randomly, or it may be more useful to sample them purposively (see Section 4.10).

4.10 Purposive sampling

The simple random, systematic and cluster methods of sampling assume that the rate of malnutrition is similar throughout the area to be surveyed. This may be true, but sometimes — particularly in times of food shortage — pockets of malnutrition develop within an area. These pockets will not necessarily be picked up by a cluster survey of the entire area, as only the average rate of malnutrition will be known.

It may therefore be more useful to make separate surveys of individual PAs, or even agro-ecological zones, which are chosen to represent different types of communities, such as the most affected (from anecdotal evidence or local knowledge), the better off, those with important markets, those frequented by pastoralists, etc. This type of sampling is known as purposive sampling. Rates of malnutrition may then be estimated for each village, but it will not be statistically valid to use the figures obtained to make estimates for the area as a whole. Purposive sampling is especially useful if you are planning a programme response to a problem.

Example 4.14
You are planning a targeted supplementary feeding programme for malnourished young children in response to a food crisis in a woreda in Fik Zone, Somali Region. You know that there are different concentrations of displaced and resident children throughout the zone, but you do not know the exact distribution of the displaced. You think the children of displaced people are more vulnerable to malnutrition than the residents' children, but you want to include both displaced and resident children who are malnourished in your programme. You are trying to work out how much food to send to which area, but it is difficult to know which areas are most affected and where most of the malnourished children are. In order to estimate where you will need the most food (where most of the malnourished children are) you could undertake some purposive sampling. Make a list of the localities or areas that you think have similar conditions. Undertake exhaustive, simple random or systematic sampling in one or two of the towns/areas that are representative. Then estimate roughly how much food will be needed in the area. Your results may look something like this.

Site	Estimated rate of malnutrition in each site	Other locations where conditions are thought to be similar
Bernil	25%	Dihun, possibly Hamero
Garasley	15%	Fik, Segeg, Dundumad, possibly Hamero, Gerinka
Gasangas	40%	Ayun

From these results you could decide that Gasnagas and Ayun were the priority areas for food distributions.

Purposive sampling differs from the other sampling methods described because it is not statistically valid. In purposive sampling you are deliberately selecting sites where you will measure children. These sites are representative of certain areas (in our example it is thought that Bernil is similar to Dihun and Hamero), whereas when you use the other sampling methods, the sites at which you measure are decided either by chance (simple random and systematic) or according to their relative population size (cluster sampling).

4.11 Cross-sectional and longitudinal sampling

Cross-sectional data are used to describe the nutritional situation of a population at a given point in time. The results of cross-sectional nutrition assessments are often used to compare the nutritional situation of one population to another. In order for nutrition assessments to be comparable they must use similar sampling methods.

Example 4.15
The ENCU at the DPPC compares the results of nutrition surveys undertaken using the same methodologies in different places to see which areas are the worse affected. This assists the DPPC in targeting limited resources to beneficiaries most in need. If the surveys are conducted using different sampling methods, for example purposive and cluster, it may not be possible to compare them.

In order for nutritional assessments to be comparable they must use similar methodologies

Sometimes we might want to compare the nutritional situation of a population over time to see if the situation is improving or deteriorating, or if there are seasonal differences in nutritional status (see Chapter 1). There are two ways to do this:

- by repeating cross-sectional surveys
- by undertaking longitudinal surveys.[23]

The sampling methods described in this chapter so far can be used to obtain cross-sectional data. To show longer-term changes (for example, seasonal changes) you would repeat the sampling procedure and survey on the same population some months, or years, after the original survey. The individuals or clusters in the sample may be different in the second survey, as they are chosen randomly and so will probably not be the same. However, the two surveys will be directly comparable if the same methodology is used and therefore, the results can be analysed to look for differences over time. The procedure to compare two sets of survey results is described in Chapter 8.

As described in Annex 1, there are other methods to compare nutrition data longitudinally. The earlier DPPC guidelines (1995) recommended that nutrition surveillance in Ethiopia should be undertaken by monitoring changes, using repeated measurements of 50 children in 12 clusters. The 12 clusters were randomly chosen at the beginning of the surveillance period and followed at regular intervals.[24]

[23] Longitudinal surveys involve measuring the same children regularly.
[24] This type of longitudinal nutritional surveillance was undertaken by SC UK for many years. SC UK's Nutritional Surveillance Programme (NSP) was set up to monitor the nutritional situation of the most drought-affected areas of Ethiopia over time. Regular nutrition assessments (every two to three months)

The 12 by 50 cluster methodology suggested by the DPPC in 1995 was actually set up as a surveillance system and so the sample size was determined to assess changes in nutrition status, rather than absolute levels. This is, of course, perfectly acceptable in a programme that is designed to monitor the nutritional situation *very regularly*, but in most cases nutrition data is not collected very regularly in Ethiopia (see Chapter 2).

It is important to remember that the fewer the clusters, the larger the confidence interval of, or range around, the estimate of the prevalence of malnutrition will be (see Section 4.8). Thus, although the DPPC method described above was able to estimate the prevalence of malnutrition in an area at any one time (cross-sectionally), the 95 per cent confidence interval around this estimate was large.

The DPPC, therefore, currently recommends that the 30 by 30 cluster sampling methodology, which gives smaller confidence intervals, is used to assess the nutrition status of a population in normal circumstances, and is more statistically valid. Surveys undertaken using this method can then be compared, either longitudinally or cross-sectionally.

Because the DPPC needs to be able to measure differences in nutritional situation across space (geographical areas) and time (longitudinal differences) it is more useful for agencies to use the standard 30 by 30 cluster methodology when assessing nutrition status, than the 12 by 50 method described in the earlier manual.

Summary of main points in Chapter 4

- Samples are taken to save time and resources.
- If a sample is unrepresentative or biased, then the results of a survey cannot be generalised to the whole population.
- All sampling methods use a highly ordered form of selection designed to eliminate observer bias.
- Under normal circumstances, the DPPC recommends that all agencies adopt the standard WHO 30 by 30 two-stage cluster sampling methodology to undertake nutritional assessments in rural Ethiopia.
- In certain circumstances, it may be necessary to make adjustments to the standard sampling methodology. This is acceptable, as long as it is clearly described in the assessment report. Remember that inappropriate changes to survey methods are liable to give misleading results.

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were undertaken in selected areas. In each area, clusters of children were randomly selected every two years. Information on the socio-economic situation of these children, their weight and height, and rainfall and other ecological factors were collected regularly. The change in the nutrition status of the children was calculated, and an analysis of the change in all the factors (socio-economic changes, ecological factors and nutrition status) was used to help predict the needs of the area.

Chapter 5

Non-anthropometric data

If we want to make sense of a nutrition survey we need to understand the causes of malnutrition in the survey area. Unless we know what the causes of malnutrition are, it will be impossible to design an appropriate intervention. There is no point wasting time and money collecting anthropometric data if we do not also collect data about why, if any, malnutrition exists.

Example 5.1
A nutrition survey in Moyale District of Liban Zone in 2001 estimated the prevalence of global acute malnutrition at 35% (<-2 z-scores and/or oedema) and severe acute malnutrition at 9.8% (<-3 z-scores and/or oedema). The survey report noted that although the population was food insecure, this was not extreme. However, the carers of 5% of the children reported that the children had had measles in the two weeks prior to the survey. The measles vaccination rate was also very low (15%). This information suggested that the very high rate of malnutrition was due to a measles outbreak rather than to food insecurity. The correct intervention was a large-scale measles vaccination in the area, not just food aid. Without the additional information on measles it would not have been possible to recommend an appropriate intervention.

So, anthropometric data is only part of the information that we need to collect in order to make sense of a situation and decide how to intervene. This chapter will focus on non-anthropometric information that is useful in a nutrition survey. We will discuss what type of information is necessary and how to collect it.

5.1 What non-anthropometric data is useful for nutrition surveys?

In order to plan an intervention to respond to a nutrition crisis properly, information on the following topics must be available at the end of any nutrition assessment:

- population figures, population movements and vulnerable groups
- causes of the crisis and geo-political context
- nutrition status and diet of the population
- food security
- coping mechanisms
- mortality and health indicators
- operational and relief activities
- community's perceived needs.

Table 5.1 outlines these categories of information in more detail and explains why the information is important. The table is only an outline of suggestions of the type of information required. It is *not* necessary to collect all this data for every emergency nutrition assessment: you will have to decide what information you need for each survey, according to what is available and what the context is.

Suggestions on how to collect the data are also given in Table 5.1. Different methods for collecting data are discussed further in Section 5.2. Extra information on how to collect the key health and mortality data indicators is given in Sections 5.3 , 5.4 and 5.5. It is assumed that readers of this manual can refer to other documents (for example DPPC, 2000a-g and SC UK 2000b) to obtain more information about collecting food security data.

Table 5.1 Non-anthropometric information that is useful for an emergency nutrition assessment

Type of information	How/where to collect the information	Why the information is important
1. Context and population		
Population figures • total number of people affected • population composition (women, men, children, older people) • ethnic and religious distribution	• census data • secondary data • interviews with woreda or zone officials • interviews with community leaders • mapping	Population figures are essential for planning any intervention. A rough estimation of population composition is useful to estimate needs for special groups. For example, a displaced population, mainly composed of women, children and older people is at higher nutritional risk than a normal population.
If displaced • total number of displaced people • when did displaced first arrive? • are people still arriving? • number arrived last week • number arrived the week before • number of residents affected	• secondary data • interviews with camp officials and community leaders	Resident populations are often put under stress and destabilised when a displaced population arrives. They may also be in need and should not be forgotten. The relationship between the two populations will depend on kinship, ratio of displaced to resident, the economic situation and the residents' degree of food security.
Vulnerable groups • is there a larger than normal proportion of physiologically vulnerable groups? • are any social, ethnic or religious groups discriminated by the community? • are older people, disabled, unaccompanied children, women head of households, etc, neglected?	• secondary data • interviews with community leaders • interviews with discriminated groups • household questionnaires	Food insecurity and health problems do not affect a whole population in the same way. Specific groups will be at a higher nutritional risk and should be identified in order to set priorities. Physiologically vulnerable groups include children under five years (particularly those aged 6-24 months) and pregnant and lactating women. Special feeding programmes may be required for these groups, so it is important to assess how many there are. Discriminated or vulnerable groups (orphans, older people) may find it difficult to access normal services and so may need extra assistance.

2. **Causes of the crisis and geo-political context**		
Causes of the crisis • obtain a brief history of the crisis, origin, and main events leading up to the current situation	• interviews with woreda officials • interviews with key informants	It is important to know if the crisis is man-made or a natural disaster.
Security for the affected population • what is the overall security situation? • are markets closed or inaccessible? • can people move freely, how far? • what happens at night? • are any groups at particular risk? • is food a source of insecurity?	• interviews with woreda officials, key informants • interviews with groups at high risk • observation	Security determines peoples' behaviour, and their potential to take care of themselves. If a population, or certain groups, are unsafe they may have limited freedom of movement, which can influence their access to markets, land and productive resources. If there are armed groups, food itself can be a security problem because of its value and the fact that it is easy to steal.
Environment and background • rural, urban or camp setting • climate: arid, wet, rainfall patterns, night temperature, etc. • what are the living conditions (shelter, crowding)? If displaced, • what was taken from home (food, cooking utensils, livestock etc.)? • are people fleeing from rural or urban areas; what were their main occupations?	• observation • interviews with key informants, woreda officials • mapping • observation • interviews with key informants, camp leaders • household questionnaires	Location can influence the effects of the crisis and opportunities to develop coping mechanisms. The climate can have dramatic effects on severely malnourished individuals, as they are susceptible to hypothermia. Populations living in cold areas require more food than other groups. The area from which a displaced population originates will affect their ability to cope in a new environment. For example, rural people may find it hard to cope in an urban environment and vice versa. Displaced populations arriving without any possessions are in immediate danger of nutritional deterioration because commodities are not available to sell in exchange for food.

3. Nutrition and diet information		
Malnutrition • has there been an increase in the number of malnourished children reporting to the hospitals, clinics, SFCs and TFCs? • are there any visible cases of adult malnutrition? • are there any known micronutrient deficiency diseases — now or seasonally?	• interviews with MoH staff, NGO staff • health surveillance system (if exists) • observation	An increase in admissions to hospitals, TFCs or SFCs usually indicates a deterioration in the nutritional status of the population. In a resident population, the comparison between the present figures and those of a normal year (in the same time period) help to determine the stage of food insecurity, whether or not it is related to seasonal food insecurity or a food crisis situation. Visible malnutrition among adolescents and adults observed in public or in the home, is an indication of severe food crisis or famine.
• have their been any previous assessments of the nutritional or food security situation in this area? • are there normal seasonal fluctuations?	• secondary information • seasonal calendar	Earlier studies of the nutrition situation provide important background information. These data can be compared to your results.
Diet • what is the normal diet at this time of year? • are the people eating unusual foods?	• secondary data • interviews with key informants • household questionnaires • seasonal calendar	A comparison of current and normal diets in the same season, gives information on the severity of the food shortage in a resident population. It also provides information on the risk of nutrient deficiencies or risk of food intoxication (toxins from wild foods, improperly soaked cassava, or from poor storage).
• how many meals per day are the children receiving? Is this normal?	• household questionnaires • Interviews with women	Children are particularly vulnerable to a poor diet (quantity as quality) and a reduction in the number of meals per day increases the risk of malnutrition. Compare the actual feeding practice to that of a normal year
Food source • what is the origin of the food currently being eaten: own produce, market purchase, food aid,	• household questionnaires • interviews with key	Knowing from where people source their main staple helps define the level of food insecurity. However, you need to consider what is normal for the population. If agriculturalists are entirely dependent on food purchased in the market this may be a sign of a food crisis (or a very good harvest), but it is normal for pastoralists to buy their cereals.

gift, loan? Is this normal for the time of year? • what proportion of food comes from each source?	informants (women) • proportional piling • direct observation	Depending exclusively on food aid is normally a sign of a severe food crisis or famine in any population. Any unusual reliance on wild foods may also be a warning sign.
4. Food security		
Own production *For agricultural communities* • how does the current year's harvest(s) compare with a normal year? • what is the current condition of the crops? • have there been pest or disease outbreaks? • how has the rainfall been? • has planting been as expected? • what type of harvest is expected and when? • are seeds accessible and available for next planting season (price)? • are fertiliser, tools and draught animals available for the next harvest? • are crop prices normal?	• interviews with MoA • interviews with key informants • household questionnaires • observation • seasonal calendar	Information on crop production (current and future) is necessary to estimate how much food the community can produce itself. The length of time until the next harvest is important for estimating how long food aid will be required (if at all). Information on the problems (pest outbreaks, etc) is required to plan interventions. Information on seed availability and accessibility (price affordable) for the next cultivation season is required. In cases of severe food crisis and famine, when households are obliged to eat or sell their own seeds, or when the price of seeds on the market is too high, the farmers will not be able to plant on time and future harvests are jeopardised. Information on fertiliser and tools may also be important for the same reasons.
For pastoral populations • how is the water availability for livestock? • what is the condition of pasture? • what is the condition of livestock? • is there any unusual livestock movement? • have there been livestock epidemics? • are dead livestock visible along the roads? • is the price of livestock normal? • how are the slaughtering, death and growth rates	• interviews with MoA • interviews with key informants • household questionnaires • observation	Pasture and livestock conditions are crucial to pastoralists' survival. Food or water shortages for livestock will oblige herders to migrate unusually with their livestock. In extreme circumstances, they may have to slaughter some of their livestock, or all their livestock in a severe food crisis or famine. Therefore, the price of meat on the market decreases. The presence of dead livestock along roads or in the bush is a sign of great distress. When herders are no longer able to slaughter their livestock (lack of market or animals too weak), the animals die and are left. When figures are available from veterinary services or EWS, the comparison of the present birth, mortality and slaughter rates with those from a normal year helps to

of livestock compared to a normal year? *For both:* • what are the terms of trade? • do the households have any food stocks?	• market surveys • interviews with key informants • household questionnaires	determine how serious a crisis is. Terms of trade are important for both agriculturalists and pastoralists as they determine how much grain can be exchanged for livestock. Information on household food stocks or reserves helps to plan when, if at all, relief is needed.
Markets • what types of food are available in the market? • what is the condition of the market? • are the prices of essential goods "normal" for the time of year? • can the whole population access markets? • can internally displaced people (IDPs) safely access markets?	• observation • market survey • historical price data • interviews with key informants	Availability of food and basic commodities on the market gives valuable information on the cause of the crisis. Many situations involve problems with food accessibility rather than food availability, meaning that markets may be well-stocked, but for various reasons, people have no access to foods. Market accessibility is important because it allows people to diversify their diet (reducing the risk of nutrient deficiencies) and get access to non-food essential commodities.
5. Coping mechanisms[25]		
Sale of assets • are small animals being sold? • are non-productive goods increasingly sold? • are productive assets being sold?	• household questionnaires • interviews with key informants • Observation in market	Sale of non-productive and productive assets can be an important factor indicating a problem of food insecurity being faced (see Chapter 1). In food insecure situations, the majority of households sell non-capital goods, (furniture, cooking pots, clothes, jewellery, surplus livestock). In a crisis, many households are obliged to sell their productive assets (tools, food reserves, seeds, reproductive livestock, land, land-rights, house, etc). This reduces their ability to produce and generate income. Self-support is threatened and it may be difficult to maintain livelihoods until the end of the crisis. Future livelihoods may also be affected. In famines, the majority of households have sold their productive assets and are completely destitute.

[25] Different types of information on coping mechanisms is also described in other sections, for example dietary information is found under section 3 of this table.

Development of new activities • what are the populations' main income-generating activities? Are these normal for the time of year? • are new activities being developed? • have pastoralists moved to new areas that are unusual for the season?	• household questionnaires • interviews with key informants • observation of daily activities	A common coping mechanism is to diversify income-generating activities. Activities may include increased wood collection to produce charcoal, selling water and doing other odd jobs. These new activities can temporarily alleviate the effects of the crisis and are usually only employed for a short time. Yet, in food crises or famines, when households have lost all of their capital assets, this change can become permanent and threaten future self-reliance.
Migration • has temporary migration in search of jobs increased more than is usual for the season? • which family members are migrating from the area? • have any households permanently migrated? • are other households planning to migrate permanently?	• interviews with woreda officials, community leaders • household interviews • mapping	Migration is a common coping strategy during the hungry season. A distinction must be made between usual and unusual migrations. In all societies, numerous people moving in search of food for immediate survival (distress migration) indicates famine. In rural populations, when whole households start to migrate in an unusual way, an impending crisis is likely. In pastoral societies, when families or certain family members are obliged to move further than usual in search of grazing areas, or water, a food crisis may be developing.
6. Mortality and health indicators		
Mortality • Crude mortality rate (CMR)/10 000/day • Under-five mortality rate (U5MR)/10 000/day	See Section 5.3 for collection methods	The crude and under-five mortality rates are key indicators in determining the severity of the situation. It is vital to estimate rapidly these data, even if they are not precise.
Morbidity/epidemics/outbreaks • is there currently an epidemic of any sort? For example, diarrhoea (bloody and non-bloody)? • are measles cases being reported?	See Section 5.3 for collection methods	Epidemics of measles and shigella have a direct impact on the nutrition status of the population. The incidence and the severity of other communicable diseases will influence, and be influenced by, the nutrition status of individuals.

• is malaria currently a problem? • are there any endemic diseases, ie, diseases which happen every year at a particular time of year?	• interviews with MoH, community leaders • secondary information	
Immunisation coverage • what are the rates of immunisation coverage? • when was last measles vaccination campaign? • was this coupled with vitamin A distribution? • what is the vitamin supplementation rate?	See Section 5.5 for collection methods	In emergencies, information concerning measles immunisation coverage of the under-five population must be collected. Vitamin A deficiency is associated with increased mortality, especially when children are low WFH. Information on supplementation rates can determine whether or not a vitamin A distribution is necessary.
Water, hygiene and sanitation • is the water supply adequate (quantity, quality) or has it changed from normal (> 15 litres/per/day)? • are people buying water, if yes at what price? • distance to, and time of queuing at, water point (< 500 meters, < 30 minutes queuing) ? *In displaced populations* • number of persons per latrine (< 20 persons per latrine) • presence and condition of defecation area	• interviews with key informants, community leaders • market survey • observation • interviews with camp leaders • observation	Insufficient water provision in terms of both quantity and quality increases the risk of diarrhoea diseases and other water-born diseases. Water is an important consideration for an entire population, not only the displaced Water prices can sharply increase during a drought particularly in an urban area and dry areas. This results in people buying less water. Time spent on water collection influences water quality and time available for child care. Bad hygiene in crowded camps for displaced people can lead to epidemics of cholera, etc.
Health facilities • what is the structure of the health system in the area? • are health facilities accessible and functioning? • how far are the facilities from the population?	• interviews with MoH • interviews with community leaders • observation	Information on what health services are currently available to the population is useful when planning a response which involves health.

• is access possible (payment, discrimination, etc)? • availability of medication in other places (pharmacies, markets etc)		
Caring practices • have normal caring practices been disrupted? In what way? • what social support exists within the household and community? • does the population have any special food taboos?	• interviews with women • observation	If child caring practices have been disrupted because of the crisis, then children's nutrition status may be affected. Examples include disruptions in breastfeeding or changes in weaning foods. Food taboos are important when planning relief supplies.
7. Operational information		
Accessibility • what are the main constraints faced by the population and agencies working in the area? • geographical accessibility of the affected area?	• interviews with woreda officials and other line ministries, including the DPPC • observation	This information is necessary to determine strategies, programme design and the size of intervention. Information on the main constraints met by the local community and by other agencies working in the area (security, environmental, logistical) is required. The information must consider access to the population in need — presence and condition of roads, availability of an airstrip or alternate modes of transport for local and regional transport capacity.
Resources and storage • what are existing food stocks like in the region or nationally? • constraints and opportunities concerning human resources • are there suitable health facilities or buildings,	• interviews with the DPPC • interviews with woreda officials • observation of buildings and storage facilities	When planning food procurement it is necessary to know what is already available. The presence or absence of skilled personnel at the local level is important when designing programmes. Are trained personnel available to run SFP and TFPs? If not, is it necessary to ask another agency to run these programmes?

which can be used for feeding or storage centres? Are they secure?		Lists of possible locations (health facilities, buildings, etc) where feeding or storage centres could be implemented are important for planning the logistic needs.
Ongoing interventions • have the local authorities, NGOs or the community taken any action yet? • what actions have been undertaken? *If there is a food security problem* • what feeding programmes exist? Who is in charge of these programmes? • is the capacity sufficient (quality, coverage)? • what is planned in the near future, number of feeding centres and number of beneficiaries? • what other programmes are there? • are they addressing long -term problems?	• interviews with MoH • interviews with community leaders • interviews with NGOs working in the area • observation	If you are going to recommend intervening in an area, it is important to know what other organisations are doing, to stop any overlap and improve co-ordination of responses. In particular, information on nutrition-related interventions are necessary. Information on the existence, access and regular functioning of health facilities, hospitals, TFCs, SFCs and dispensaries are necessary to define needs and plan interventions.
General food distribution (GFD) • what is the theoretical ration? • who is in charge of distribution? • date, content and quantity of last distribution • number of beneficiaries • implementation of the distributions (chaotic, violent, etc?) • is the distribution equitable? Is any group excluded? • any suspicion of food diversion? • any food shortages now or expected (pipeline, transport, etc)?	• interviews with DPPC, woreda officials, NGOs in area • interview with key informants, community leaders • household questionnaires • observe food distributions	Information on general food distribution is obviously very important in times of food insecurity or famine. It is important to see if any groups are being excluded and if the ration is correct (in terms of quantity and quality).

• when is the next distribution planned?		
Coverage of nutrition programme • are households with malnourished children receiving a supplementary ration? • what is the coverage of the SFC or TFC?	See Section 5.5	If a special feeding programme is in place, it is useful to get information on the coverage of the programme in case any adjustments are necessary.
8. Community's perceived needs		
• what are the communities' immediate concerns and priorities? • how do they regard the situation compared to other crisis episodes?	• Interviews with different groups — rich/poor, agriculturalists/pastoralists, men/women	Community participation in recommending interventions is important for acceptance.

5.2 How to collect non-anthropometric data

Data gathering and analysis are dynamic processes. Analysis starts during the course of the data gathering since information and data collection will be adapted depending on the situation.

Example 5.2
When the first information collected points towards a severe food crisis, the assessment will re-focus on how many people are affected, where they are, what their needs are and what feasible action should be implemented immediately.

Different qualitative and quantitative methods should be used. The validity and reliability of data is crucial since it is gathered for decision-making. Good quality data is more important than the quantity of data collected. Thus, observations and information should be collected from various sources and cross-checked. Repeating and reformulating questions with different people can be a useful way to compare information. All data should be carefully collected and, when based on reports, the sources and dates should be verified and indicated.

The most commonly used methods of data collection for nutrition surveys are described below. This list is not exhaustive and other methods exist.

- secondary information
- direct observation
- household questionnaires
- community questionnaires
- market surveys.

Remember that the purpose of collecting data using different techniques and different sources is to ensure that it can be cross-checked and validated.

5.2.1 Secondary information

The purpose of collecting secondary information is to review and summarise all the existing information and knowledge about a situation. You should be thorough, seek all potential sources of information and summarise the relevant points in clear and concise notes.

This type of research should be carried out before you undertake a nutrition survey, because it will save you repeating work already carried out by other organisations. It may also reveal gaps in the existing knowledge, suggest what extra information is needed and stimulate ideas. You should, however, be aware that secondary information can be out-of-date or biased. In addition, history does not always repeat itself and what has happened in the past may not necessarily happen again.

Table 5.2 gives some examples of where you can obtain secondary information in Ethiopia. It should be noted that the information obtained from the Government offices can be from different levels (federal, regional, zonal or woreda).

Table 5.2 Useful sources of secondary information

Source	Type of information
Central Statistical Authority (CSA)	• census data • economic and social indicators
Administration offices	• population statistics • EW information • current and previous relief plans • logistics • maps
Ministry of Health	• coverage of health services • immunisation coverage • vitamin A supplementation • availability of essential drugs • major causes of morbidity and mortality and numbers of people affected • recommended treatment/procedures
Ministry of Agriculture	• population statistics • climate • farming systems • availability of tools, fertiliser, seeds • livestock quantity and condition • crop harvests and condition • market prices
DPPC	• previous nutrition assessments (from ENCU) • population statistics • EW information • current and previous relief plans • logistics
Department of Planning and Economy	• maps • population statistics
NGOs and UN agencies	• previous nutrition and food security assessments • their views of the situation
Ethiopian Health Research Institute	• previous nutrition and food security assessments

5.2.2 Semi-structured interviews

Semi-structured interviewing is a way of informally guiding a discussion to obtain information. The interviewer often has a checklist of key areas he or she wishes to learn about. The structure is flexible, to allow the interviewer to follow-up points of interest and ask new questions that arise as the discussion continues.

Individuals of interest are often people who have special knowledge including: woreda officials, DPPC officials, MoH and MoA staff, women and community leaders, etc. Obviously, you will ask the different groups questions about their own particular area of expertise.

Example 5.3
If you want to find out about child caring practices, you would probably question a group of mothers. Older people may be asked about previous problems in the area. Community leaders may be able to provide information on population size, etc.

It is also important to seek out the people who are most vulnerable to nutritional problems. This is often female-headed households and the destitute, or near destitute. Remember that perceptions of who these people are will vary, and some key informants may not want to identify them.

Semi-structured interviews are an extremely useful way of obtaining a lot of information relatively quickly — you do not have to ask every household all the questions. However, you must be careful to look for bias when undertaking interviews with people who have a special interest.

5.2.3 Direct observation

Direct observation, by looking and learning, is one of the best ways to cross-check what people are saying. For example, if stories of severe malnutrition and dead livestock are common, have you seen this, and if not why not?

Direct observation involves looking at the environment, the condition of the harvest and livestock, the physical appearance of the population and its living conditions (household hygiene, etc). Observation can also provide information about social interactions and caring practices.

Important sites to visit and observe during assessments include markets, health centres, water sources and food distributions.

5.2.4 Household questionnaires

Household questionnaires are used to obtain information at the household level. If the households are properly selected then this type of questionnaire can give a broad picture of what is happening, without the bias introduced by asking only special-interest groups.

Example 5.4
Imagine you want to ask questions about what people are eating, and whether or not they are receiving food aid. If you ask community leaders or woreda officials they may answer that everyone is receiving food aid equally. If you ask people at the household level you can check this, and be sure that no particular group is being excluded.

Ideally, you would use household questionnaires in every household in the anthropometric survey, but this can be very time-consuming. In emergency nutrition assessments, household questionnaires are normally designed to help you fill in the gaps in your secondary data and observations, or to confirm what key informants have told you. The data you collect in household questionnaires is not statistically valid — it is meant to give you a broad picture of the situation only. Thus, it is normally acceptable to use the household questionnaire only at every third household in the survey.

There is *no standard* household questionnaire for an emergency nutrition survey. In some situations there is no need for a household questionnaire at all. For example, if you think that all households are living in a very similar way, then you could just ask a community questionnaire (see Section 5.2.5). The questionnaire you design will depend on the situation: the population's livelihood system, the season, the reason for the emergency and other contextual factors.

Example 5.5
If you know that the population is 100 per cent pastoralist and people do not grow crops, then there is no point in asking them about crop production. Instead, you should focus your questions on livestock condition, water and pasture availability, terms of trade, etc.

Normally, the most useful information that you can obtain from household questionnaires is about:

- diet — food sources, number of meals consumed per day, types of food consumed
- food security — food stocks, livestock condition and type, income generating activities
- caring practices — maternal education level, weaning practices, constraints for caring practices
- health practices — use of contraception, use of medical facilities.

When designing a household questionnaire you should always take two important factors into consideration: the information you already have and how sensitive an issue is. There is no point asking households a question you already know the answer to, and asking questions about very sensitive issues can be both offensive and time-consuming.

Example 5.6
If you know for certain that there has been no rain in the area for six months, then do not ask each household about the rainfall pattern — it is a waste of your and their time.

Example 5.7
Asking rural households how many animals they own can be like asking urban households how much money they have in their bank account. It is extremely difficult to get a straight answer to this question. It may be more useful to ask them what type of animals they have, or whether or not their herd size has increased or decreased. You could then cross-check this information with direct observations and interviews with the MoA and community leaders.

When designing a household questionnaire, where possible, always try to start questions with:

- where…?
- what…?
- why…?
- when…?
- how…?

This helps to stop you directing the answer. For example, “Where do you get your food from?” is likely to give you more information than “Do you get your food from food aid?”.

Finally, remember to field test your household questionnaires before the proper survey (see Section 6.10).

Examples of household questionnaires are given in Annex A5.1.

5.2.5 Community questionnaires

Community questionnaires can be useful tools for obtaining information about factors that affect the whole community. Community questionnaires normally focus on more general information than household questionnaires. The types of information usefully collected in community questionnaires include:

- causes of food insecurity (if any) — rainfall patterns, condition of the harvest, availability of fertiliser, livestock epidemics, delivery of relief food, etc
- general human and livestock health — disease outbreaks, immunisation campaigns
- coping mechanisms — migration patterns, off-farm employment opportunities
- community perception of the problems and possible solutions.

You would normally ask a community questionnaire in each locality that you visit for the nutrition survey (so you would ask 30 community questionnaires in a standard 30 by 30 survey). Generally you would call for the community leaders and elders to answer the questions in a group, but you must make sure you also include some women. In some areas, it might be useful to do a questionnaire once with a group of women and then again with a group of men — all of whom live in the same area.

Again, there is no standard community questionnaire for every nutrition survey. You will need to design each one separately. In some cases there is no need for a community questionnaire. Remember to field test your community questionnaire (see Section 6.10).

Examples of community questionnaires are given in Annex A5.2.

5.2.6 Market surveys

The objectives of a market survey are:

- to measure current cereal and livestock prices for comparison with other years
- to estimate the availability, access and supply of food in the market
- to estimate the terms of trade.

The information can be collected from local or major markets and traders. When collecting the information it is important to take precautions to avoid getting inflated prices. If people know that the information is going to be used for relief purposes they may inflate the prices.

In local markets different people should be interviewed. You should interview both traders and local people who are selling livestock or cereal in the market. Remember to take a standard local measure so that you can easily convert cereal prices per local measure into quintal.
It is also important to obtain information about where the grains or animals have come from. Prices normally depend on the source, local availability, distance and road accessibility. If the area

is normally self-sufficient, but currently dependent on imported grains, this can be a sign of a food crisis.

Price comparisons should be made with prices recorded in previous years during the same season. When baseline data is not available you can interview traders for this information.

5.3 Mortality data

Mortality data is often collected in nutrition surveys. Mortality data can tell us about how many people have died immediately prior to the survey. This information is a powerful tool to use when advocating for an immediate response, although it is, of course, a very late indicator of a crisis. Baseline mortality data should also be established to evaluate the ongoing efficacy of assistance programmes. This is also essential in the interpretation of anthropometric results (see Chapter 8).

In emergency situations mortality is normally reported in two ways: crude mortality rate (CMR) — the total number of deaths reported over a given period of time, and under-five mortality rate (U5MR) — the total number of deaths among children under five reported over a given period of time.

Mortality rates

Crude mortality rate (CMR) = total deaths/10,000 people/day

Under-five mortality rate (U5MR) = deaths in children under five/ 10,000 children under five/day

There are several different ways to collect mortality data:

- by a retrospective mortality survey, which can be attached to a nutrition assessment
- by gathering data on death registrations, if available, or lists or registers that are held by local leaders (funeral associations), clinics, hospitals or local authorities
- by counting the number of graves, although this is not always feasible (for example, it is impossible in a setting where bodies are incinerated). This method cannot be used to assess mortality rates prior to displaced people moving.

5.3.1 Sampling for a retrospective mortality survey

If you are going to collect mortality data retrospectively, it is quite easy to combine this with an anthropometric survey by using a separate mortality questionnaire. Like an anthropometric survey, you can use simple random, cluster or systematic sampling to collect mortality data (see Chapter 4). It is useful to use the same clusters as the nutrition survey, but in a mortality survey you are sampling households not children. In general, for a mortality survey you need a sample of 900 households (30 by 30) if you are using cluster sampling and 450 households if you are using systematic sampling (Moren, 1995).

Selection of households is similar to that for anthropometric surveys. However, all households, including those with no children aged 6-59 months, are eligible for selection. This is because households with young children may not be representative of the whole population and we need a sample that is representative of everyone. Thus, when you are using cluster sampling, after the selection of the first household (see Chapter 4) a mortality survey should visit all the subsequent houses to the left or right, including those with no children.

Example 5.8
You visit a household, but it has no young children. If the reason the household has no young children is because a child died recently, then this information would be important in a mortality survey. So we should include this household in the mortality survey for estimating both U5MR and CMR.

This means that although a mortality survey may be usefully coupled with an anthropometric survey, the households included in the two surveys are not necessarily the same. An anthropometric survey requires 30 children per cluster, whereas a mortality survey requires 30 households per cluster, including households which do not have children aged 6-59 months.

An anthropometric survey requires 30 *children* per cluster, whereas a mortality survey requires 30 *households* per cluster, including households which do not have children aged 6-59 months.

In practice this does not normally make much difference. When you are undertaking a anthropometric survey you normally have to visit about 25 houses (because you normally find more children than houses). If you are doing a mortality survey you need to visit thirty households, this means that you need to visit about five extra households. Of course, sometimes you will need to visit more than 30 households to get 30 children, so the mortality survey won't mean any extra walking at all!

5.3.2 Questionnaire variables for a mortality survey

In crisis situations, deaths occurring in the month prior to the survey are investigated. In a more stable situation, the questionnaire inquires about deaths dating back three months. Longer recall periods are not recommended as people can make mistakes about remembering who died and when. It is also useful to find an important incident in the area that happened around the time period. For example, you could ask how many people have died since Fasika, or Timkat, or the start/end of Ramadan.

The following data should be collected:

- number of persons per household at the time of the survey (number of children aged less than five, and others)
- number of deaths (all, and under fives) in the household during the month (or three months) preceding the survey.

The questionnaire can also ask about the cause of death. However, this data is often difficult to collect when death takes place outside health facilities. Information collected from family members is generally not very reliable. Data on cause of death should therefore be limited to very common diseases such as diarrhoea and acute respiratory infection, or to any specific disease that may be causing an outbreak, for example, malaria or measles. Information on the most common causes of death can also be obtained from MoH staff.

An example of a mortality questionnaire is provided in Annex A5.3. An explanation of the calculation of mortality rates is given in Chapter 7. The interpretation of mortality data is discussed in Chapter 8.

5.4 Morbidity data

Even during famines, people rarely die as a direct result of famine — people die because they catch infectious diseases (measles, acute respiratory infections, diarrhoea and malaria). These diseases may spread more rapidly because of conditions found during famine, and also may be more severe or of longer duration because people are malnourished. Of most immediate importance are recent or current outbreaks of disease that may be contributing to excess mortality and/or malnutrition. Information on which diseases are most common will help you to plan an intervention.

Unfortunately, good data on morbidity is difficult to obtain. Different people understand different things by diarrhoea or fever, so you have to use standardised case definitions and this can sometimes be difficult. Also, some symptoms (like diarrhoea and fever) are associated with more than one disease (like malaria and measles).

Probably the best way to get information on morbidity is from MoH staff and through discussions with women or community leaders. They can tell you if there have been any outbreaks and what the major illnesses are at the time of the survey.

Data on morbidity of children can also be collected during a nutrition survey, but the interpretation of this data should be done very carefully. It is most useful to collect information only on very common diseases, or very well-known diseases (like for mortality). Thus, questions about measles, diarrhoea and fever are commonly included. This type of information should always be cross-checked with MoH staff and key informants.

An example of a questionnaire with morbidity data attached to the anthropometric questionnaire is given in Annex A5.4.

5.5 Immunisation and vitamin A supplementation data

Immunisation data, particularly information on measles vaccination and vitamin A supplementation, is always important in nutrition emergencies.

5.5.1 Measles immunisation

Measles and malnutrition are closely associated: poor nutrition makes children more susceptible to measles and makes the attack of measles worse. In turn, measles leads to increases in malnutrition because of diarrhoea and fever (see Chapter 1). Therefore it is extremely important to prevent malnourished children from getting measles by immunising them. If the rates of vaccination are low, then a measles vaccination campaign is always advisable.

It is common, and advisable, to add questions about measles vaccination to nutrition surveys. This allows us to find out the rate of measles vaccination in children aged 9-59 months. If the rate is low, and there is a problem of malnutrition, then a measles vaccination campaign should be instigated immediately.

In Ethiopia, measles vaccinations are given either during campaigns, or during routine EPI work. Children should be vaccinated for measles at nine months. You can tell whether or not a child has had a measles vaccination by examining his vaccination card, or by asking his carer to remember whether or not he has been vaccinated.[26]

5.5.2 BCG vaccination

A BCG vaccination partially prevents an individual from developing TB. Children should receive a BCG injection soon after birth. In Ethiopia, BCG vaccinations are not normally given during vaccination campaigns (unlike measles), but are routinely administered by the MoH when the child visits the clinic, or during routine EPI work. It is, therefore, interesting to measure the rate of BCG vaccination because it gives an indication of how well the health system is working in a given area. In addition, TB is associated with chronic (long-term) malnutrition in both adults and children.

BCG vaccinations are relatively easy to detect. You should look for a scar on the upper arm. The scar is normally on the right arm, but may be on the left, so you should check both.

5.5.3 Vitamin A supplementation

Vitamin A deficiency is associated with increased mortality, especially when children have low WFH. Low WFH is usually associated with low vitamin A body stores and often with frank vitamin A deficiency. Furthermore, vitamin A requirements are greatly increased during nutritional rehabilitation.

Vitamin A deficiency is difficult to detect without special training. However, information on supplementation rates can determine whether or not a vitamin A distribution is necessary.

When asking a mother about vitamin A supplementation, it is normally easier to bring a capsule with you. Show the mother the capsule and ask her if her child has taken one of the capsules in the past six months (the capsules are normally distributed in conjunction with vaccination campaigns).

An example of an anthropometric data questionnaire with questions about supplementation and immunisation is given in Annex A5.4. An explanation of how to calculate immunisation and supplementation rates is given in Chapter 7.

5.6 Programme coverage data

Nutrition surveys are also a useful time to measure the coverage of a special feeding programme. For example, if a targeted supplementary feeding programme for all malnourished children has already started when you undertake a nutrition survey, it may be useful to find out what the coverage of the programme is. This can help you adjust the programme if necessary.

A simple question about whether or not each child measured is enrolled in the feeding programme can be added to the questionnaire (see Annex A5.4 for an example of a questionnaire).

[26] In Ethiopia, children who are immunised for measles during a campaign do not receive an immunisation card, so we have to ask mothers to remember whether or not their children were vaccinated.

The coverage rate is calculated as:

$$\text{Coverage rate} = \frac{\text{number of malnourished children who are registered in the programme}}{\text{total number of malnourished children}}$$

The calculation of coverage rates is discussed in more detail in Chapter 7.

Summary of main points in Chapter 5

- In order to plan an intervention to a nutritional crisis properly, information on the following topics must be available at the end of any nutrition assessment:
    - population figures, population movements and vulnerable groups
    - causes of the crisis and geo-political context
    - nutrition status and diet of the population
    - food security
    - coping mechanisms
    - mortality and public health indicators
    - operational and relief activities
    - community's perceived needs.
- Different qualitative and quantitative methods should be used. The validity and reliability of data is crucial since the data is gathered for decision-making. Thus observations should be made and information should be collected from various sources and cross-checked.
- Information on mortality, morbidity and immunisation rates can easily be collected in conjunction with an anthropometric survey. This information helps interpret the anthropometric data and plan interventions.

Chapter 6

Fifteen practical steps for conducting a survey

This chapter will describe the practical steps for undertaking an anthropometric survey. Some of the steps have been described in detail earlier in the manual and so will only be referred to briefly here. Other steps have not been discussed yet and will be describe here in full. The steps are:

1. Decide whether or not the survey is necessary.
2. Define survey objectives.
3. Define geographic target area and population group.
4. Meet the community leaders and local authorities.
5. Determine timing of the survey.
6. Select sampling method and clusters (if required).
7. Gather all available background information.
8. Decide what information to collect and design questionnaires and surveyor's manual.
9. Obtain and prepare equipment.
10. Field test questionnaires.
11. Select the survey team.
12. Train survey team members.
13. Implement the survey.
14. Analyse and interpret your findings during the survey
15. Write the report.

There will, of course, be overlap between these steps, particularly the first four steps, and so the exact order in which you undertake these activities may not be the same as the order described here. Steps 1-3 and 6-9 will probably take place in the DPPB's office, or via the telephone. The remaining steps will normally take place in the field.

6.1 Decide whether or not a survey is necessary

As described in Chapter 2, the final decision to undertake a nutrition survey will be made by the Regional DPPC, in conjunction with the zone and woreda officials. The actual decision-making process will depend on regional variations in the organisation of the DPPB. The DPPB should always discuss this decision with the Federal DPPC: this is important to prevent repetition and overlap of surveys.[27] The decision process for an NGO wishing to undertake a nutrition survey will be different, but NGOs should always seek permission from the DPPC and the local administration before undertaking a nutrition survey.

Conducting a nutrition survey is expensive and time-consuming, so before starting a survey you should consider the following points:

- Are the results crucial for decision-making? If a population's needs are obvious, immediate programme implementation is the first priority. A nutrition survey can be carried out later. For example, if there has been a natural disaster, such as an earthquake or landslide, and it is clear that the population's main food source has been destroyed, it is not necessary to undertake a survey. Similarly, if another agency

[27] Currently the Federal DPPC undertakes surveys as well, but it is envisaged that as the Regionalisation process progresses more autonomy will be granted to the Regional DPPB.

has recently carried out a nutrition survey in the same area then it should not be necessary for the DPPB to repeat the process.

- The assessment results must be used to inform action. There is no point undertaking a nutrition survey when you know that a response will not be possible (unless the data is to be used for baseline information). Before undertaking the assessment you should ensure that a response is possible, if needed.
- Is the affected population accessible? Insecurity or geographical constraints may result in limited access to the population of interest. If this is extreme, a survey cannot be conducted.

Unless these three pre-requisites are fulfilled you should not undertake a nutrition assessment.[28]

6.2 Define objectives

Before starting any nutrition assessment you must be clear about your objectives. Precise and clear objectives will make it much easier for your team, the survey population and donors to understand what you are trying achieve.

Usually, the DPPC and other agencies in Ethiopia will undertake emergency nutrition surveys in order to quantify the proportion of acute malnutrition in a given population, at a defined point in time. If the survey is undertaken in an emergency situation, the nutrition information should help the agency to:

- estimate the prevalence of acute malnutrition in children aged 6-59 months
- understand the causes of malnutrition in the area
- if necessary, make recommendations about suitable interventions.

Alternatively, if the survey is undertaken during a good or normal time, then the data can be used to establish a baseline, from which changes in nutritional status can be monitored over time.

Undertaking a nutrition survey provides an ideal opportunity for agencies to see a population they are assisting, or planning to assist. It is sometimes useful to collect additional information on the population, such as mortality, immunisation and nutrition programme coverage data (see Chapter 5). This can help inform interventions. Thus, many nutrition surveys have additional objectives which include:

- estimating the prevalence of measles vaccination and the rate of vitamin A supplementation
- estimating impact and coverage of feeding programmes
- estimating mortality rates.

6.3 Define geographic target area and population group

You need to decide in which area the survey should be conducted, and which population groups you will assess. In most cases, the area chosen will correspond to one or more administrative areas (for example, a woreda or a zone). The survey must be conducted in an area where the whole population has a similar nutritional situation. Remember that if you conduct a survey of a woreda with two very different agro-ecological zones, the results will be averaged over the two zones, and

[28] Sometimes it may be difficult to fulfil the second requirement (make sure that a response will be possible) if the results are going to be used to lobby for a response.

will mask any differences that exist. You can only resolve this by undertaking two separate surveys, but this is costly (See section 4.2 for more details on this point).

You also need to decide at this point what age group to measure. As stated in Chapter 3, anthropometric surveys are usually carried out amongst children aged 6-59 months. (If age is unreliable, children will be selected by their height — 65-110 cm).

In some specific situations, a nutrition survey can be conducted amongst adults or adolescents, but remember these surveys are much harder to undertake and you should seek advice from the ENCU before you undertake one (see Section 3.8 for more).

6.4 Meet the community leaders and local authorities

It is absolutely essential to meet the community leaders and local authorities before trying to start a nutrition survey. During your visit you should:

- make sure the community fully understands the objectives of the survey. If the population does not understand why you are doing a survey, you may not be able to guarantee co-operation during the survey's implementation
- agree the dates of the actual survey with the community and local authorities
- obtain information on population figures (particularly at the kebele or camp level)
- obtain information on security and access in the survey area. This information will help you plan the survey better
- obtain a map of the area in order to plan the survey
- obtain letters of permission from the woreda office, addressed to the kebele chairmen, stating that you will be visiting. The letters should explain why you are conducting a survey and ask for the population's co-operation.

6.5 Determine timing

The exact dates of the survey should be chosen with the help of community leaders and local authorities in order to avoid the survey conflicting with market days, local celebrations, food distribution days, vaccination campaigns, or other times when people may be absent. It is important to take the agricultural calendar into consideration because women may be in the fields for most of the day during certain seasons.

The survey schedule should allocate time for preparation, training, pilot surveying, community mobilisation, data collection, analysis and reporting.

6.6 Select sampling methods and clusters

Once you have decided what population group in which geographical area you want to assess, you can decide on your sampling method and, if necessary, select the clusters. This process is described fully in Chapter 4. Remember to select extra clusters if you are in an insecure area.

6.7 Gather available information

Before starting the survey, all available secondary information should be collected, as discussed in Chapter 5. This includes population characteristics and figures, previous surveys and assessments, health statistics, food security information, etc. Once you establish what information is available, you will know what extra information you need to obtain in order to understand the nutrition situation. Only then you can start to design your questionnaires.

6.8 Decide what information to collect and design questionnaires and surveyor's manuals

The information you collect must correspond to the survey's objectives. You should also devise a plan of analysis prior to the data collection to ensure the validity of the questions, and to get the responses in a format that is easy to use during data entry and analysis.

Remember that in order to plan an intervention to a nutrition crisis properly, information on the likely causes of malnutrition must be available at the end of any nutrition assessment (see Chapter 5).

6.8.1 Children's anthropometric data

When you are estimating the prevalence of acute malnutrition in children aged 6-59 months, the following data should always be collected:

- age, in months (from a known date of birth or based on an estimate derived from a calendar of local events)
- sex
- weight in kilogrammes (to the nearest 100g)
- height, in centimetres (to the nearest millimetre if possible, otherwise to the nearest half centimetre)
- presence of oedema.

According to specific survey objectives, other data is optional:

- measles immunisation status (and possibly BCG)
- vitamin supplementation status, especially Vitamin A
- morbidity
- nutrition programme coverage
- MUAC (see Section 3.4.4).

An example of a standard children's anthropometric questionnaire is given in Annex A5.1.

6.8.2 Mortality data

It is relatively easy to couple a mortality survey with an anthropometric survey, but remember that different households may be included in the different surveys. An anthropometric survey requires 30 children per cluster, whereas a mortality survey requires 30 households per cluster, including households which do not have children aged 6-59 months.

An example of a standard mortality questionnaire is given in Annex A5.3

6.8.3 Other data

A variety of methods can be used to collect extra data. This includes household and community questionnaires, key informant interviews, market surveys and observation. These methods are all described in Chapter 5.

6.8.4 Surveyor's manual

If questionnaires are complicated they should be accompanied by a "surveyor's manual" with details on how each question should be asked and recorded. A surveyor's manual is intended as a guide for nutrition survey teams working in the field. These are optional — you only need one if you think that the team might need some clarification in the field.

An example of a surveyor's manual for standard anthropometric and mortality data questionnaires is given in Annex A6.1.

6.9 Obtain and prepare equipment

Measuring material, scales and height boards should be in perfect condition and regularly tested for accuracy. For example, during a survey, scales should be checked each day against a known ten kilogramme weight. If the measure does not match the weight, the scales should be discarded or the springs must be changed.

A list of equipment required should be made. This should include transport facilities, fuel, paper and pens, per diem, etc. An example of a list of materials needed for a survey is given in Annex A6.2.

Information about minimum standards for anthropometric measuring equipment can be found in Annex A2.

Copies of questionnaires, absentee forms and forms for referral of moderately or severely malnourished cases to supplementary feeding and therapeutic feeding programmes (if they exist), should be prepared.

6.10 Field testing questionnaires

Once you have designed your questionnaire you need to field test it. This is done to ensure that there are no errors in the questionnaire, and that the population can easily understand and respond to the questions. There is no standard method for field testing. Normally you would try out a household questionnaire on about ten households, and try the community questionnaire on two communities.

After the field testing you should alter your questionnaire as necessary. For example, if the respondents had difficulty understanding a particular question, you need to change the language of the question in the final questionnaire.

Field testing should not take place in a location where the proper survey will take place, but in a similar community. For example, you could field test your questionnaire in a neighbouring woreda or a PA that has not been selected during the cluster sampling. Do not forget to get a permission letter from woreda officials, even for field testing.

It should be noted that field testing questionnaires forms a separate activity to pilot testing the survey method, which takes place during team member training (described in Section 6.12).

6.11 Select the survey team

Survey teams usually consist of three persons: two to undertake the measurements and one writer/supervisor. The supervisor is responsible for the quality and reliability of the data collected. It is often also useful to have a respected community member on the team. This person can introduce the survey team to the population and assist in guiding the team around the location. The community member is additional to the core (trained) three-person team. In some cases it is also necessary to have a translator on the team.

The team can be composed of health workers, but team members do not have to be health professionals. Anyone from the community can be selected and trained as long as they are able-bodied (there is normally a lot of walking involved) and have a relatively high educational level. They must be able to read and write fluently (we suggest employing people with Grade 10 education or more). Women have more experience of dealing with young children and so are very useful members of a survey team.

Two to six teams may be needed according to the number of households to be visited, the size and the accessibility of the area covered. Obviously, if you are in a great hurry to get the results, then it is more convenient to have more teams. However, the more teams you have the larger the variation in the precision of the results will be. Moreover, it is difficult to supervise and organise (logistically) a larger number of teams.

In general, it is very useful to have a survey supervisor as well as the team supervisors. This person should be experienced in undertaking nutrition surveys, training and managing logistics and people. The survey supervisor will be responsible for training the team members. In addition he or she will visit the teams when they are in the field and check that they are undertaking the assessment properly.

6.12 Train survey team members

The training of the survey team members is a key step needed for the proper implementation of an anthropometric survey. All surveyors should undergo the same training, whatever their former experience, to ensure standardisation of methods. The training usually takes two or three days and should include:

- a clear explanation of the objectives of the survey
- an explanation of the sampling method. This should stress the rationale and the importance of representativeness
- a demonstration and practice of weight and height measurements. Each measurer should practise ten to twenty height and weight measurements and oedema assessment. Annex A2.3 describes a method for helping the team members to standardise their measurements. The purpose of the standardisation exercise is to detect and correct errors in measurement technique prior to the survey

- an explanation of the questionnaire in order to verify the formulation of the questions. Role play exercises are useful for this. If you have prepared a surveyor's manual then you should also explain and test this
- a pilot survey in the field. This is the time to test all the parts of the survey under realistic conditions. Make sure that you visit a location that will not be in the real survey but that is similar to the real site. Data collected during the pilot survey should not be used in the analysis of the results.

A pilot survey is different from field testing the questionnaire as it is intended to make sure that you test all the different parts of a survey, including:

- the sampling procedure. This means that the team will practice selecting the first house and children of the right age
- how to take and record measurements correctly. This means that the team will practice distributing measuring tasks between them
- how to question the respondents. The teams will practice using the questionnaire and surveyor's manual. If necessary, the questionnaire and survey manual can be changed after the pilot visit
- how to organise the equipment logistically (transport and care of equipment).

At the end of the pilot survey, the team members and survey supervisor will have an idea about how long the questionnaires and measurements take for each child. This information will help you calculate how many children you can expect to measure each day during the real survey, and so will help you plan your survey timetable.

6.13 Survey implementation

There are several ways to improve the quality of the data collected during a nutrition survey:

- ensure errors in the field are minimised by using good quality equipment that is regularly calibrated
- check the forms for blank entries at the end of each day to make sure no data is left out. The team supervisor should review all questionnaires before leaving an area in order to make sure no pieces of data have been left out. If there are any problems the team can return to the household
- regular supervision of survey teams by the survey supervisor. In particular, the survey supervisor should check for cases of oedema. If team members are not properly trained it is easy for them to mistake a "fat" child for one with oedema (particularly with younger children). Survey supervisors should look out for teams that are reporting an excessive amount of oedema and actually visit some of these children to cross-check
- do not overwork your teams. When people are tired — and nutrition surveys can be very tiring because of all the walking involved — they make mistakes. Make sure the team has enough supplies to keep them going.

6.14 Analysing and interpreting your findings during the survey

Do not wait until you have completed your fieldwork before beginning to analyse and understand your findings. During fieldwork you can "learn as you go". Record important points in a notebook as soon as you can. Include observations, ideas or hunches. Remember to record the reasons behind them. Label notes with the date, location and name(s) of relevant people.

The team should regularly discuss their findings together. This may bring out important points or indicate necessary changes in the assessment methods.

If possible, at each household, the team supervisor should calculate the percentage weight-for-height median score for each child and classify their nutrition status. If the supervisor finds a malnourished child he or she should refer it to the nearest facility, where possible. Ideally this will be a therapeutic or supplementary feeding programme. If these are not available the supervisor should urge the parents to take the child to the nearest health facility. Obviously, logistical and security constraints have to be taken into account.

You can also calculate the proportion of malnourished children in the sample (see Chapter 7). You can then present these results to the community. Discuss your findings with the community leaders and note their reactions:

- Are the findings important?
- Are they concerned about the malnourished or destitute, or do they have other priorities?
- What is their analysis of the situation?

6.15 Report writing

The final part of a nutrition survey is the report writing. The results of the assessment should be presented in a standardised format so that different assessments can be compared. This issue is discussed further in Chapters 7 and 9.

Agencies must produce their reports in a timely fashion. The results of an emergency assessment must be released and disseminated as soon as possible to prevent any delay in the intervention. The DPPC recommends that the reports for emergency assessments should be available within one month after the survey has been completed. Baseline survey reports may not be needed so rapidly.

Summary of main points in Chapter 6

There are 15 practical steps for conducting a survey:

1. Decide whether or not the survey is necessary.
2. Define survey objectives.
3. Define geographic target area and population group.
4. Meet the community leaders and local authorities.
5. Determine timing of survey.
6. Select sampling method and clusters (if required).
7. Gather all available background information.
8. Decide what information to collect and design questionnaires and surveyor's manual.
9. Obtain and prepare equipment.
10. Field test questionnaires.
11. Select the survey team.
12. Train survey team members.
13. Implement the survey.
14. Analyse and interpret your findings during the survey.
15. Write the report.

Chapter 7

Analysis of results

In order to compare easily the results of different nutrition assessments, we need to present the results in a standardised format. This means that the analysis of the information collected also has to be conducted in a standardised way. This chapter will describe a standard analysis of results, including:

- data preparation and cleaning
- sample description
- analysis of anthropometric, mortality and morbidity data.

Model results tables will also be explained. Further discussion will focus on analysing other data commonly collected during nutrition assessments, for example, programme coverage.

7.1 Analysis by computer or by hand?

The analysis presented in this chapter will assume that you do not have a computer or the software available for computing anthropometric data. In fact, a computer software programme called EpiInfo is freely available from the web (www.cdc.gov) and the ENCU. The Centre for Disease Control (CDC) specifically designed this programme to analyse public health data. A second programme, Epinut, was then designed to analyse nutrition survey data. EpiInfo and Epinut can calculate all the nutritional indices from age, weight, height and sex data.

Unfortunately, it takes time to learn the Epinut and EpiInfo programmes.[29,30] Unless you already have the necessary skills, in an emergency situation it is probably quicker to make manual calculations. This chapter will only describe calculations that are possible by hand.

7.2 Calculating nutrition indices for each child

To analyse nutrition survey data you need to calculate the WFH medians and z-scores for every child in the dataset. The equations to calculate WFH medians and z-scores are given below (see Chapter 3 for a more detailed explanations).

$$\text{percent median} = \frac{\text{individual weight}}{\text{median reference weight}} \times 100$$

$$\text{z-score} = \frac{\text{actual weight} - \text{median reference weight}}{\text{standard deviation for reference population}}$$

[29] SC UK has developed a user manual for EpiInfo, which is available from SC UK and the ENCU. The manual describes how to analyse nutrition survey data using the programme, (SC UK, 2002).
[30] The ENCU plans to give the Regional DPPB training in these programmes in the future. In the meantime the Federal ENCU can provide the Regions with technical support for analysis.

WFH medians are often calculated at the time of the survey (see Annex A5.4 for a model anthropometric questionnaire). However, it may be more difficult to calculate z-scores in the field. These should probably be calculated either at night, or after the survey (when a chair, table and good light are available).

When you have finished calculating WHM and WHZ for each child, your anthropometry form should look something like the one shown in Figure 7.1

Figure 7.1 *Nutrition survey: anthropometric data*

Survey Kebele: 011 Gott: Worset Cluster Number: 12

Date: 21/6/93 Team Number: 3

HH. no.	child no.	Name	Age in months	Sex (F/M)	Oedema (Y/N)	Weight (kg) ±100g	Height (cm) ±0.1cm	% W/H	Registered in SFP/TFC (Y/S/T)	Need to refer (Y/N)	Vaccination			Illness	WHZ
											BCG mark (Y/N)	Measles Card=1 Yes but no card=2 No=0	Vit A (Y/N)	No=N Diarrhoea=D Cough=C Fever=F Other=O	
1	1	Belay Endris	49	F	N	12.9	96.5	89.1	N	N	N	1	Y	O	-1.24
1	2	Alem Endris	18	F	N	8.2	74.5	86.5	Y	N	N	1	N	D	-1.51
2	3	Zeyneba Alebachew	41	F	N	10.9	92.5	80.7	Y	N	Y	2	Y	N	-2.20
3	4	Toyba Aragaw	50	F	N	12.3	95.5	86.5	N	N	N	1	N	N	-1.54
3	5	Mohmmed Aragaw	13	M	N	5.7	65.5	78.5	Y	N	Y	1	N	D	-2.19
5	6	Meka Endris	54	F	Y	15.7	104.5	94.6	N	Y	N	0	N	F	-0.61
6	7	Asya Hussen	28	F	N	10.7	87.0	87.2	N	N	N	0	Y	N	-1.43
13	8	Mersha Said	36	F	N	10.8	87.5	88.8	Y	N	N	0	Y	N	-1.25
15	9	Endris Yimer	50	M	N	13.6	102.5	82.8	N	N	N	2	Y	N	-1.98
15	10	Awol Yimer	18	M	N	8.8	77.5	84.8	N	N	N	2	N	N	-1.9
16	11	Ketemaw Abitew	24	M	N	6.9	76.5	67.4	Y	N	Y	0	N	D	-3.31
17	12	Said Yimer	39	M	N	12.9	93.0	92.3	N	N	N	2	N	N	-0.88
19	13	Fatima Said	15	F	N	8.1	73.0	88.6	N	N	N	0	Y	N	-1.25
20	14	Aleme Adem	50	F	N	15.9	105.0	95.0	N	N	N	0	Y	N	-0.57
20	15	Habtamu Adem	30	M	N	12.7	91.0	94.1	N	N	N	0	N	N	-0.67
21	16	Ebre Girma	23	M	N	9 .9	83.0	86.0	N	N	Y	1	N	N	-1.82

Diarrhoea = more than three loose stools/day; C = cough or difficulty breathing; Fever = high temperature; Other = other illness in two weeks before survey.

HH. no.	child no.	Name	Age in months	Sex (F/M)	Oedema (Y/N)	Weight (kg) ±100g	Height (cm) ±0.1cm	% W/H	Registered in SFP/TFC (Y/S/T)	Need to refer (Y/N)	Vaccination			Illlness	WHZ
											BCG mark (Y/N)	Measles Card=1 Yes but no card=2 No=0	Vit A (Y/N)	No=N Diarrhoea =D Cough=C Fever=F Other=O	
22	17	Ahmed Said	19	M	N	7.6	79.0	71.0	N	Y	Y	0	N	D	-3.66
23	18	Ali Mekonen	43	M	N	14.8	100.5	93.2	N	N	N	2	Y	N	-0.78
27	19	Moh'd Ahmed	45	M	N	14.5	94.0	102.0	N	N	Y	2	Y	N	0.19
28	20	Rukya Endri	45	F	N	15.6	103.0	96.4	N	N	Y	1	Y	N	-0.40
28	21	Aregu Endri	30	F	N	10.3	83.0	90.2	N	N	Y	1	Y	N	-1.06
29	22	Zemal Yimam	38	M	N	11.2	89.0	86.0	N	N	N	2	Y	N	-1.59
30	23	Ebrahim Said	46	M	N	15.3	98.5	99.7	N	N	N	2	Y	N	-0.04
31	24	Merima Kassaw	18	F	N	7.2	69.0	89.0	N	N	N	1	Y	N	-1.16
32	25	Nurye Jemal	50	M	N	13.5	98.5	87.9	N	N	N	1	Y	N	-1.38
32	26	Shikur Jemal	48	F	Y	10.7	91.5	80.6	N	Y	N	1	N	F	-2.21
33	27	Ali Ahmed	46	M	N	13.1	95.5	89.8	N	N	N	2	Y	N	-1.17
33	28	Addisu Ahmed	19	M	N	9.8	80.5	88.9	N	N	N	2	N	N	-1.4
34	29	Adane Yimmer	23	M	N	7.9	77.5	75.5	N	Y	N	1	N	O	-2.53
34	30	Tayech Tesfaye	58	M	N	11.5	100.0	74.8	Y	N	N	1	N	O	-2.85
	31					:	:								
	32					:	:								

Diarrhoea = more than three loose stools/day; C = cough or difficulty breathing; Fever = high temperature; Other = other illness in two weeks before survey.

7.3 Data preparation and cleaning

Before starting the analysis, the data needs to be prepared and "cleaned". Some of the information you have collected during the survey will probably be incorrect. This is because each child's record has undergone a process of measurement, interview, interpretation, listening and recording. Mistakes can be made during any of these processes. Examples of common mistakes include:

- measurement error
- reply error (incorrect information heard)
- data recording error.

If any of these mistakes occur then the information you have on your record sheets will not be "true" information.[31] The objective of data preparation/cleaning is to remove this "false" data so that the data we actually analyse and report is real.

When we check the data during the analysis we have to look for pieces of data that are either missing, out of our required range, or extreme.

7.3.1 Missing data

If we are missing any important piece of data (sex, weight, height, age, oedema) on any of the children then we cannot include this child in our analysis. This is because we will not know whether or not the child is malnourished, or what age, or sex the child is. Children who are missing this type of information have to be excluded from all analyses. For example, if data on oedema is missing then we cannot know whether or not the child is malnourished — we would have to exclude the child from our anthropometric analysis.

7.3.2 Data out of the required range

In most nutrition surveys we are measuring children aged 6-59 months or who are 65-110cm tall. Children outside these ranges should not be included in our results. For example, if a child is measured at 112cm, or is only five months old, it should not be included in the analysis.

7.3.3 Extreme weight for height data

As well as excluding children who have information missing, or who are out of the required range, we also exclude children who have an extremely high or low WFH during data cleaning. By "extreme" we mean biologically unlikely. It is very unusual to find any child with a WHZ<-4.00 or a WHZ > +6.00. The chances of finding a child with such a low or high WFH are very, very small. It is more likely that either the weight or the height data was wrongly measured, or recorded, or that the WHZ was wrongly calculated.

If you find a child with a WHZ outside of these limits (less than -4.00 WHZ or more than +6.00 WHZ) you should first check your calculation of WHZ. If the calculation is correct then you must assume that the weight or height figure is wrong. Exclude the child from further analysis.[32]

[31] Methods to ensure that you get clean or true data are discussed in Section 6.13.
[32] In very extreme famine conditions, where many children are severely malnourished, it is possible that there may be children with WHZ<-4.00 and that the results are not false. In this case you can change the lower level of exclusion to WHZ<-5.00. Before you do this you should try and verify that there really are children with WHZ this low in your sample (by re-measuring if necessary).

Example 7.1
Imagine a child of 75cm whose real weight is 9.0kg. His real WHZ would be:

$$\text{WHZ} = \frac{9.0 - 9.6}{0.8} = -0.75 \text{ z-scores}$$

But if we recorded his weight as 6.0kg then we would think his WHZ was:

$$\text{WHZ} = \frac{6.0 - 9.6}{0.8} = -4.5 \text{ z-scores}$$

We would have to exclude this child from the rest of the analysis.

7.3.4 Mistakes we cannot correct

In general, if we cannot correct data then we delete the record or ignore it during analysis. Of course, it is never possible to be sure that data is completely clean because some errors will not look like mistakes.

Example 7.2
If we recorded the weight of the 75cm child described above as 8.0kg instead of 9.0kg then his WHZ would be:

$$\text{WHZ} = \frac{8.0 - 9.6}{0.8} = -2.0 \text{ z-scores}$$

We would not exclude this child for having an extreme WHZ, so the mistake made will not show up during our data cleaning. This is why you have to be very careful when taking and recording measurements. Even a small mistake can make a big difference.

Once you have finished the data cleaning you can start with the analysis.

7.4 Description of the sample

The first step in an analysis of a nutrition survey is to describe the sample by producing tables showing the distribution of characteristic variables, such as sex and age.

You should always include an age-sex breakdown of your survey sample. This breakdown will indicate if the sample is made up of eligible children. For example, a distribution according to age will show whether or not the sample under- or over-represents any particular age group. An under-representation of an age group may reflect higher mortality in that age group, or a bias in the survey (for example, too many young children because the older children were playing outside the house and were not measured). In the same way, a distribution according to sex allows us to verify that both sexes are equally distributed, and that no selection bias has occurred.

A standard table showing the distribution of the age and sex of a sample is shown below (Table 7.1). This table should be presented in the results section of every nutrition survey report to show any sex or age sampling bias. The table is easy to fill out — you simply have to add up how many boys and girls there are of each sex and each age group, and put these figures in the first and third columns.

The age groups proposed here are 6-17 months, 18-29 months, 30-41 months, 42-53 and 54-59 months. The age groups are centred around whole years, because many ages are misreported and age biasing is towards the full years. For example, a child may be said to be one year old, while in fact he is only ten months old.

Table 7.1 How to fill in the table for distribution of age and sex of sample

	Boys		**Girls**		**Total**		**Ratio**
	No.	**%**	**No.**	**%**	**No.**	**%**	**Boy:girl**
6-17 months							
18-29 months							
30-41 months							
42-53 months							
54-59 months							
Total							

Percentage of boys in this age group = 100× (boys/boys + girls) in the selected age group

Percentage of girls in this age group = 100× (girls/boys + girls) in the selected age group

Percentage of age group compared to whole sample = 100× (age group/ whole sample)

Ratio of boys to girls in this age group = girls/boys in the selected age group

As an example, try filling out this table using the example anthropometric form in Figure 7.1. The answers are given in Table 7.2 below.

Table 7.2 Example of a table showing the distribution of age and sex of sample

	Boys		**Girls**		**Total**		**Ratio**
	No.	**%**	**No.**	**%**	**No.**	**%**	**Boy:girl**
6-17 months	1	50.0	1	50.0	2	6.7	1.00
18-29 months	6	66.7	3	33.3	9	30.0	0.50
30-41 months	3	50.0	3	50.0	6	20.0	1.00
42-53 months	6	54.5	5	45.5	11	36.7	0.83
54-59 months	1	50.0	1	50.0	2	6.7	1.00
Total	17	56.7	13	43.3	30	100	0.76

The interpretation of the standard age and sex distribution table is described in Section 8.4.4.

When you have finished describing the sample in terms of age and sex you can start analysing the anthropometric data.

7.5 Anthropometric data

There are two approaches to analysing and presenting anthropometric results.

- The first approach estimates the prevalence, or proportion, of children whose WFH index falls below a cut-off value. This approach produces an estimate of the prevalence of malnutrition.

- The second approach describes the mean of the whole distribution of children according to index values. This approach produces an estimate of the mean WFH for the population.

In general, although the two approaches are complementary, the first approach (estimating the prevalence or proportion of children falling below a cut-off value) is more popular. In particular, if one of the survey's objectives is to quantify the number of children who may benefit from an intensive feeding programme based on a cut-off value of the index, then the first approach is more appropriate.

The second approach is useful when you are assessing change in the nutritional status of a population.[33] However, changes in the mean nutritional status of a population are difficult to interpret.[34] For this reason it may actually be more useful to compare the prevalence of low WFH, which is physiologically meaningful, rather than mean WFH, when measuring change in the nutritional status of a population.

This thinking represents a change since the last guidelines (DPPC, 1995) when it was recommended that the second approach (mean WFH) was a more useful way to describe a population's nutrition status. Current thinking is that it is more important to know the prevalence of malnutrition in a population than the mean nutrition status of the population. This is because it is useful to know how many people are malnourished and so need assistance.

The DPPC recommends describing a population's nutritional status in terms of the prevalence of low WFH rather than the mean population WFH.

7.6 Calculating prevalences and confidence intervals for rates of malnutrition

Several different analyses of the anthropometric data need to be undertaken and presented in order to make the most of the information collected in a nutrition survey. These will be explained below. However, a brief explanation of how to calculate a prevalence and a confidence interval will be given first.

33 This is because if you compare two means you can use a smaller sample size than if you compare two proportions. This is statistical fact. Because the mean anthropometric status is based on all children in the sample, it can be estimated with greater precision than the prevalence rate, which is based on a smaller number of children. This means that larger samples are needed to demonstrate significant differences between the prevalence of different samples than would be required to show significant differences between means (Briend et al, 1989). In practice, with our standard 30 by 30 cluster surveys, we normally have a fixed sample size of 900 children. By using the method which compares two means we can detect smaller significant changes in malnutrition than if we use the method to compare two prevalences.

34 A change in mean WFH may give a good indication of changes in food security, but does not necessarily correspond to important physiological differences, such as risk of disease or death. This is because WFH is not linearly related to mortality, there is a threshold of WFH below which the risk of death increases (for example, <80% median WFH or <-2 z-scores).

7.6.1 Calculating a prevalence

The prevalence, or proportion, of malnutrition is the number of children who are malnourished in relation to the total number of children in the sample. This is calculated by:

$$\text{prevalence malnourished} = 100 \times \frac{\text{(number of malnourished children)}}{\text{total number of children measured}}$$

Example 7.3
If a total of 919 children are measured and 155 children are found to be malnourished, the prevalence of malnutrition is:

$$\text{prevalence malnutrition} = 100 \times \frac{155}{919}$$
$$= 16.9\%$$

7.6.2 Confidence intervals

Results should always be presented with their confidence intervals (C.I.), except if the survey was exhaustive. Confidence intervals have already been introduced in Chapter 4 and Annex A4.

A confidence interval is a range around an estimate. When we undertake a survey using sampling we calculate a prevalence of the rate of malnutrition for the sample. This prevalence is only an estimate of the true population prevalence: in order to know the true population prevalence we would have to measure every child. So when we present our sample prevalence we have to also present a range around the value which corresponds to the precision of the estimate. This range, or confidence interval, has a 95 per cent chance of including the true prevalence of malnutrition in the whole population.

The formula to calculate a confidence interval is:

$$d = \pm\ 1.96\ SE(p)$$

where, S.E. = standard error of the sample proportion
(p) = sample proportion

So, in order to calculate a confidence interval, we first have to calculate the standard error (S.E.).

Detailed descriptions of how to calculate confidence intervals for both random and cluster surveys are given in Annex A7.1.

7.7 Calculation of nutrition indicators

The estimates of the prevalence of global and severe acute malnutrition, in terms of both z-scores and percentage of the median, should be given both for the 6-59 month age group and the 6-29 month age group. This is important because the prevalence of malnutrition may be higher in one age group than another (see Section 7.8.2 for more details). All results should include a prevalence and confidence interval.

The definitions of malnutrition are given below (see Chapter 3 for further explanation).

Prevalence expressed in z-scores

Global acute malnutrition prevalence:
Proportion of children with WFH <- 2 z-scores and/or oedema

Severe acute malnutrition prevalence:
Proportion of children with WFH <- 3 z-scores and/or oedema

Prevalence expressed in percentage of the median

Global acute malnutrition prevalence:
Proportion of children with WFH < 80% and/or oedema

Severe acute malnutrition prevalence:
Proportion of children with WFH < 70% and/or oedema

The steps to calculate the prevalence rates for WFH z-scores are described below.

1. begin by classifying all data collected according to the WFH reference table and the presence of oedema (already done in the sample form)
2. determine the number of children with oedema = A
3. determine the number of children with WFH <-3 Z-scores but without oedema = B
4. determine the number of children with WFH <-2 Z-scores but without oedema = C
5. global malnutrition will be C + A
6. severe malnutrition will be B + A
7. do not count children twice. For example, a child who has oedema and a W/H <-3 Z-scores should not be counted as two cases of severe malnutrition – count it as an oedema case.

Then you can calculate the rates of malnutrition.

Example 7.4
We will use the data from the sample anthropometric form (Figure 7.1) to illustrate these calculations:

	Number	Calculation for prevalence	Prevalence
Oedema (A)	2		
W/H: <-3 Z-scores without oedema (B)	2		
W/H: < - 2 Z-scores without oedema (C)	6		
Global (A + C) < - 2 Z-scores or oedema	8	$= 100 \times (8/30)$	26.7%
Severe (A + B) < - 3 Z-scores or oedema	4	$= 100 \times (4/30)$	13.3%

The procedure for WFH medians is exactly the same:

1. begin by classifying all data collected according to the WFH reference table and the presence of oedema (already done in the sample form)
2. determine the number of children with oedema = A
3. determine the number of children with WFH <70% median but without oedema = B
4. determine the number of children with WFH <80% median but without oedema = C
5. global malnutrition will be C + A
6. severe malnutrition will be B + A
7. do not count children twice. For example, a child who has oedema and a WFH <70% median should not be counted as two cases of severe malnutrition.

Example 7.5
We will use the data from the sample anthropometric form (Figure 7.1).

	Number	Calculation for prevalence	Prevalence
Oedema (A)	2		
W/H: <70% median without oedema (B)	1		
W/H: <80% median without oedema (C)	5		
Global (A + C) < - 2 Z-scores or oedema	7	= 100 × (7/30)	23%
Severe (A + B) < - 3 Z-scores or oedema	3	= 100 × (3/30)	10.0%

You are now ready to learn how to fill in all the anthropometric results tables.

7.8 Presenting the results of anthropometric data

All reports of nutrition surveys in Ethiopia should present the anthropometric results in the tables that are shown and explained below.

7.8.1 Summary anthropometric results tables

Tables 7.3 and 7.4 summarise the anthropometric results of a nutrition survey. The prevalence of acute malnutrition is given for two age groups: 6-59 months and 6-29 months. This is important because the prevalence of malnutrition may be higher in one age group than another.

Table 7.3 Prevalence of acute malnutrition based on weight-for-height z-scores and/or oedema

	6 – 59 months **n=**	**6 - 29 months** **n=**
Prevalence of global acute malnutrition **(<-2 z-score and/or oedema)**	(no.) % (95% C.I.)	(no.) % (95% C.I.)
Prevalence of severe acute malnutrition **(<-3 z-score and/or oedema)**	(no.) % (95% C.I.)	(no.) % (95% C.I.)

The prevalence of oedema is %

Table 7.4 Prevalence of acute malnutrition based on the percentage of the median and/or oedema

	6 – 59 months n=	6 - 29 months n=
***Prevalence of global acute malnutrition* (<80% and/or oedema)**	(no.) % (95% C.I.)	(no.) % (95% C.I.)
***Prevalence of severe acute malnutrition* (<70% and/or oedema)**	(no.) % (95% C.I.)	(no.) % (95% C.I.)

The prevalence of oedema is %

Example 7.6
To illustrate how to fill in these tables, we will use data from a survey in Gola Oda.

Total number of children: 926
Total number of children with oedema: 0
Total number of children with WHZ<-2.00 and no oedema: 180

$$\text{prevalence of global acute malnutrition} = 100 \times \frac{(180 + 0)}{926}$$

$$= 19.4\%$$

$$\text{prevalence of oedema} = 100 \times 0$$

$$= 0\%$$

If we know that the confidence intervals are 15.6-23.2% (see Annex A7.1 for this calculation), we can fill in the table.

Table 7.5 Example of table showing the prevalence of acute malnutrition based on weight-for-height z-scores and/or oedema

	6 - 59 months n=926
***Prevalence of global acute malnutrition* (<-2 z-score and/or oedema)**	(180) 19.4% (95% C.I. 15.6-23.2%)

The prevalence of oedema is 0%

You repeat this process to fill in each of the boxes in Tables 7.3 and 7.4.

7.8.2 Age-specific prevalence of malnutrition

It is standard practice to report the prevalence of malnutrition by age-specific groups. This is important because the prevalence of malnutrition may be higher in one age group than another.

The table below is the standard one used to report age-specific prevalences of malnutrition defined by low weight-for-height z-scores and/or oedema in nutrition surveys. Children with oedema have their own column. These children should only be included in the oedema column and should not be put into any other column, even if they have low WFH.

The standard age-groups are as follows: 6-17 months, 18-29 months, 30-41 months, 42-53 months and 54-59 months. (These age-groups are again centred around whole years — 12, 24, 36 months, etc. This is meant to balance the bias towards the reporting of age in whole years.)

Table 7.6 Prevalence of acute malnutrition by age, based on weight-for-height z-scores and oedema

		Severe malnutrition (<-3 z-score)		**Moderate malnutrition (>= -3 and <-2 z-score)**		**Normal (> = -2 z score)**		**Oedema**	
Age (mths)	**Total no.**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**
6-17									
18-29									
30-41									
42-53									
54-59									
Total									

Percentage of children <-3 z-scores in this age group = 100× (number <-3z scores/total) in the selected age group

Percentage of children >=-3 z-scores <-2 z-scores in this age group = 100× (number>=-3 z-scores and <-2z scores/total) in the selected age group

Percentage of children >=-2 z-scores in this age group = 100× (number >=-2 z scores/ total) in the selected age group

Percentage of children with oedema in this age group = 100× (number with oedema/total) in the selected age group

An identical table is used to show the age-specific prevalences of malnutrition defined by low weight-for-height medians and/or oedema.

Table 7.7 Prevalence of malnutrition by age, based on weight-for-height medians and oedema

		Severe malnutrition (<70% median)		**Moderate malnutrition (>=70% and <80% median)**		**Normal (> =80% median)**		**Oedema**	
Age (mths)	**Total no.**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**
6-17									
18-29									
30-41									
42-53									
54-59									
Total									

Example 7.7
To practise filling in one of these tables we can use the data from the sample anthropometric data form (Figure 7.1). Let us take the youngest age group first. Two children are in this age category (child number "5" and child number "13"). So the total number of children of this age is two. Neither of these children has a WHZ <-3.00 so that column equals zero. Child number "5" has WHZ = -2.19, so he should be entered under the moderate malnutrition column. Child number "13" has a normal WHZ so she is entered under that column. There are no children with oedema in this age group, so that column is zero. Continue this process for each age group. Then fill in the percentage values as explained in Table 7.6. The correct results can be seen in Table 7.8.

Table 7.8 Example of a table showing the prevalence of acute malnutrition by age, based on weight-for-height z-scores and oedema

		Severe malnutrition (<-3 z-score)		Moderate malnutrition (>= -3 and <-2 z-score)		Normal (> = -2 z score)		Oedema	
Age (mths)	**Total no.**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**
6-17	2	0	0	1	3.3	1	3.3	0	0
18-29	9	2	6.7	1	3.3	6	20.0	0	0
30-41	6	0	0	1	3.3	5	16.7	0	0
42-53	11	0	0	0	0	10	33.3	1	3.3
54-59	2	0	0	1	3.3	0	0	1	3.3
Total	30	2	6.7	4	13.3	22	73.3	2	6.7

For example, $100 \times (2/30) = 6.7$ %.

Normally, the prevalence of malnutrition tends to be higher in the 6-29 months age groups than in the older age groups, because the younger groups are beginning to wean and are also more susceptible to disease. When the prevalence of malnutrition is similar or higher in the older age groups, this should be indicated and investigated. If all age groups are severely affected it usually means there is a serious food crisis.

The differences observed may be due to a certain disease affecting the younger age groups more than the older age groups. If this is the case it may be necessary to implement certain programmatic responses focusing on one age group more than others, or on a certain disease (such as measles or diarrhoea).

7.8.3 Distributions showing the population according to WFH and oedema

The final anthropometric results table should show the distribution of WFH with respect to the presence of oedema. This allows for the differentiation of children presenting with kwashiorkor from those presenting with marasmic kwashiorkor. It is important to present these results, as children with marasamic kwashiorkor are at greater risk of death than those with either marasmus or kwashiorkor alone.

Table 7.9 Distribution of acute malnutrition and oedema based on weight-for-height z-scores

	<-2 z-score	**>=-2 z-score**
Oedema present	Marasmic kwashiorkor No. (%)	Kwashiorkor No. (%)
Oedema absent	Marasmic No. (%)	Normal No. (%)

Example 7.8
To practise filling in one of these tables we can use the data from the sample anthropometric data form (Figure 7.1). In the sample two children have oedema (child number "6" and child number "26"). One of these children has oedema and low WHZ (child 26) and the other has oedema but normal WHZ (child 6). Six children have low WHZ with no oedema and the rest are normal. Thus, the results table should be filled as below.

Table 7.10 Example of table showing the distribution of acute malnutrition and oedema based on weight-for-height z-scores

	<-2 z-score	**>=-2 z-score**
Oedema present	*Marasmic kwashiorkor* *1* *(3.3%)*	*Kwashiorkor* *1* *(3.3%)*
Oedema absent	*Marasmic* *6* *(20%)*	*Normal* *22* *(73.3%)*

7.9 Population statistics

Once you have filled in all the anthropometric tables described above, you have finished the analysis section that produces estimates of the prevalence of malnutrition in the population. This section describes how to produce statistics that describe the whole population (not just the group who are malnourished).

7.9.1 Plotting WFH distribution curves

The prevalence of malnutrition at the population level can be plotted on a graph and compared to the reference population. Distribution curves of z-scores give a complete picture of the nutrition status of the whole population, which can be compared to that of the reference population.[35]

To calculate a frequency distribution curve, the range of z-scores from <- 4.75 to >+4.75 is broken down into a number of intervals, and the proportion of children within each interval is calculated. This data is used to plot the frequency distribution curve. This is normally easier to do with a computer programme (like Microsoft Excel) which can draw a graph, than by hand.

[35] Although the plotting of distribution curves is useful, it is very time consuming without a computer. Thus the DPPC recommends you omit plotting if you do not have access to a computer.

In order to plot the data on a graph, you need to create a table like the one below. This table shows us how much of the sample population falls between various ranges of the WHZ measure.

Example 7.9
Table 7.11 shows the frequency distribution of z-scores for children from the Gola Oda sample and the distribution for the reference children.

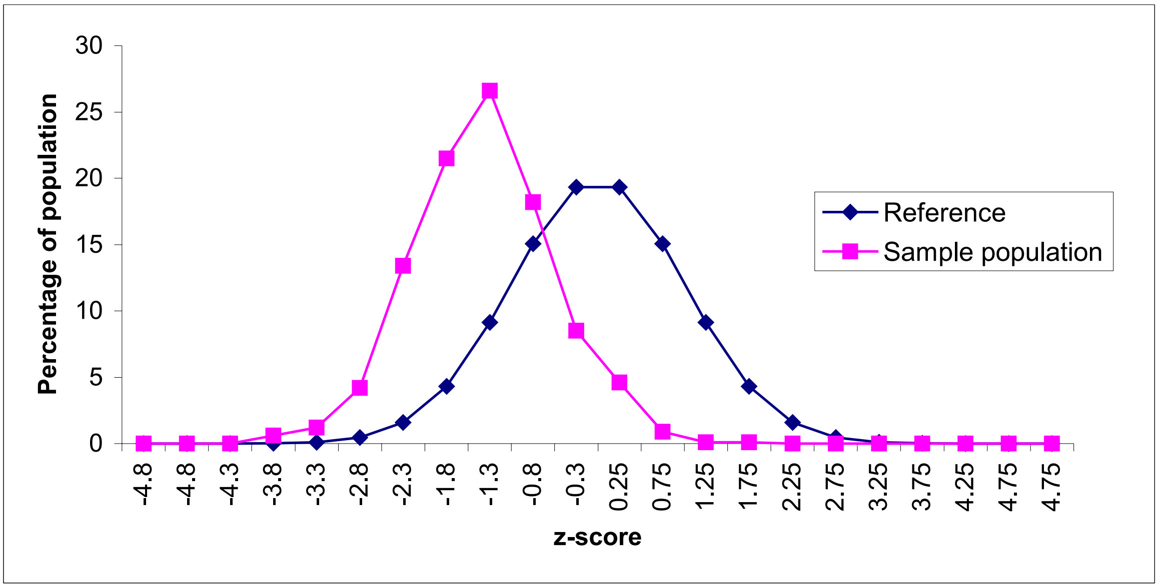
Column 1 shows the range of WHZ
Column 2 shows the number of children in the total sample in this range of WHZ
Column 3 shows the proportion of children from the total sample in this range of WHZ (to get this number divide the number of children in a particular range by the total number of children, for example: for the proportion of children in the -3.75 WHZ [(6/927) × 100] = 0.6)
Column 4 shows the proportion of children in the reference population in this range. This figure does not change — keep the same column for all surveys.

Table 7.11 Frequency distribution of z-scores for the Gola Oda survey and the reference population

1 WHZ range	2 Number of children in this range in survey	3 Proportion in survey population	4 Proportion in reference population
<-4.75	0	0	0
-4.75	0	0	0
-4.25	0	0	0
-3.75	6	0.6	0.02
-3.25	11	1.2	0.1
-2.75	39	4.2	0.45
-2.25	124	13.4	1.59
-1.75	199	21.5	4.31
-1.25	247	26.6	9.13
-0.75	169	18.2	15.06
-0.25	79	8.5	19.33
0.25	43	4.6	19.33
0.75	8	0.9	15.06
1.25	1	0.1	9.13
1.75	1	0.1	4.31
2.25	0	0	1.59
2.75	0	0	0.45
3.25	0	0	0.1
3.75	0	0	0.02
4.25	0	0	0
4.75	0	0	0
>4.75	0	0	0
	927	**100**	**100**

Then use this data to make a graph like in Figure 7.2 below.

Figure 7.2 Graph - WHZ frequency distribution for the reference and Gola Oda populations



From this type of graph you can compare the distribution of z-scores in your sample population to the reference population.

In Figure 7.2 we can see that the sample population's WHZ distribution has shifted to the left compared to the reference population. This indicates that the population in Gola Oda are malnourished compared to the reference population.

You can make a graph like this for either WHM or WHZ. The process is identical.

7.9.2 Population mean WFH measurements

The mean WFH is sometimes used to describe a population's nutrition status. This is calculated as:

$$\text{mean WFH} = \frac{\text{sum of all WFHs}}{\text{number of children measured}}$$

This measurement was previously recommended by the DPPC (1995) as the most useful measure of population nutrition status. However, as described in Section 7.5, the DPPC now recommends describing a population's nutrition status in terms of the prevalence of low WFH rather than the mean population WFH.

In some situations it may be useful to calculate the mean WFH in order to compare current survey results with older survey results. Annex A7.2 describes how to calculate confidence intervals for the population mean WFH.

7.10 Mortality data

The collection of mortality data was discussed in Chapter 5. Mortality rates should be presented in the format shown in the box below:

Mortality rates

Crude mortality rate (CMR) = total deaths/10,000 people/day

Under-five mortality rate (U5MR) = deaths in children under five/10,000 children under five/day

Mortality rates in nutrition surveys are calculated by the following formula.[36]

$$\text{CMR} = \frac{\text{total number of deaths over a given period of time}}{\text{estimated mid-period population}}$$

The estimated mid-period population is the average of how many people were alive at the beginning of the recall period and at the end of the recall period.

Example 7.10
If we interviewed 4,000 people in our household survey and found that 44 people had died in the previous 3 months, then

the estimated mid-period population would be

$$= \frac{\text{4,044 (at the beginning of the recall period) + 4,000 (at the end of the recall period)}}{2}$$

= 4,022 people

So the crude mortality rate would be:

$$= 10{,}000 \times \frac{\text{44 deaths}}{\text{(4,022 people)} \times \text{90 days}}$$

= 1.22 deaths/10,000 people/day

The calculation for the U5MR is the same, except you only use the under-five population data.

[36] There are, of course, far more sophisticated ways to calculate mortality rates using other demographic methods. The method to calculate mortality described here is "quick and dirty", but it is the standard one used in emergency nutrition assessments.

Example 7.11
If there were 1,000 under-fives in our sample and 27 under-five deaths, the calculation is:

the estimated mid-period population

$$= \frac{1{,}027 \text{ (at the beginning of the recall period)} + 1{,}000 \text{ (at the end of the recall period)}}{2}$$

$$= 1013.5 \text{ people}$$

So the under-fives mortality rate would be:

$$= 10{,}000 \times \frac{27 \text{ deaths}}{(1013.5 \text{ people}) \times 90 \text{ days}}$$

$$= 2.96 \text{ deaths/10,000 people/day}$$

7.11 Morbidity data

In general, morbidity data is presented in frequency tables showing simple proportions. Table 7.12 should be presented first. This shows the total number of children reporting any illness.

Table 7.12 Prevalence of reported illness in children in the two weeks prior to interview (n=)

	6-59 months
Prevalence of reported illness	%

Then create a table showing what illnesses were reported among children who reported any illness.

Table 7.13 Symptom breakdown in the children who reported illness in the two weeks prior to interview (n=)

	6-59 months
Diarrhoea	%
Cough	%
Fever	%
Measles	%
Other	%

For definitions of diarrhoea, etc see Annex A5.4

Example 7.12
You can practise filling in morbidity tables using the data from the sample anthropometric form in Section 7.2.

Total children =	30	
Total with diarrhoea =	4	
Total with cough =	2	
Total with fever =	2	
Total with measles =	0	
Total with other =	3	
So total ill =	4+2+2+3	= 11

$$\text{Prevalence of illness} = \frac{11}{30} \times 100$$

$$= 36.7\%$$

Therefore your results should look like Table 7.14.

Table 7.14 Example of table showing prevalence of reported illness in children in the two weeks prior to interview (n=30)

	6-59 months
Prevalence of reported illness	36.7%

To calculate the symptom breakdown among children who reported illness:

Total ill children = 11
Total with diarrhoea = 4

$$\text{Proportion with diarrhoea} = \frac{4}{11} \times 100$$

$$= 36.4\%$$

Therefore your results should look like Table 7.15.

Table 7.15 Symptom breakdown in the children who reported illness in the two weeks prior to interview (n=11)

	6-59 months
Diarrhoea	36.4%
Cough	18.2%
Fever	18.2%
Measles	0%
Other	27.3%

7.12 Vaccination data

The estimated prevalence of vaccination should be calculated and presented in a similar way to prevalences of acute malnutrition. Tables should look like the one below:

Table 7.16 Vaccination coverage: BCG for 6-59 months and Measles for 9-59 months

	BCG **N=**	**Measles (with card)** **N=**	**Measles (with card or confirmation from mother) N=**
YES	(no.) % (95% C.I.)	(no.) % (95% C.I.)	(no.) % (95% C.I.)

You should calculate the prevalences and confidence intervals of vaccination in exactly the same way as you do for acute malnutrition (explained in Section 7.6). The analysis of the measles vaccination should only include children aged nine months and above because a measles vaccine should not be given before the age of nine months. An example of a completed table for vaccination results is given below.

Table 7.17 Example of a table showing vaccination coverage: BCG for 6-59 months and measles for 9-59 months

	BCG N=905	Measles (with card) N=886	Measles (with card or confirmation from mother) N=886
YES	189 20.9% 95% CI (13.1–8.7%)	37 4.2% 95% CI (0.9–7.4%)	272 30.7% 95% CI (19.2–42.2%)

7.13 Programme coverage data

Coverage of a nutrition programme is calculated using data from the survey, using the following equation:

$$\text{coverage rate} = \frac{\text{number of registered children (from the surveyed children)}}{\text{total number of malnourished children}}$$

Example 7.13
Imagine there is a supplementary feeding programme for all malnourished children in a woreda. During the nutrition survey you find 23 children who are registered on the programme and malnourished and 107 children who are not registered in the programme but are malnourished. You measure a total of 908 children. What is the coverage rate?

$$\text{coverage} = \frac{23 \times 100}{23 + 107}$$

$$= 17.7\ \%$$

It is important to make a distinction between supplementary and therapeutic feeding programmes, even though there may be very few severely malnourished children in the survey.

7.14 Other quantitative data

There is no standard method to analyse other quantitative data collected in nutrition surveys. In general, continuous data are presented in terms of means and ranges. Categorical data are normally presented as frequency distributions. A few examples will be given below, but remember there is no standard method to analyse this type of data.

7.14.1 Analysing continuous data

A good example of continuous data is household size. Information on household size is usually collected in the mortality questionnaire. Typically, you would present the data like this:

"Average household size was 5.2, the range was 1-11 people."

Another example is land holding:

"The average size of land owned by a household was 0.4ha, the range was 0-2.0ha."

7.14.2 Analysing categorical data

A good example of categorical data is source of main food in the diet. Imagine that you asked households where they obtained their staple food from in the month prior to the survey. You could turn the results from this question into a frequency table showing the proportion of households that received food from different sources.

Table 7.18 How households obtained their staple food in January 2001

Food source	Proportion of households
Own production	39%
Relief (employment generation scheme (EGS) or free)	38%
Bought	22%
Borrowed	1%

It is sometimes useful to cross tabulate this kind of data with agro-ecological zone information.

Example 7.14
For example, if your survey took place in three agro-ecological zones (meher, belg and mixed meher-belg dependent) then you could look at where households received their food from in each agro-ecological zone. To do this you need to work out the proportions for each group separately. You could then fill in a table like the one below.

Table 7.19 How households in different agro-ecological zones obtained their staple food in January 2001

	All HH	Belg-dependent households	Meher-dependent households	Belg and meher dependent households
Own production	39%	26%	87%	23%
Relief (EGS or free)	38%	70%	3%	38%
Bought	22%	1%	10%	38%
Borrowed	1%	2.5%	0%	0%

From Table 7.19 you can see that more households in the belg-dependent areas were relying on relief for their staple food than any other area. Also, fewer of the belg-dependent households were relying on their own production.

Cross-tabulations can also be used for many other variables. For example, you could see whether people in one area have more animals than other people, etc.

7.15 Analysing qualitative data

The inclusion of qualitative data in an assessment normally helps generate a wider and deeper understanding of the situation, which is missing from the qualitative data. This is needed to make sound judgements and recommendations for interventions.

Most of the DPPC's EW staff are used to analysing qualitative data on a regular basis; indeed qualitative data forms the basis of most of the DPPC's annual multi-agency assessments. Thus these guidelines will not describe the analysis of qualitative data in great detail.

There is no standard way to analyse qualitative data. When you are analysing this type of data you need to weigh up the different information you have received and decide which is the most trustworthy and which is the most important. Probably the most important techniques to use when analysing qualitative data are:

- **working in a group:** did all team members get the same impression or answers in their key informant interviews or observations. If not, why not?
- **comparing information from different sources:** did all key informants answer the same to similar questions, or did men and women answer differently? If they gave different answers, why?
- **triangulating qualitative data with the quantitative results:** do the two types of data agree? If not, why not?

The analysis of all qualitative data involves an element of judgement on the part of the person doing the analysis. Get someone who knows the area well to check your qualitative analysis, to ensure it makes sense!

Summary of main points in Chapter 7

- Anthropometric data should always be prepared and cleaned prior to analysis. This means excluding children who have missing or extreme anthropometric data.
- A standard set of anthropometric results tables must be filled in for every nutrition survey. This allows the ENCU and other agencies to compare the results of different surveys. The standard tables include:
  - sample distribution of age and sex
  - summary anthropometric results tables (for WFH medians and z-scores)
  - age-specific prevalence of malnutrition (for WFH medians and z-scores)
  - distributions according to WFH and oedema.
- Morbidity, mortality and immunisation data should also be presented in a standard format, if they are collected.
- There is no standard method to analyse qualitative data, although it is always important to triangulate the results with the quantitative data.

Chapter 8

Interpretation of results

Once you have analysed the anthropometric data from your survey you will produce some results that include an estimate of the prevalence of both global and severe acute malnutrition. The next challenge is to try to put the results in context, explain the findings and make recommendations for interventions. In order to fulfil these challenges you need to answer the following questions:

- Is the level of malnutrition "normal" for the population in the current season? In other words, how severe are the malnutrition rates within the context of the area?
- What are the causes of the malnutrition seen?

The interpretation of the results is probably the most difficult part of a nutrition survey because there is no standard method for interpreting 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 get the right intervention.

When you interpret the results of a nutrition survey you also need to consider whether or not the results are biased. The first sections of this chapter will focus on how to interpret rates of malnutrition and mortality in emergency nutrition assessments. The last section will discuss how to look for bias in nutrition surveys.

8.1 Classifying the severity of population malnutrition rates

When you are trying to interpret the results of a nutrition survey it is important to know whether or not a population's nutrition status is "normal". This allows us to make judgements about whether or not there is a problem and whether or not we need to intervene.

Unfortunately, there is no internationally accepted classification of the severity of malnutrition in a population. We can classify individual children as malnourished, or not, but it is much harder to grade a population's nutrition status. This is mainly because of two factors:

- the baseline prevalence of acute malnutrition varies from one population to another
- the prevalence of malnutrition varies seasonally.

8.1.1 Variations in the baseline prevalence of malnutrition between populations

Although in theory all children less than five years old should grow the same way, we find that some populations nearly always have a higher level of acute malnutrition than others. Differences in the baseline prevalence of malnutrition are found between countries, but also within countries. In Ethiopia, the recent DHS data showed that there are regional differences in the prevalence of both chronic and acute malnutrition.

Table 8.1 shows the prevalence of acute malnutrition (defined by z-scores) for the different regions of Ethiopia in 2000 (CSA and ORC Macro, 2001). This was a particularly bad year for many regions — including Somali, Gambela, Tigray, Amhara and Oromiya — so the prevalence of acute malnutrition may not always be this high every year.

Table 8.1 DHS data showing the prevalence of acute malnutrition by region

Region	Prevalence <- 2 z-scores	Prevalence <- 3 z-scores
Tigray	11.1%	0.9%
Affar	12.6%	1.7%
Amhara	9.5%	1.1%
Oromiya	10.4%	1.6%
Somali	15.8%	2.5%
Benishangul-Gumuz	14.2%	2.2%
SNNP	11.8%	1.5%
Gambela	18.1%	3.1%
Harari	6.3%	1.0%
Addis Ababa	4.2%	0.5%
Dire Dawa	11.1%	1.4%
Whole country	10.5%	1.4%

Differences can also be seen when comparing the results of emergency nutrition assessments undertaken at the same time of year in different places.

Example 8.1
In January 2002 two nutrition surveys were undertaken in different parts of the country. The results of the assessments are shown in Table 8.2. 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 8.2 Results of nutrition assessments undertaken in January 2002

	Dessie Zuria Woreda, South Wollo, Amhara	Lowland areas of Wolayita Zone, SNNPR
***Prevalence of global acute malnutrition* (<-2 z-scores and/or oedema)**	11.6% (95% C.I. 8.8-15.1%)	4.4% (95% C.I. 2.5-6.4%)
***Prevalence of severe acute malnutrition* (<-3 z-scores and/or oedema)**	0.8% (95% C.I. 0.2-2.3%)	0.4% (95% C.I. 0.0-0.9%)

The different prevalences of malnutrition found across Ethiopia can be explained by differences in the underlying causes of malnutrition (see Chapter 1):

- household food security — access and availability of food
- public health — health environment, access to healthcare
- caring practices — infant feeding practices, other direct caring behaviour of children, women's education, etc.

Differences in any of these factors will affect the population's nutrition status. 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.

In practice, this means that in Ethiopia we find different levels of malnutrition according to factors like agro-ecological zone and access to health facilities. For example, a population dependent on the meher rains has its lean period (hungry season) at a different time to a population that is dependent on the belg rains, or a pastoral population dependent on the gu rains. This means that if we were to undertake a survey of all these three populations at the same time, we would probably find different prevalences of malnutrition in each population.

8.1.2 The WHO classification of the severity of population malnutrition rates

The variation in the prevalence of malnutrition between agro-ecological areas means that it is extremely difficult to design a classification of population nutrition status that is globally applicable. Indeed, all the leading international agencies in nutrition have slightly different classifications.[37] Table 8.3 shows WHO's classification of the severity of malnutrition rates in a population (WHO, 2000).

Table 8.3 *The classification of the severity of malnutrition rates in a population according to WHO (WHO, 2000)*

Severity of malnutrition	**Prevalence of wasting (<–2 z-scores)**
Acceptable	<5%
Poor	5-9%
Serious	10-14%
Critical	>=15%

Although these guidelines have generally tried to follow WHO's recommendations, unfortunately this WHO classification is not suitable for use in Ethiopia. There are several reasons for this:

- The WHO classification does not include oedema. Oedema is a sign of severe malnutrition and must be included in any classification of malnutrition for Ethiopia.
- The classification does not take any aggravating factors, such as seasonality, into account.
- The highest cut-off point is a prevalence of 15 per cent less than -2 z-scores. In many parts of Ethiopia 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 critical.

Ethiopia is not the only country which has had problems in adopting the WHO classification of population level malnutrition rates. To overcome this problem, the Sphere Project guidelines[38] suggest that decisions about whether levels of malnutrition are acceptable require analysis of the situation in the light of local norms. This recommendation is discussed further below.

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[37] WHO, MSF and Concern all have different methods for classifying the severity of malnutrition at the population level.

[38] The Sphere Project's Humanitarian Charter and Minimum Standards in Disaster Response sets out minimum standards in humanitarian assistance to disasters.

8.1.3 An Ethiopian population classification of malnutrition

Due to the complications described above, the DPPC has decided to suggest a very general classification of malnutrition for populations in Ethiopia. The classification takes into account not only the prevalence of malnutrition, but also other aggravating factors.[39]

The classification of population malnutrition rates (presented in Table 8.4) is intended to help interpret the seriousness of a situation by considering a variety of indicators, and consequently suggesting alert stages. In other words, it attempts to set benchmarks of nutrition status. The classification is a supportive tool: it should not be strictly followed as a set of rules. How you classify a situation will vary greatly according to the context and must be adapted accordingly.

There are several important changes between this classification and the one recommended in the previous guidelines (DPPC, 1995):

- This classification takes aggravating factors such as the food security and health situation into account, not just the prevalence of acute malnutrition.
- Population mean WFH is not used in this classification, instead the proportion of the population who are malnourished is taken as the most important indicator (see Section 7.5).
- Acute malnutrition is defined in terms of z-scores and/or oedema (rather than the percentage of the median only). The use of z-scores is in line with the current WHO recommendations (WHO, 2000).
- The DPPC has also suggested that the prevalence of severe malnutrition is an important indicator in deciding how critical a situation is. This is because we know that children who are severely malnourished have a very high risk of death and consequently, if there is a large number of them (>=5%), the situation should be viewed as critical, irrespective of other factors (MSF, 2000). Some kind of intervention would definitely be needed at this point (be it medical, food or other).

[39] Ideally, to design a meaningful classification of population nutrition we would look at the relationship between the prevalence of malnutrition and the rates of mortality or morbidity in a population. If we defined a certain CMR as a crisis, then we could see what level of malnutrition corresponded to the CMR crisis-level. In turn, we could then decide what level of malnutrition indicated a crisis (that is, had a CMR that was unacceptably high). From this type of information we could then design our classification. However, in Ethiopia, the relationship between CMR and the prevalence of malnutrition is different in distinct populations. The association depends on the season, available healthcare, options for coping mechanisms, availability of relief, etc. These complications mean that it is nearly impossible to find a classification that fits all the different parts of the country at different times of the year. Thus, a very precise classification would have to look at different parts of the country separately.

Table 8.4 Classification of the prevalence of malnutrition for a population: alert stages (global acute malnutrition defined as <-2 z-scores and/or oedema, severe acute malnutrition defined as <-3 z-scores and/or oedema)

<table>
<tr><th>Indicators</th><th>Stage of alert</th></tr>
<tr><td>Global acute malnutrition prevalence > 20%
and/or
Severe acute malnutrition prevalence >= 5%</td><td rowspan="2">Critical</td></tr>
<tr><td>Global acute malnutrition prevalence 15-19%
and
Aggravating factors</td></tr>
<tr><td>Global acute malnutrition prevalence 15-19%</td><td rowspan="2">Serious</td></tr>
<tr><td>Global acute malnutrition prevalence 10-14%
and
Aggravating factors</td></tr>
<tr><td>Global acute malnutrition prevalence 10-14%</td><td rowspan="2">Poor</td></tr>
<tr><td>Global acute malnutrition prevalence 5-9%
and
Aggravating factors</td></tr>
<tr><td>Global acute malnutrition prevalence 2-9%</td><td>Typical for a chronically malnourished population</td></tr>
</table>

Potential aggravating factors include:

- poor household food availability and accessibility (due to a poor harvest, poor pasture conditions, high market prices, insecurity, or inadequate general distribution in a camp setting, etc)
- epidemics of measles, cholera, shigella and other important communicable diseases
- inadequate shelter and severe cold
- low levels of measles vaccination and vitamin A supplementation
- inadequate safe water supplies (quality and quantity) and sanitation.

Consideration of aggravating factors is an absolutely essential part of a good interpretation of anthropometric data. If more than one aggravating factor is present then the situation may be worse than if there is just one.

Example 8.2
A prevalence of global acute malnutrition of 14% and severe of 1% may be interpreted quite differently at different levels of food security. If you found this result after a poor harvest, and you knew that the population would not be receiving a harvest for a further six months, this would qualify as a serious situation. However, if you estimated the prevalence of global acute and severe malnutrition to be 14% and 1% at the end of the hungry season, and a good harvest was predicted for the next month, you would probably classify the situation as poor, but not as serious.

Example 8.3
You have estimated the prevalence of global acute malnutrition at 10% cent in a newly formed IDP camp. A full general ration is not yet available to the population. It is very cold at night — below freezing — and no proper shelters have been constructed yet. This should be considered as a serious situation, despite the relatively low rate of global acute malnutrition, because the population is not yet receiving a proper ration and there is inadequate shelter and extreme cold. Malnourished people are more susceptible to the cold. Advocate for an increased ration and proper shelter construction immediately.

No standards or norms are given for the aggravating factors. There is a deficiency of information on standards for most of the aggravating factors in rural settings in Ethiopia. Until such standards are determined, it is important to consider what is normal for the area. Information on norms, for factors such as EPI coverage, is available from the Demographic Health Survey (2001) or the MoH (1993).

WHO, UNHCR and other agencies have set international standards for many of the aggravating factors in an IDP or refugee camp setting. Standards exist for access to clean water, sanitation, shelter and vaccination rates, as well as other essential services. For example, it is recommended that at least 15 litres of water per person per day is collected in a camp setting. These standards are described in the SPHERE handbook (2000).

In fact, most of the aggravating factors are more important in a camp setting, where epidemics can spread extremely quickly, than in settled rural populations. For example, it is especially important to act quickly if vaccination rates are low or sanitation is poor, if the population is in an overcrowded camp rather than in its normal (village) setting.

Consideration of aggravating factors is an absolutely essential part of a good interpretation of anthropometric data.

The prevalence of severe acute malnutrition is an important indicator because it tells us how many very malnourished children there are, and how many children are at high risk of mortality. This type of information should help you decide how urgent your response needs to be. If the prevalence of both severe and global malnutrition is high, then it is a more serious situation than if only the global malnutrition level is high.

Example 8.4
A prevalence of global acute malnutrition of 15% and severe of 5% cent may be interpreted quite differently from a prevalence of global acute malnutrition of 17% and severe malnutrition of 1%. The first result would indicate that the situation was critical. The second result would probably indicate that the situation was serious. In such a situation it would be very important to look at the information on aggravating factors.

Finally, remember that the results of a nutrition survey must always be interpreted in terms of relativity. For example, if the levels of malnutrition are normally very low, for example less than three per cent, then an increase to ten per cent may indicate a bigger problem than described in the classification. Methods for comparing two surveys are discussed below.

8.2 Factors to consider in the interpretation of malnutrition rates

In order to be able to interpret correctly the malnutrition rates from a survey, it is necessary to:

- determine seasonal variations
- compare the results to previous surveys in the same area or agro-ecological zone at the same time of year. This means obtaining baseline data
- interpret all results according to the causes of malnutrition framework (Chapter 1). Interpret all results in their cultural, socio-economic and agro-ecological context, together with other supporting data such as indicators on health, food supply, markets, etc
- analyse mortality rates in the survey area.

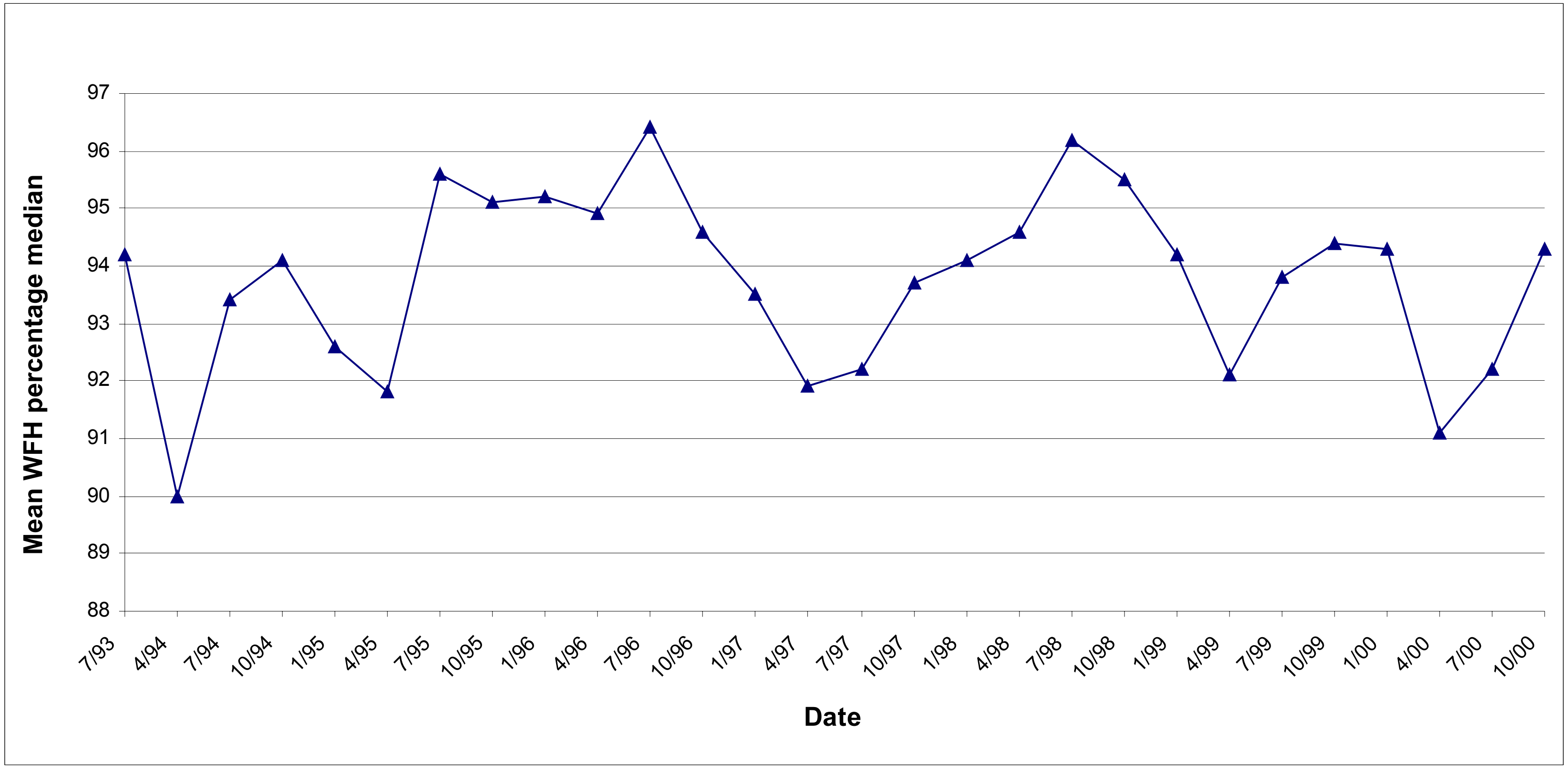
8.2.1 Seasonal variation in the prevalence of malnutrition in Ethiopia

Examples of seasonal variation in acute malnutrition are found in almost every rural population in Ethiopia. Towards the end of the hungry season, before the harvest in agricultural populations, and before the rains in pastoral populations, there is normally 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 8.5
The graph in Figure 8.1 shows the results of nutrition surveys conducted in the highland areas of Wolayita over four years in different seasons.

Population mean WFH 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 correspond 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 8.1 The results of nutrition surveys conducted in the highland areas of Wolayita over four years in different seasons (SC UK, 2000a)



8.2.2 Measuring change in population nutrition data: comparing nutrition data to baseline information and other surveys

It is always essential to compare survey results to previous surveys in the same area or agro-ecological zone.

Figures obtained through a single cross-sectional nutrition survey reflect the nutrition status of the under-five population at the moment of the survey. We can classify these figures, using other nutrition-related information, as a given alert stage (as described above). However, taken alone, the prevalence of malnutrition — or the alert level — does not give any indication of the trend in the nutritional situation. We cannot know whether the nutrition status is improving or deteriorating without comparing the results to other surveys or baseline information. Information about trends in nutrition status is very important in relief planning.

In order to have information about trends you need baseline data. Ideally, baseline data provides estimates of the prevalence of malnutrition in different seasons in a "normal" year. From this information we could determine what was a normal prevalence of malnutrition for a given time of year in a certain population. We could then decide whether or not the current nutrition status of a population is normal, or better, or worse than normal. This distinction between the absolute level of malnutrition and the change in a population's nutrition status, helps you to plan a better intervention.

Information about trends in nutrition status is very important in relief planning: without this information we cannot know whether the nutritional status is improving or deteriorating. This information is obtained by comparing nutritional survey data to baseline information.

Chapter 2 describes where baseline nutrition information can be found. The DHS provide regional level data and the DPPC, NGOs and UN agencies provide woreda or zone level data. The results of all nutrition surveys can be obtained from the DPPC (specifically the ENCU's database[40]).

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

- used similar methodologies (sampling, measuring, same definitions of malnutrition, same age groups, etc)
- covered the same population. If there were any large migrations in or out of the area, you could be measuring a different population

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

[40] The ENCU database is made up of nutrition surveys from all over Ethiopia from the year 2000 to the present. The reports are provided to the ENCU by the agencies undertaking the assessments. All assessments are undertaken according to the standard WHO recommended methods (described in these guidelines). The database provides information on the prevalence (and 95 per cent confidence intervals) of global and severe acute malnutrition defined in terms of z-scores and oedema. Information on the exact date of the survey, the number of children measured and sampling methodology is also provided.

A word of warning: the ENCU database mainly consists of nutrition surveys undertaken during emergencies. This means that many of the ENCU's survey results are not providing baseline information, but information about a population at a bad time. This is not true of all the surveys. Some agencies — specifically Concern and World Vision — undertake surveys regularly and will have data from normal years which can be considered useful as baseline data.[41] However, you should be very careful when comparing your results to earlier results to make sure that you find out what the context was in the earlier surveys. In practice, this means that you have to read the previous survey report (again, you can get this from the ENCU or the agency that undertook the assessment).

Comparing the level 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 survey results, before any conclusions on trends are drawn from the figures presented.

In order to see if there has been a change in the nutritional situation of a population, you need to compare either the prevalence of malnutrition, or the population mean WFH, between two surveys. In general, it is more common to compare the prevalences of malnutrition,[42] but both methods will be described. Remember, comparisons should only be made if the surveys used the same methodology and covered the same population.

The statistically correct way to compare the prevalence of malnutrition between two surveys (using a chi-squared test) is described in Annex 8. A simpler method is to look at the confidence intervals for each survey. If the 95 per cent confidence intervals around the prevalence of malnutrition do not overlap, then you can conclude that there is a statistically significant difference between the two prevalences of malnutrition.

Example 8.6

An NGO conducted two nutritional surveys six months apart in Damot Woyde Woreda in North Omo Zone in 2000. The estimates of the prevalence of global acute malnutrition of the surveys can be seen in Table 8.5.

Table 8.5 Results of nutrition surveys in Damot Woyde Woreda in April and October 2000

	April 2000 (n=960)	**October 2000 (n=903)**
Prevalence of global acute malnutrition (<-2 z-scores and/or oedema)	25.6% (95% C.I. 22.9-28.5%)	7.2% (95% C.I. 5.0-10.1%)

From these results we can see that there has been a significant improvement in the population's nutrition status between April and October 2000. The upper 95% confidence interval for global acute malnutrition from the October survey (10.1%) is less than the lower

[41] SC UK also conducted a nutrition surveillance programme in North and South Wollo, Haraghe, Wolayita, and Tigray for many years. These data are currently being processed to produce baseline prevalences (and 95 per cent confidence intervals) of global and severe acute malnutrition for specific agro-ecological zones. The information will be passed to the ENCU and other interested agencies when the analysis is completed.

[42] This is because, as discussed in Section 7.5, knowing the change in the prevalence of malnutrition is more meaningful than knowing the change in the population mean WFH. If we know the difference in the prevalence of malnutrition, then we know how many children's nutrition status has improved or deteriorated, and so we know whether there has been an increase or decrease in needs. A change in the mean WFH cannot be interpreted so easily.

95% confidence interval of the April survey (22.9%) — this means that the prevalence of global acute malnutrition was significantly less in October than April.

Example 8.7
An organisation conducted three surveys in Gode district between August 2000 and July 2001. The estimates of the prevalence of both severe and global acute malnutrition can be seen in Table 8.6. The organisation claimed that these results showed that *"the nutritional status of children has continuously and significantly improved over the three surveys".* Is this true?

Table 8.6 The results of three surveys conducted in Gode district between August 2000 and July 2001

	August 2000 (n=865)	**November 2000 (n=894)**	**July 2001 (n=736)**
Prevalence of global acute malnutrition (<-2 z-scores and/or oedema)	29.1% (95% C.I. 25.9-32.1%)	16.6% (95% C.I. 13.7-18.6%)	14.4% (95% C.I. 12.0-17.2%)
Prevalence of severe acute malnutrition (<-3 z-scores and/or oedema)	5.3% (95% C.I. 3.9-7.0%)	1.7% (95% C.I. 1.0-2.8%)	1.1% (95% C.I. 0.0-2.2%)

Between August and November 2000 there was a significant decrease in the prevalence of both global and severe acute malnutrition in Gode (the 95% confidence intervals do not overlap). Thus we can see that the situation has significantly improved during this period.

The estimated prevalence of global acute malnutrition is also less in July 2001 than in November 2000 (14.4% is less than 16.6%). However, this change is not significant because the confidence intervals around the estimates overlap. The lower confidence interval for the November survey is 13.7%, but the highest confidence interval for the July survey is 17.2%. The same is true for the severe malnutrition rate — the confidence intervals overlap and so the change cannot be described as significant.

The organisation was, therefore, wrong to say that there has been a continuous significant improvement in the nutritional situation of the population. There was a significant improvement between August and November 2000. However, the change in the estimated prevalence of malnutrition between November and July could have happened merely by chance. The organisation should have said something like *"the nutritional status of the population has not significantly improved since the survey in November 2000, however the situation is still better than in August 2000".*

This method — comparing confidence intervals — can also be used to compare the proportion of children vaccinated from one survey to another.

Example 8.8
The results of measles vaccination results from two different nutrition surveys are presented in Table 8.7. A measles campaign had been conducted between the two surveys. Was the measles campaign successful?

Table 8.7 Results of measles vaccinations from two surveys

	April 2000 (n=850)	April 2001 (n=823)
Prevalence of measles vaccination* (as confirmed by card or mother*)	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%).

In the old DPPC guidelines, comparing the population WFH means was recommended as the method to compare two nutrition surveys. This method has now been replaced in popularity by comparing the prevalences of malnutrition. An explanation for this is given in Section 7.5.

The statistically correct way to compare the population mean WFH between two surveys (using non-matched t-tests) is described in Annex A8.2.

8.2.3 Analysis of the causes of malnutrition

Nutrition status data only detects the symptoms of malnutrition, but cannot explain the causes. Nutrition status data should therefore never be interpreted alone for decision-making processes. Corroborative information is needed to seek possible explanations and causes for poor nutrition status and, especially, deterioration.

Nutrition data must always be interpreted in context. In order to recommend appropriate interventions we have to understand why a certain level of malnutrition exists. Nutrition survey results must be analysed in combination with other information collected, using the UNICEF causal framework. This is absolutely vital for planning an appropriate response.

There is often a tendency to attribute a decline in a population's nutrition status purely to a lack of food at the household level. Although this may be true in some cases, it is essential to look at other causes of malnutrition as well, particularly if a food supply or access problem cannot be identified.

Using the causal framework of malnutrition to help with interpretation of results

One of the easiest ways to interpret nutrition data correctly is to make a local framework of the causes of malnutrition in the survey area. This helps you to see what is really happening in the area (see Chapter 1). Figure 8.2 shows an adapted version of UNICEF's conceptual framework that is useful to use when you are interpreting nutrition data.

To construct a framework you need the kind of contextual information described in Chapter 5. You will remember the broad outline of topics:

- population figures, population movements and vulnerable groups
- causes of the crisis and geo-political context
- nutrition status and diet of the population
- food security
- coping mechanisms

- mortality and health indicators
- operational and relief activities
- community's perceived needs.

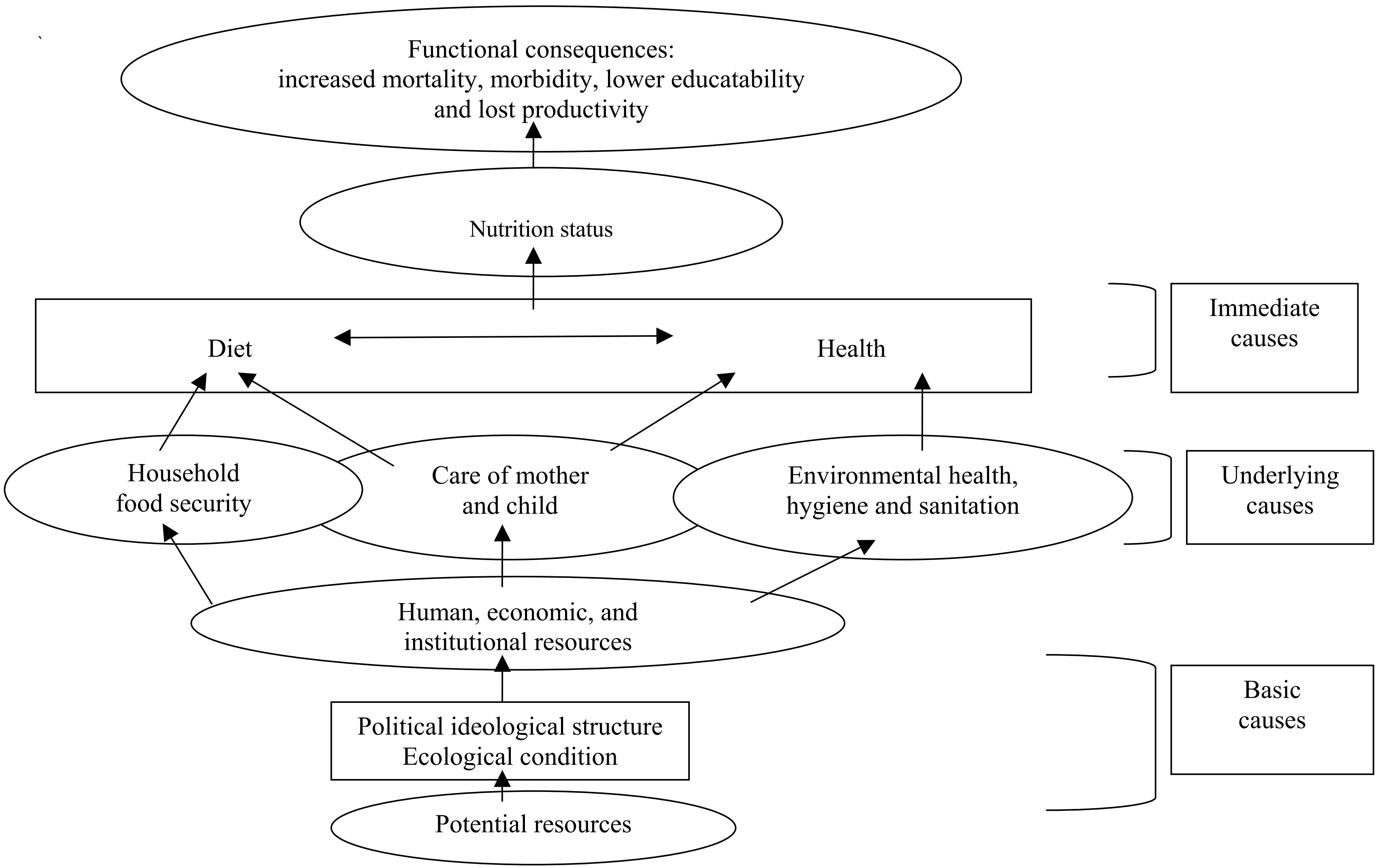
Information on all these subjects is important when you are interpreting nutrition data, but you need different parts of the data for different purposes. If we base our analysis on the causal framework of malnutrition (Figure 8.2), then we could use the data like this:

- Immediate causes of malnutrition
  - food intake — number of meals and type of food consumed.
  - disease — mortality and morbidity rates
- Underlying causes of malnutrition
  - household food security — availability of food at the household level, sources of food, prices of food, future prospects of food availability (own production or relief), coping mechanisms available, household asset base, etc
  - public health — health environment, epidemic status, access to basic health services, vaccination rates, vitamin A supplementation rates, etc
  - caring practices — infant and young child caring practices, community support mechanisms, etc
- Basic causes of malnutrition
  - economic resources — infrastructure, markets, community asset base
  - institutional resources — quality and quantity of schools and medical facilities
  - human resources — mothers' education, women's status in the community, Government capacity, local NGO capacity.

Using the information like this will enable you to build up an understanding of the major causes of malnutrition in the survey area. As stated before, there is no standard recipe for doing this properly. You need to look at your background information, key informant interview notes and household and community questionnaires. You should discuss your findings as a group. Did all the teams observe the same problems?

Apart from the data described above, there are also several other crucially important factors that can assist in the interpretation of nutrition data in Ethiopia. These include coping strategies (including migration patterns) and mortality rates, and are discussed below.

Figure 8.2 Adapted UNICEF causes of malnutrition framework



Coping mechanisms
As described in Chapter 1, people adopt a range of strategies (coping mechanisms) in order to deal with reductions in food availability and access. As the process continues towards the later stages of famine and death, coping mechanisms become exhausted and the priorities of the individual and community shift towards survival.

Information on coping strategies can be extremely helpful when interpreting nutrition data. If a large section of the population is practising unusual coping mechanisms, particularly strategies that will affect their long-term ability to survive, then this is an indication that the situation is severe. Some of the most useful things to monitor are change in dietary patterns (especially unusual increases in the consumption of wild foods), sale of productive assets, large-scale slaughtering of animals and increases in water or firewood sales. Examples of the kind of questions to ask about coping strategies are given in Chapter 5.

High numbers of people looking for paid work, either locally or moving away from the area in search of jobs, may also indicate that the population is experiencing a disruption of their normal living patterns. It is important to differentiate between normal, temporary migration that happens every year, and unusual, distress migration. Remember that most famines actually occur when a population has migrated and congregates somewhere away from their home with negative consequences for public health and nutrition. Unusual migration is a useful early warning tool in this case.

Example 8.9
You have undertaken a nutrition survey in a pastoral area of Somali Region. The community questionnaires revealed that a relatively high proportion of households have migrated with their camels to look for water at the permanent river. What does this mean? Firstly, you need to find out whether or not this migration is normal. At what time of year is your survey being conducted? Where are people normally at this time of year? If the survey is in the long dry period, and households always migrate to the river at this time, then this information may not be cause for alarm. However, if the survey was conducted during a season when most of the households are normally at the village, then this information may indicate that the situation is abnormally bad.

8.2.4 Analysis of mortality rates

High mortality rates are a very important indicator of a crisis — mortality rates cannot really be described as an aggravating factor, but are an outcome. You should always take the results of mortality data (if they are available) into consideration when you are trying to interpret anthropometric data.

If the rates of both acute malnutrition and mortality are high, then it is clear that you have a more serious situation than if the malnutrition rates are high and CMR is low. Table 8.7 shows some rates for crude and under-five mortality in the developing world, and stages of alert (USAID, 2000). You can use this table as a guide to classifying the stage of alert with regards to mortality, but remember that the classification was not specifically designed for Ethiopia.

Table 8.7 Mortality rates and stage of alert

	CMR	U5MR
Average for the developing world	0.27 deaths/10,000 people/day	1.0 deaths/10,000 people/day
In an emergency: ***not critical***	<1 death/10,000 people/day	<2.0/deaths/10,000/people/day
In an emergency: ***serious***	1-2 deaths/10,000 people/day	2-4 deaths/10,000 people/day
In an emergency: ***out of control***	>2 deaths/10,000 people/day	>4 deaths/10,000 people/day

Example 8.10
You have estimated the prevalence of global acute malnutrition at 14% and severe acute malnutrition at 2%. The food security situation seems acceptable, but the U5MR is estimated at 4 deaths/10,000/day and the CMR is estimated at 2/10,000/day. This kind of result would need further investigation. Why is the nutrition rate "poor", but the mortality rate "serious"? It is probably because of some kind of epidemic — possibly measles or malaria, or a diarrhoea outbreak. You need to find out what is happening and make (medical) recommendations immediately.

Another important reason for collecting mortality data is that it can be particularly useful in explaining a situation if the overall situation is very poor and actually worsening. A high mortality rate can mask a deteriorating nutritional situation, as can the absence of the most vulnerable members of a community. This type of interaction can confuse the interpretation of what is really happening and lead you to the wrong conclusions.

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. For example, in Hararghe in the 1970s, no difference was found between the anthropometric status of nomadic and agricultural groups. However, the death rate amongst children in the nomadic groups was three times the rate found in the agricultural groups (Rivers et al, 1976). Any potential differences between the anthropometric status of these groups may have been masked by the effects of different mortality rates.

Excess mortality among children under five years 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 normal population. For example, a survey in Bardera, Somalia in 1993, found that only 3.3 per cent of the total population was under five years (normally around 20 per cent of the population is under five years) as a result of high mortality among this group. This was thought to bias the anthropometric results, which no longer represented the nutritional situation of the population as a whole.

8.3 Differences between results expressed in percentage of the median and z-scores

We have recommended that the classification of a population's nutrition status be based on WFH z-scores and/or oedema. However, we have also suggested that the results of nutrition surveys should present both z-scores and percentage of the medians (see Chapter 7). This may lead to some confusion during interpretation.

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: on average the z-score prevalence is about 1.4-1.6 times as much as the percentage of the median prevalence.

A difference in the prevalence of acute global malnutrition of about 5% between the results expressed in percentage of the median and the results expressed in z-scores can be expected (unless the rate of malnutrition is very high). If a bigger difference is found it is necessary to consider the prevalence of severe malnutrition and the mortality rate, to correctly interpret the results.

The differences between z-scores and percentage of the median are particularly important in areas with a low prevalence of kwashiorkor, and in populations with long and thin statures (for example, Somali, Dinka and Turkana populations).

Example 8.11
The results shown in Table 8.8 come from a survey conducted in Moyale Woreda, Liban Zone, an arid pastoral 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 8.8 Results of a nutrition survey in Moyale Woreda, Liban Zone

Prevalence of global acute malnutrition (<-2 z-scores and/or oedema)	17.1% (95% C.I. 14.3-19.8%)
Prevalence of global acute malnutrition (<80% median and/or oedema)	9.5% (95% C.I. 7.7-11.2%)
Prevalence of severe acute malnutrition (<-3 z-scores and/or oedema)	0.8% (95% C.I. 0.3-1.3%)
Prevalence of severe acute malnutrition (<70% median and/or oedema)	0.1% (95% C.I. 0.0-0.3%)
CMR	0.73/10000/day
U5MR	1.83/10000/day

Despite the high prevalence of global acute malnutrition in z-scores, both the prevalences (z-sores and percentage of the median) of severe acute malnutrition and the mortality rates were acceptable. 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. In addition, they were not selling more livestock than usual at the end of the dry season. Camel prices were good. The situation was classified as “serious”, but not as “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.

When there is a large discrepancy between the prevalence of global malnutrition expressed in z-scores and the percentage of the median, and in addition the prevalence of severe malnutrition or the mortality rate is high, consider the situation as serious. However, when there is a large discrepancy between z-scores and percentage of the median and a low prevalence of severe malnutrition and low mortality rates, the data suggest that the situation is not yet serious, but there is a large population at risk. For more detail on the meaning of z-scores versus percentage of the median, see Chapter 3.

8.4 Factors that might bias the estimation of the prevalence of malnutrition

When you are interpreting nutrition data you need to think about factors which might have biased the results. The strong appeal of anthropometric data is their objectivity as a precise measure of nutrition status and growth failure. However, on closer inspection, anthropometric results are not quite as objective as most of us think. To be objective, results must be both valid and reliable.

8.4.1 Reliability — sources of bias

A reliable measure gives roughly the same answer whenever it is carried out. The design of anthropometric surveys is intended to do just that. Standardised measuring techniques, sampling design and training are all intended to maximise reliability. Statistical checks, such as confidence intervals, provide a measure of the reliability and precision of results. Sample size affects the size of the confidence interval, which widens as sample size decreases.

A large sample is not enough, however, to guarantee the reliability of results, because of the possibility of a biased sample. Various sources of bias, common in nutrition surveys, are listed in the box below. These may have a profound effect on the survey results, much greater than random measurement errors, which may be removed by the analysis.

Sources of bias in nutrition surveys

Type of bias	Cause
Incomplete coverage	• inaccurate or out-of-date sampling frame • large-scale population movements, distress migration • sampling subsections of the population, famine camps, feeding centres • geographical bias towards the more accessible, affluent or urban areas.
Age or sex bias	• samples of varying age composition, younger children are more susceptible to wasting, while older children are more susceptible to stunting. All nutrition indices therefore vary according to the age structure of the sample • if the population does not allow one sex to be measured for cultural reasons.
Non-random measurement error	• systematic errors because of faulty weighing equipment or incorrect measuring techniques • inadequate training and supervision • non-standardised measuring equipment.

It is important to be aware of age bias in pastoral areas because, in some pastoral populations, children aged four to five years may travel with their livestock. This will probably mean that they are not included in the nutrition survey and there will be an over-representation of younger children. This may lead to bias: if there are more younger children then the prevalence of malnutrition may be over-estimated.

8.4.2 Validity — finding the true meaning behind the figures

A measure is valid if it is relevant to the question asked and provides the correct answer. For example, if the question is "what is the rate of wasting?", a valid measure would be the WFH anthropometric index. Problems with the validity of anthropometric results occur when wide-ranging conclusions are drawn on the basis of anthropometric results alone. This can happen when anthropometric data is used as an indirect measure, or proxy indicator, for some other factor of interest, such as inadequate food intake, or inadequate household food security, etc. Valid conclusions about these factors cannot be drawn from anthropometric data in isolation.

8.4.3 Confounding variables and anthropometric status — watch out for deceptive data

Confounding variables interact with anthropometric indicators and can profoundly affect the reliability and validity of results. High mortality, as described in Section 8.2.4 is one example.

Again, in a situation with high migration, nutrition status data may give a false positive picture. The households that leave first are usually the worst affected and are likely to be the most malnourished. The better-off, whose children are better nourished, will remain in the area for longer. Thus, the anthropometric survey data will not be representative of the population as a whole. It is, therefore, important to assess data on migration patterns when interpreting nutrition status data.

When malnutrition is a problem mainly in age groups other than the under-fives, emergency nutrition assessment results for children aged 6-59 months might underestimate the problem. For example, in some Borena populations, during food insecure periods, food is given in priority to small children: consequently, older people or adults can suffer from malnutrition before children do.

8.4.4 How to detect age and sex biases

Whenever you undertake a nutrition survey it is important to produce a standardised table showing the age and sex distribution of the sample (see Section 7.4). This table helps us to detect any age or sex biases.

The ratio of boys to girls allows us to verify that the sample was not biased in terms of sex. As a general rule, if the total ratio is between 0.9-1.1 then you can be confident that there was no sex bias in the selection.

Potential reasons for a sex bias include:

- during the survey one sex (either boys or girls) was more likely to be absent or hidden
- either boys or girls suffered higher mortality rates in the past
- chance — sometimes just by chance more boys will be picked than girls (or vice versa). Of course, the smaller the sample, the more likely it is that there will be some bias by chance.

Example 8.12
You take a sample of 510 children aged 6-59 months. If you find 256 boys and 254 girls, the sex ratio would be 1.01. This is acceptable: there is no sex bias. However, if you find 306 boys and 204 girls, the sex ratio would be 1.5. This indicates a sex bias in the sampling.

A normal distribution by age group (for a population aged 6-59 months in the developing world) is shown below in Table 8.9. The distribution of your age groups (in the standard table) should not vary too much from this if the sample is unbiased, ie, the percentage total column should be about the same for all unbiased samples.

Table 8.9 Normal age group distribution

	Boys		**Girls**		**Total**		**Ratio**
	No.	**%**	**No.**	**%**	**No.**	**%**	**Boy:girl**
6-17 months						23.9	
18-29 months						25.5	
30-41 months						22.4	
42-53 months						19.2	
54-59 months						9.0	
Total						100	

An under-representation of an age group, such as the 6-17 months group, may reflect a higher mortality in this subgroup, but may also reflect the fact that these children were not present on the day of the survey, or it may be due to the effect of chance.

8.4.5 How to manage bias when interpreting data

As you might expect, there is no standard way to manage biased nutrition data. If you do find sources of bias, for example, if you realise that the proportion of one age group is very low or that certain sections of the populations have been missed out, then the best thing to do is to explain this in your survey report. You should explain why the bias has happened and what effects you think this might have had on the survey results.

Example 8.13
You have undertaken a survey to assess the nutritional situation of a population in a woreda. When you analyse the results you realise that one team has reported a lot more oedema than any of the other teams, although they were all working in the same area. This is a form of systematic measurement error. What should you do? Report the problem in the survey report and, if you think it is necessary, discard the children with oedema from the analysis. This is a good example of why it is so vital to check the results as the survey progresses.

Example 8.14
You have undertaken a survey in a woreda. When you analyse the results you realise that the youngest age group is very under-represented. You discover that this is due to high mortality caused by an outbreak of measles a few months before the survey. In this case, you should state in your survey report that this survey is unusual because of this. The survey results should not be compared to other surveys in the area with a different age-group balance.

Example 8.15
You have undertaken a survey to assess the nutritional situation of a population in a woreda where the population is approximately half nomadic pastoralists and half settled agro-pastoralists. When you have finished the analysis, you realise that the nomadic pastoralists are under-represented in the sample. This was because the population data you were originally given by the authorities was based on settlements. The pastoralists were mainly in the bush, not in these settlements, and so you did not interview or measure many of them. You do not know whether the nutrition status of the nomads or the settled population is worse.

In this case, you should write in your report exactly what happened during the sampling procedure. You should then be totally honest in stating that you do not whether the nutrition status of the two groups is different or not. If necessary, you will have to undertake another survey — of the nomadic group — in order to know if there is a real difference between the groups.

Summary of main points in Chapter 8

- There is no standard recipe for interpreting nutritional data.
- The classification of a population's nutritional status must take into account the prevalence of global acute malnutrition (defined as <-2 z-scores and/or oedema) and aggravating factors.
- To interpret nutrition data correctly we need to:
  - determine seasonal variations
  - compare the results with Ethiopian benchmarks of malnutrition
  - compare the results to previous surveys in the same area or agro-ecological zone at the same time of year
  - interpret all results according to the causes of malnutrition framework
  - analyse mortality rates.
- All nutrition data must be interpreted in the cultural, socio-economic and agro-ecological context, together with other supporting data, such as indicators on mortality, coping mechanisms and seasonality.
- Anthropometric data are subject to biases. Potential biases must be considered when interpreting nutrition data.

Chapter 9

Using the information

This final chapter will focus on how you should use the information collected in a nutrition survey. The discussion will start with how to produce a useful survey report. Secondly, we will look at nutrition interventions and strategies commonly used in Ethiopia. We will then discuss how to use the data for monitoring and evaluating programmes. Finally we will discuss what to do with nutrition survey reports when you have completed them.

9.1 Writing the report

A report on the survey should be written as soon as possible after the survey has finished. The DPPC has developed a model survey report format which all agencies undertaking nutrition assessments in Ethiopia should follow. The model report format can be found in Annex 9. Some changes will obviously have to be made to the format from one survey to another, but on the whole all reports should have a similar layout.

A brief explanation of each section of the model survey report is given below.

Report summary

- write the summary last, after you have finished the rest of the report
- ninety per cent of readers will probably only look at this section. Make sure all important information is here and is very clear. Diagrams are very useful
- this section of the report should be short (one or two pages)
- information should include: the area covered, the date and the objectives of the survey, the methodology used, the main results and recommendations.

Report introduction

- the context in which the survey was carried out should be described. What population was surveyed, at which period and in which geographical area?
- the introduction should be scene-setting, so that someone who has never been to the area can understand how the surveyed community lives, and what has happened to them
- this information is mainly from secondary sources, or interviews with woreda officials, etc.

Objectives of the survey

- the objectives of the survey should be clearly stated
- what was measured, in which population and why?

Methodology

- a straightforward description of the methods employed, including sampling techniques. This is necessary so that readers can ensure the validity of the survey and have a clear reference for future comparison
- describe any problems encountered
- include selection criteria for inclusion in the survey
- describe what measurements were taken, by whom and using what instruments
- describe how the questionnaires were designed and piloted.

Results

- this section is mainly graphs and tables
- a table of the distribution of the sample, according to age and sex is required
- all nutrition surveys should report the anthropometric statistics tables found in Annex 9
- not all surveys will have food security, health, vaccination, care and mortality data — the collection of these variables depends on the objectives of the survey, although mortality and vaccination data should be prioritised. Thus, the reporting of these variables will vary.

Discussion

- the discussion puts the results back into context. The aim of the discussion is to explain the results seen (eg, prevalence of malnutrition and mortality rates) in terms of the causes of malnutrition — health, food security and care. It is often easiest to split the discussion up into these three broad areas and discuss each separately
- it is useful to compare current findings to previous surveys and explain changes seen (if any)
- much of information for the discussion will come from key informant interviews, observations and casual conversations (that is, not during questionnaires) with community members
- it is useful to focus on what is normal and what is happening now, also to try to predict what might happen in the future.

Conclusions

- this section is not essential. If you feel the discussion was long and complicated you may wish to summarise the most important points in bullet points in a conclusions section
- a diagram to show the causal framework of malnutrition may be useful.

Recommendations

- a report must include recommendations. A nutrition assessment is meant to promote rational decision-making
- it is important to prioritise — it would probably be useful to do a public health education campaign in all parts of Ethiopia, but is it an absolute priority in this area?
- state who should implement the recommendations and when/why.

9.2 Nutrition interventions and strategies

The selection of appropriate nutrition interventions and strategies largely depends on the context. Consequently, a fixed intervention blueprint does not exist. However, it is important that there are relatively equal responses to nutrition emergencies in all parts of the country, ie nutrition interventions must be fair.

In order to try and make responses fair, it is important to use the classification of the severity of population malnutrition rates (Table 8.4) when deciding what intervention is appropriate. Of course, it is not possible to state, with absolute certainty, what is the correct intervention at each level of alert in the nutrition classification, but the classification can help.

To chose the right intervention you need to consider:

- the prevalence of global and severe acute malnutrition, mortality rates, coping mechanisms, seasonality and other aggravating factors
- the causes of malnutrition. Usually, in emergency nutrition surveys you can never be absolutely certain which factor is the most important determinant of malnutrition in a population. This is because the different factors often interact with each other. For example, poor food availability and illness interact, so you cannot attribute all the malnutrition either to disease or to food insecurity. However, you can normally make an informed decision about what interventions to prioritise if you use the causes of malnutrition framework analysis technique
- the population's future needs, including immediate food prospects, potential disease outbreaks and potential changes in caring practices
- what other on-going interventions already exist
- what resources are available and what constraints exist.

9.2.1 Predicting future needs

When you are interpreting nutrition data you need to think not only about what has caused the current levels of malnutrition, but also what will happen in terms of the population's nutrition status in the future.

Emergency nutrition assessments usually need to consider what will happen to a population in the few months after the survey. To be able to predict future needs you require information on immediate food supply prospects, potential outbreaks of disease and potential breakdown in care-providing structures. You also need information on the coping mechanisms available to the population for dealing with any problems. This type of information will help you to plan a better intervention.

Immediate food supply prospect data is extremely important. If a high level of acute malnutrition has been recorded, but there are crops in the field that are about to be harvested, then it is important not to flood markets with relief food when farmers are harvesting and selling their food. If, however, there are high levels of acute malnutrition and there is no immediate prospects of a harvest or of obtaining food through any other coping mechanisms, then there may be a need to provide relief food.

Example 9.1
You have estimated the prevalence of global acute malnutrition at 12% in highland belg area of South Wollo. The prevalence of severe acute malnutrition is estimated at 2%. The belg harvest happened last month and was very poor. No other major harvest is expected for a year. Although this prevalence of malnutrition is not yet very high, the aggravating factors — a poor harvest — suggest that the situation is likely to get worse. You could classify this situation as serious and advocate for an EGS programme.

Populations that are malnourished are more susceptible to disease (Chapter 1). You should always be aware of this when you are predicting needs for a malnourished population. You need to consider interventions that will help minimise the risk of a disease outbreak — measles immunisation and the distribution of vitamin A capsules to young children are two good examples. Of course, if you discover that there has been a vaccination campaign very recently, then this may not be necessary.

Example 9.2
You have estimated the prevalence of global acute malnutrition at 12% in a newly formed IDP camp. A full general ration is not yet available to the population. The measles vaccination rate is estimated at only 20%. This should be considered as a serious situation, despite the relatively low rate of global acute malnutrition, because the population is not yet receiving a proper ration and the measles vaccination rate is dangerously low — especially for such a crowded place. Advocate for an increased ration and a measles campaign immediately.

In some situations, mainly when a population is forced to migrate, there can be a break-down in normal caring practices for young children. This may mean that children can no longer be properly cared for. For example, in some camp situations, women find it difficult to breastfeed normally and may need support. You need to consider this when planning your interventions.

Example 9.3
Young children from a pastoralist community are used to depending on camel or cow milk. The children are separated from their animals when they move to the outskirts of a town to receive relief food. You need to consider how best to help mothers provide other foods for these young children. Perhaps you will have to instruct mothers how to prepare fafa, or other relief foods, so that it is suitable for children to eat.

9.2.2 On-going interventions

It is important to consider what other interventions are on-going before you make any recommendations. Do not waste precious resources by over-lapping with other programmes.

Example 9.4
Imagine, like in Example 9.1, you have estimated the prevalence of global acute malnutrition at 12% in a highland belg area of South Wollo. The prevalence of severe acute malnutrition is estimated at 2%. The belg harvest last month was very poor. No other major harvest is expected for a year. However, an EGS programme is planned to start in two months. In this case, you could classify the alert level as “poor”, because you are expecting the population’s food security situation to improve. There should be no need to advocate for a new EGS programme, instead you should closely monitor the impact of the planned EGS programme.

You must also consider what interventions are practical and feasible: what resources are available and what constraints exist. In particular, you should consider constraints of possible programmes when making recommendations. If requirements are not realistic, the strategy must be adapted accordingly. Common constraints include: limited access to the population, lack of skilled personnel, insufficient financial resources and insecurity. For example, the size of a blanket feeding programme often depends largely on the logistic capacity and amount of food available.

9.2.3 Types of nutrition interventions

There are many different emergency nutrition programmes based around food and therapeutic feeding that can be considered. These include:

- General food distribution (GFD)
- Blanket feeding programmes

- Supplementary feeding programmes (SFP)
- Therapeutic feeding programmes (TFP)

There are, of course, many other important programmes that effect nutrition status indirectly. These include:

- vaccination and supplementation programmes (measles and vitamin A)
- water, sanitation and hygiene programmes
- food security programmes.[43]

None of these programmes will be fully described in these guidelines. Information on nutrition programmes can be found in the *Nutritional Guidelines for Food Relief Rations* (RRC, 1989) and also in *The Management of Nutrition in Major Emergencies* (WHO, 2000). A brief description of the main types of nutrition programmes is given in Annex 10.1.

9.2.4 What type of response is appropriate?

Table 9.1 is intended as a guideline of responses to each of the alert levels described in Table 8.4. The alert stages, objectives of response and potential nutrition interventions are summarised in Table 9.1. It must be stressed that these recommendations are *not* intended as a set of fixed rules in response to a particular alert level. You must consider the particular circumstances of each nutrition assessment separately in its own context.

[43] Food security interventions are not covered in these guidelines. Such interventions are complex and require strengthening of social structures and economic and agricultural measures.

Table 9.1 Summary of alert stages, objectives of response and nutritional interventions

Stage of alert	Objectives of response	Nutritional interventions
Poor *Food insecurity*	*Mainly preventive measures* • avoid loss of assets • preserve livelihoods • preserve health status of population and vulnerable groups	• advocate for food security interventions • continue to monitor the situation • advocate for support to medical facilities (to treat severe malnutrition) if necessary • raise public awareness of a potential problem.
Serious *Food crisis*	*Preventive and curative measures* • reduce mortality and morbidity related to malnutrition • maintain health and nutrition status of population. • prevent deterioration	• ensure the population has adequate access to food • implement selective feeding programmes if necessary and practical • control epidemics and primary communicable diseases through provision of adequate health care (especially measles vaccination and vitamin A distribution) and sufficient water and sanitation • as soon as the situation is under control, focus on recovering livelihoods.
Critical *Famine*	*Mainly curative measures* • ensure survival of population (reduction of mortality) • stop distress migration	• ensure adequate GFD • provide an increased general ration if necessary • implement selective feeding programmes: TFP, SFP and blanket feeding programmes if necessary • control epidemics and primary communicable diseases through provision of adequate health care and sufficient water and sanitation.

Some examples of different intervention programmes in response to different alert levels are given in Annex 10.2.

9.3 Monitoring and evaluating nutrition programmes

Nutrition survey results, specifically anthropometric data, may be used to assess the efficacy and quality of nutrition programmes such as GFDs, SFPs and TFPs.[44] This is an essential part of the management of such programmes: survey results should be used to adjust programmes, particularly if the objective of a programme is to improve the population's nutrition status. Nevertheless, an improvement or deterioration in nutrition status normally cannot just be attributed to the quality of the nutrition programmes implemented.

Three important questions need to be asked when assessing nutrition programmes:

- What is the impact of the programme on the nutrition status of the whole area within which the programme operates?

[44] Nutrition surveys are also used to assess food security interventions and health or sanitation programmes. However, this is more complex because such interventions do not always directly impact on nutrition status and so it is harder to monitor and evaluate them on the basis of anthropometric data.

- What is the impact of the programme on the nutrition status of those households receiving food aid, ie, the beneficiaries?
- Should the programme be closed or altered?

The discussion below will focus on how nutrition data can be used to answer these questions. The importance of non-anthropometric data for programme monitoring and evaluating will also be discussed.

9.3.1 Non-anthropometric data needed to monitor and evaluate nutrition interventions

Before discussing how anthropometric survey data can be used to monitor and evaluate nutrition interventions, we need to consider what other data is also necessary. You need other, non-anthropometric data to evaluate a nutrition (or food security or health programme) because you need to be able to explain why there has been an improvement or deterioration in nutrition status, if you are evaluating the programme. For example, you need to know whether it was the nutrition intervention that improved the situation, or some other factor.

Many factors contribute to a change in a population's nutritional status, as has been described in Chapters 1, 5 and 8. Any of the underlying and basic causal factors that determine malnutrition could have changed.

For example, households' access to food could have increased because of a harvest, a decrease in cereal market prices, an increase in demand for labour, or other income generating activities. Unfortunately, this normally means that you cannot be sure exactly how useful the nutrition intervention was — unless absolutely no other factors have changed between the two surveys. The only way to deal with this problem is to try to find out what other factors have also changed, and then try to work out how important the nutrition programme was.

Example 9.5
You undertake a follow-up nutrition survey in an agricultural woreda and find that there has been a significant decrease in malnutrition since an EGS programme started in the woreda. How can you tell whether or not this is due to the programme or other factors? You need to find out through discussions with key informants or community/household questionnaires, what other factors have also changed.

If a continuing deterioration in nutrition status is found in an area after a relief food programme has been implemented, then you should consider the following factors:

- Was the beneficiary number adequate?
- Was the ration size adequate?
- Was the food delivered frequently enough?
- Does a health problem exist? Should a health intervention be considered?
- Was the targeting system properly implemented?
- Are the young children receiving their fair share of the food?

9.3.2 How can you measure the impact of a programme on the whole population?

Repeated cross-sectional 30 by 30 surveys are a very useful way to assess the impact of the programme on the whole area. Cluster surveys can be made at the start of an intervention and then a few months later to assess the nutrition status of the whole population. Chi-squared tests (described in Annex A8) should be made to indicate whether or not there has been a significant change in the population's nutrition status. Remember, if you are using repeated cross-sectional surveys to assess whether or not there has been a change in nutrition status, you must make sure that you are sampling the same population as the earlier surveys (see Section 8.2.2).

The results of the chi-squared tests, in conjunction with information described above, should enable you to assess the impact of the programme. Hopefully, the situation will have improved significantly. If not, there is a need to re-consider your intervention.

9.3.3 How can you measure the impact of the programme on the beneficiaries?

You cannot measure the impact of a programme on only the beneficiaries, using repeated cluster surveys, unless the whole population was a beneficiary. In order to measure the impact on individuals receiving food, for example in an SFP, it is necessary to follow-up those individuals directly. This means that each child in an SFP should initially be registered, weighed and measured, and then he or she should be longitudinally measured over time.[45]

The same is true for households. If you want to measure the change in nutrition status only in households that were included in food distributions, then you would have to set up a longitudinal survey that looked specifically at this group. A description of such a survey is beyond the scope of this manual.

9.4 What to do with the nutrition survey report

As discussed in Chapter 2, it is extremely important that all agencies undertaking nutrition surveys in Ethiopia send their nutrition survey reports to the ENCU. If we all do this, then the ENCU will eventually build up a library of nutrition survey reports that will be very useful for EW planners. The ENCU will also update its database with the results of all surveys. This database can be used by any agency working in the field of nutrition, so it is in all of our interests to help the ENCU keep it up-to-date.

In addition to the ENCU, nutrition survey reports should be sent to:

- DPPC at the federal/regional/zone level
- MoH at the regional/zone/woreda level
- MoA at the regional/zone/woreda level
- Planning at the regional/zone level
- Administration at the regional/zone/woreda level
- NGOs working in the survey area.

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[45] The process of monitoring individuals in SFP programmes, and also the progress of the whole SFP, is beyond the scope of this manual. Information on this is available from WHO (2000) and MSF (1995).

If possible, inter-agency meetings should be held with the authorities and other interested agencies in the different regions, to discuss the findings of nutrition surveys — particularly regarding the recommendations. If necessary, additions can be made to reports after these meetings.

Summary of main points in Chapter 9

- The DPPC's model survey report format should be used by all agencies undertaking nutrition surveys in Ethiopia. The report should be made available as soon as possible after the survey has been completed.
- A fixed blueprint for interventions to nutrition emergencies does not exist. In order to try to make responses fair and effective you need to consider:
    - the prevalence of global and acute malnutrition, mortality rates, coping mechanisms, seasonality and other aggravating factors
    - the causes of malnutrition
    - the population's immediate future needs
    - what other on-going interventions exist
    - what other resources are available and what constraints exist.
- Anthropometric data can be used to monitor and evaluate nutrition interventions, however, the other non-anthropometric data is also required.
- All agencies undertaking nutrition surveys in Ethiopia must send their results to the ENCU, so that the DPPC can build up a central database of information on the prevalence of acute malnutrition in different parts of the country.

Annex 1

Different approaches for the collection of anthropometric data to monitor deteriorating food security in Ethiopia

There are a number of different practical approaches for the collection of anthropometric data, which are usually defined by the objectives of the surveillance system, the available infrastructure and the context in which the system is implemented.

Four approaches are commonly used to collect anthropometric data in order to monitor a deterioration in food security:

- growth monitoring programmes
- longitudinal anthropometric data systems
- community-based sentinel site systems
- repeated cross-sectional surveys.

A brief discussion of the relevance of each of these four approaches for Ethiopia follows.

Growth monitoring programmes

One of the most common mechanisms for the systematic collection of anthropometric data is through growth monitoring programmes (GMPs) in maternal and child clinics. These programmes are, however, fraught with limitations, including the bias of the information in relation to attendance and coverage (not representative), the timeliness of the data and a question of its reliability and, finally, the absence of a health infrastructure in many communities (Shoham et al, 2001). For the above reasons, this type of nutritional surveillance system is not currently appropriate for use as part of Ethiopia's EW system.

Longitudinal anthropometric data systems

Longitudinally collected anthropometric data is an alternative approach to GMP. This method involves measuring the same children regularly. The Nutrition Surveillance Programme (NSP) is a good example of one such longitudinal nutritional data collection system[46]. SC UK's NSP was formally linked to the Ethiopian Government's national EW system[47] and provided much of the national data for nutrition surveillance in the 1990s.[48] The aim of the NSP was to add to the DPPC's capacity to predict and relieve food shortages by monitoring the nutritional status of populations prone to food shortage, and in particular to identify and explain any deteriorating trends.

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[46] The NSP randomly selected approximately 12-50 villages each year in vulnerable areas. From these villages, fifty children between 70-110cm were randomly selected, and all children were followed-up every two months. The same children were continuously monitored for two years, after which a new batch of children was selected. In addition, household and village questionnaires were completed and analysed. Data on rainfall, cereal prices and terms of trade, among other data, was also collected. The information collected by the NSP was analysed on the basis of the characteristic differences in food production seasons (meher-dependent, belg-dependent, etc) in the areas monitored. Quarterly reports were produced. Anthropometric data were presented in terms of change in mean weight-for-length of children.

[47] The 1995 DPPC nutrition guidelines stated that the Government had only limited capacity to collect nutrition data and that it relied on non-governmental organisations (mainly SC UK) to supply the data until the Government "is able to expand its area of operation".

[48] Other NGOs, including World Vision, collected nutritional data during this period, but the NSP provided wider coverage for a longer time period.

The information collected and presented by the NSP was useful to the DPPC and other national and international agencies involved in EW for famine prevention. The data was regarded as comprehensive, comparable and consistent, and many agencies used the reports to provide background information on the situation in many of the most drought prone areas of Ethiopia. Recently, however, the NSP programme has closed down. There were various reasons for the closure of the NSP. The most important reasons were:

- The link between the NSP data and response was weak — the NSP provided information to the DPPC, NGOs and donors, but did not have a mandate to respond.
- The programme was expensive and the Federal Government could not commit to taking over the funding.
- Although the DPPC and others used the anthropometric data, they did not take much account of the other data, leading to late responses in some cases.
- The methodology employed was outdated (see Section 4.11). This led to some problems with interpretation of the data for users outside the DPPC and SC UK.

It is probable that other longitudinal systems would face similar problems to the NSP. In particular, longitudinal surveillance programmes are always very expensive to run.

Community-based sentinel site nutritional surveillance

Community-based sentinel site nutritional surveillance can provide a more suitable alternative to large-scale longitudinal nutritional data in some situations. This type of monitoring was used in dispersed pastoralist communities in Darfur, Sudan (Young and Jaspars, 1995). Sentinel site systems are generally less expensive and more sustainable than the longitudinal survey method. Sentinel site methods may also provide more timely information that is of greater depth and more participatory in approach. Problems with this method include questions concerning the reliability of the data. Furthermore, issues of poor representation, selection of inappropriate sentinel sites and interpretation of data (specifically the inability to extrapolate findings to other areas) are associated with this type of system. Also, it is difficult to compare this type of data to that collected in other areas with different livelihood systems. Therefore, this type of surveillance is not recommended, at least on a large scale (it may be more effective in smaller areas, for example in one zone).

Repeated cross-sectional surveys

Repeated cross-sectional quantitative surveys, usually using simple random, cluster or systematic sampling, is the most common approach used in refugee camp settings (see Chapter 4 for an explanation of sampling methods). Nutrition surveillance in these contexts usually consists of collection of anthropometric data, health and mortality information every two to three months, during the earlier stages of the emergency, and every six months at later stages. UNHCR and its partners use this type of surveillance in the refugee camps in Gambela and Jijiga. While these methods can be ,and are, applied to non-refugee settings, the logistical constraints are substantially greater and the feasibility of implementing surveys on a regular basis over the longer term is more challenging. Some NGOs, notably World Vision and Concern, currently monitor nutrition status in their project areas using this methodology.[49]

What works best for Ethiopia?

The two approaches for collecting nutrition status data, using a relatively sustainable approach, would involve either integrating the collection of information into the existing health structures or giving the community the responsibility for its collection and analysis. Neither of these approaches is feasible in the current Ethiopian context. An alternative approach would be to consider the potential collection and analysis of nutrition status data through the existing EW system. In the

[49] The major difference between repeated cross-sectional surveys and longitudinal surveys is that longitudinal surveys measure the same children, whereas repeated cross-sectional surveys measure different children (see Chapter 4 for more on this topic).

current context, this would require the nutrition data to be collected by woreda-level development agents (DAs). This is already happening on a small scale, but the data is not objective (see Section 2.1.4). Given the overwhelming workload of the DAs and the woreda EW committee, it is doubtful that they would be able to collect any more (objective) nutrition data.

In conclusion, it seems that it is not possible for the DPPC/DPPB to systematically collect nutrition status data using a community-based surveillance method or a longitudinal methodology like the NSP. In other words, routine collection of objective nutrition data to monitor the deterioration of food security, is currently not practical for the DPPC/DPPB.

Annex 2

Anthropometric measurement of children aged 6-59 months

A2.1 Specifications for weighing and measuring equipment

A brief description of the specifications of weighing and measurement equipment suitable for nutrition surveys is given below. If an agency is interested in ordering equipment, they should contact UNICEF, which has model scales and height-boards.

A2.1.1 Weighing equipment

A suitable instrument for weighing children aged 6-59 months is a 25kg hanging spring scale marked out in steps of 0.1kg. Weighing pants should be provided with the scale. Normally, Salter scales are used. Salter scales can sometimes be bought in Addis Ababa, although they may be of poor quality. Most agencies order the scales from overseas.

A2.1.2 Equipment for measuring height and length

A measuring board is normally at least 130cm long, is made of hardwood and has a hard water-resistant finish. The board should have a metal tape-measure attached to it, which should be marked out in 0.1cm steps. The head-board must be movable and the foot-board must be large enough for a child to stand on it.

Height boards are usually ordered from carpenters in this country, although the DPPC may obtain them from UNICEF in some cases.

A height arch can be used for selecting children shorter than 110cm. This can be constructed simply and should consist of a horizontal bar fixed at 110cm above the ground at right angles to a vertical pole (or between two vertical poles). Any child who can walk under this horizontal bar without hitting it, and without stooping, should be included in the sample for further measuring.

A2.1.3 Equipment for measuring mid-upper arm circumference

Mid-upper arm circumference measurements should be made using a flexible, non-stretch tape made of fibreglass or steel. Alternatively a fibreglass insertion tape can be used.

Some agencies (such as Oxfam and ACF) have produced specially made MUAC tapes for use in nutrition screenings. These are colour banded so that the measurer knows whether or not to refer a child for further (weight and height) measurements.

A2.2 Measuring children aged 6-59 months

A2.2.1 Estimating age

Emergency nutrition surveys normally measure the weight and height of children aged 6-59 months. However, in many areas of rural Ethiopia, the age of children is not known. In general, the younger the child is, the more accurately you can estimate his or her month of birth.
The following methods are helpful for determining or estimating the age of a child, if the mother does not know:

- look up age in official registers. In rural communities, you normally cannot find local official registers of births or a baptismal certificate book. Instead, you may be able to find the child's immunisation card in some households. If the health workers properly recorded the date of birth on the immunisation card, then you can copy the date from the card. Therefore, when trying to determine a child's age, you should always ask to see the child's immunisation card.
- use a birth date of a neighbour's child as a reference. If the age of a neighbour's child is known, then you can ask other women whether or not their child was born before or after the reference child. The younger the child is, the more accurately you can estimate his or her month of birth.
- use a local events calendar. A local events calendar shows all the dates on which important events took place during the past 5 years. It can show local holidays, hailstorms, the opening of a nearby school or clinic and political elections, etc. An example of a local events calendar (designed for Gubalafto Woreda in North Wollo) is given in Table A2.1. You should ask the mother whether or not the child was born before or after a certain event, and work out a fairly accurate age in this way.

Table A2.1 Example of a local events calendar to estimate age in children aged 6-59 months

Month	**1989 Ethiopian calendar**	**age**	**1990**	**age**	**1991**	**age**	**1992**	**age**	**1993**	**age**	**1994**	**age**
September	New year Meskel	62	New year Meskel	50	New year Meskel	38	New year Meskel	26	New year Meskel	14	New year Meskel	2
October	Green cereals Ramadan	61	Green cereals	49	Green cereals	37	Green cereals	25	Green cereals	13	Green cereals	1
November	Meher	60	Meher Ramadan	48	Meher Ramadan	36	Meher	24	Meher	12		
December	Christmas	59	Christmas	47	Christmas	35	Christmas Ramadan	23	Christmas Ramadan	11		
January	Epiphany Arafat	58	Epiphany Arafat	46	Epiphany	34	Epiphany	22	Epiphany	10		
February		57		45	Arafat	33	Arafat	21	Arafat	9		
March		56		44		32		20		8		
April	Good Friday Easter	55	Good Friday Easter	43	Good Friday Easter	31	Good Friday Easter	19	Good Friday Easter	7		
May	Mewlid	54	Mewlid	42		30		18		6		
June	Belg harvest	53	Belg harvest	41	Mewlid Belg harvest	29	Mewlid Belg harvest	17	Mewlid Belg harvest	5		
July	Kremt rain	52	Kremt rain	40	Kremt rain	28	Kremt rain	16	Kremt rain	4		
August	Weeding	51	Weeding	39	Weeding	27	Weeding	15	Weeding	3		

If, for some reason, no age data is available and a local events calendar cannot be used to estimate the age of the children, then it may be useful to use a height cut-off instead. The DPPC currently recommends measuring children between 65cm and 110cm, as an equivalent to 6-59 months. These heights have been chosen because 65cm is the median WFH in the NCHS reference of children aged 6 months and 110 cm is the median for children aged 60 months.

In fact, WHO has recently recommended that only children 65-100cm tall should be included in nutrition surveys for children aged 6-59 months, in countries where the prevalence of stunting is known to be high (WHO, 2000). However, this new recommendation has not yet been widely adopted as it has not been properly field tested. It is possible that by including children 100-110cm tall we will include some children who are more than 59 months old, if they are stunted. However, if we include only children less than 100cm, we will exclude older children who are growing normally.

The DPPC recommends that, until further field testing takes place, agencies working in Ethiopia should measure children 65-110cm as an equivalent to 6-59 months when no age data is available.

A2.2.2 Weight

Weight should be measured to the nearest 100g. Although various types of scales are used for weighing young children in the field, the most commonly used is the hanging spring balance, which can weigh up to 25kg. Hanging scales are robust, cheap and easy to carry.

Calibration of the scales should be checked immediately before, and during, each session using the same known weights. The scales should first be set at zero, with the weighing pants or basket attached. Suitable items for the calibration include a stone or a standard 5-10kg weight. Spring balance scales should be replaced whenever the springs are so stretched that the readings are incorrect.

Figure A2.1 shows the correct procedure for weighing a child with a hanging spring balance. Additional notes are provided below:

1. Explain the procedure to the child's mother or carer before starting.
2. Install a 25kg hanging spring scale (graduated by 100g). If mobile weighing is needed, the scale can be hooked on a tree or a stick held by two people
3. Suspend weighing pants from the lower hook of the scale and recalibrate to zero
4. Remove the child's clothes, and any jewellery and place him or her in the weighing pants (older children may hold on to the bar and lift themselves off the ground)
5. Ensure nothing is touching the child.
6. Read the scale at eye level (if the child is moving about and the needle does not stabilise, estimate weight by using the value situated at the midpoint of the range of oscillations).
7. Announce the value to the assistant, who repeats, verifies and records.

Note: in very cold areas, or in certain cultures, it may be impossible to undress a child. The average weight of the clothes should be estimated and deducted from the measurement.

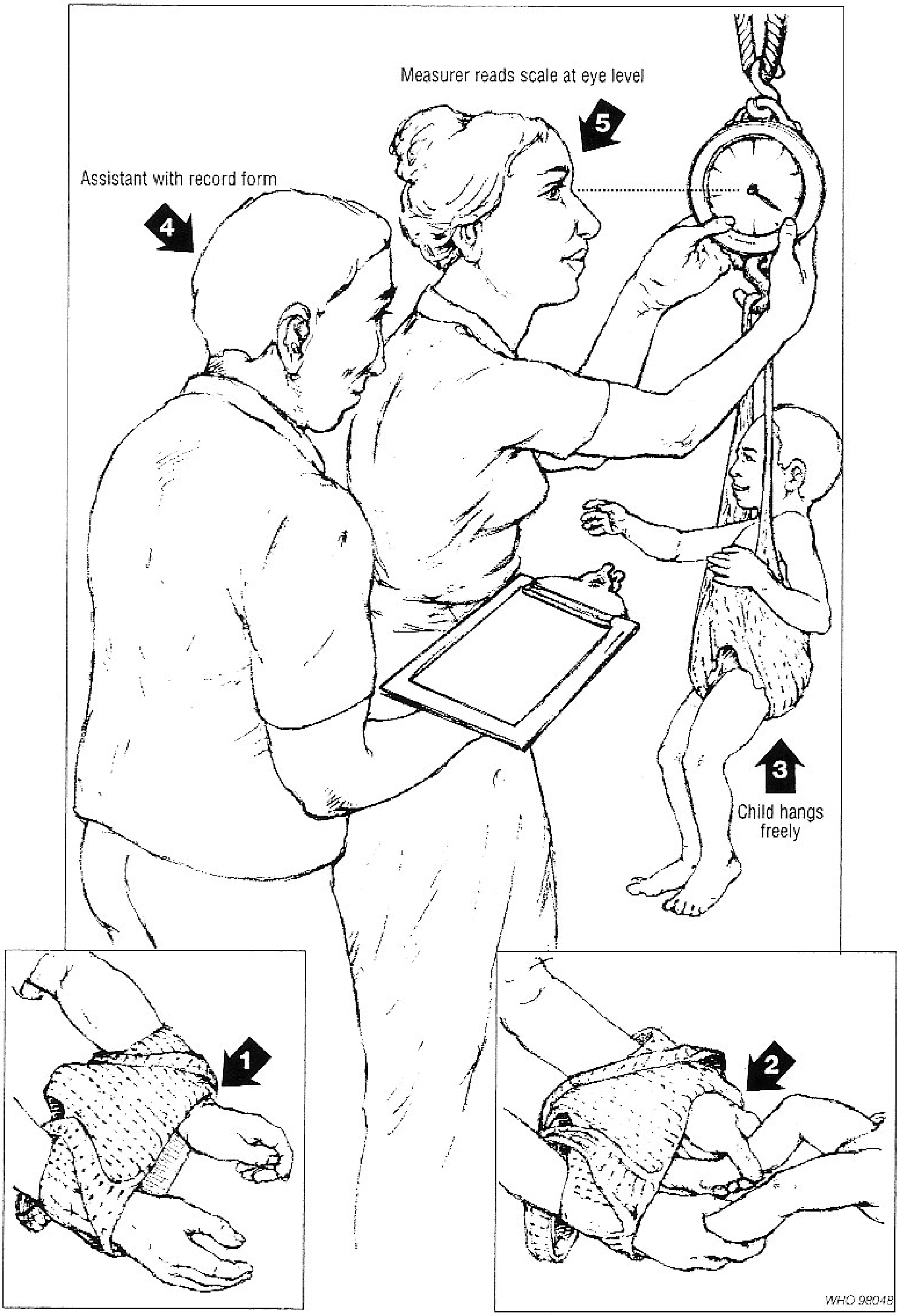

Figure A2.1 How to take weight of a child using hanging scales

A2.2.3 Height and length

Every effort should be made to measure children's height accurately, to the nearest 0.1cm if possible. Measurement errors of 2-3cm can easily occur and cause significant errors in classifying nutrition status.

Children up to 85cm in height are measured on a horizontal measuring board. Children above 85cm should be measured standing up. This recommendation differs from that in the previous DPPC guidelines (DPPC, 1995) when it was recommended that all children were measured lying down. WHO suggests that it is more accurate, convenient and simple to measure older children standing up than lying down (WHO, 2000).

Once a child can stand (normally above 85cm) it is easier and more convenient to measure him or her standing up — children are also normally happier to stand than to lie down (it is less frightening for them). Also, in terms of accuracy, it is also important to follow the rule that children must be measured in a lying position when they are shorter then 85cm and in a standing position when they are taller than or equal to 85cm. This is because it is how the NCHS/CDC/WHO reference children were measured, and individuals measured in the lying position are taller (on average between 0.5 and 1.5cm) than individuals measured in the standing position. Thus, if you measure children in a different way from that used to measure the children in the reference tables, you have to adjust for this when you are comparing their heights (see Section A2.2.4 below for adjustments).

Figure A2.2 shows the correct procedure for measuring the length of a child less than 85cm. Additional notes are provided below:

1. Explain the procedure to the child's mother or carer.
2. Remove the child's shoes.
3. Place the child gently onto the board, with head against the fixed vertical part, and the soles of the feet near the cursor or moving part. The child should lie straight in the middle of the board, looking directly up.
4. The assistant should hold the child's head firmly against the base of the board, while the measurer places one hand on the knees (to keep the legs straight) and places the child's feet flat against the cursor with the other hand.
5. The measurer reads and announces the length to the nearest 0.1cm.
6. The assistant repeats and verifies the measurement and then records it.

Note: in some cultures, to measure a child lying down is related to death (measurement of the coffin). Where this occurs, information and education sessions may be held to prepare the mothers for this kind of procedure.

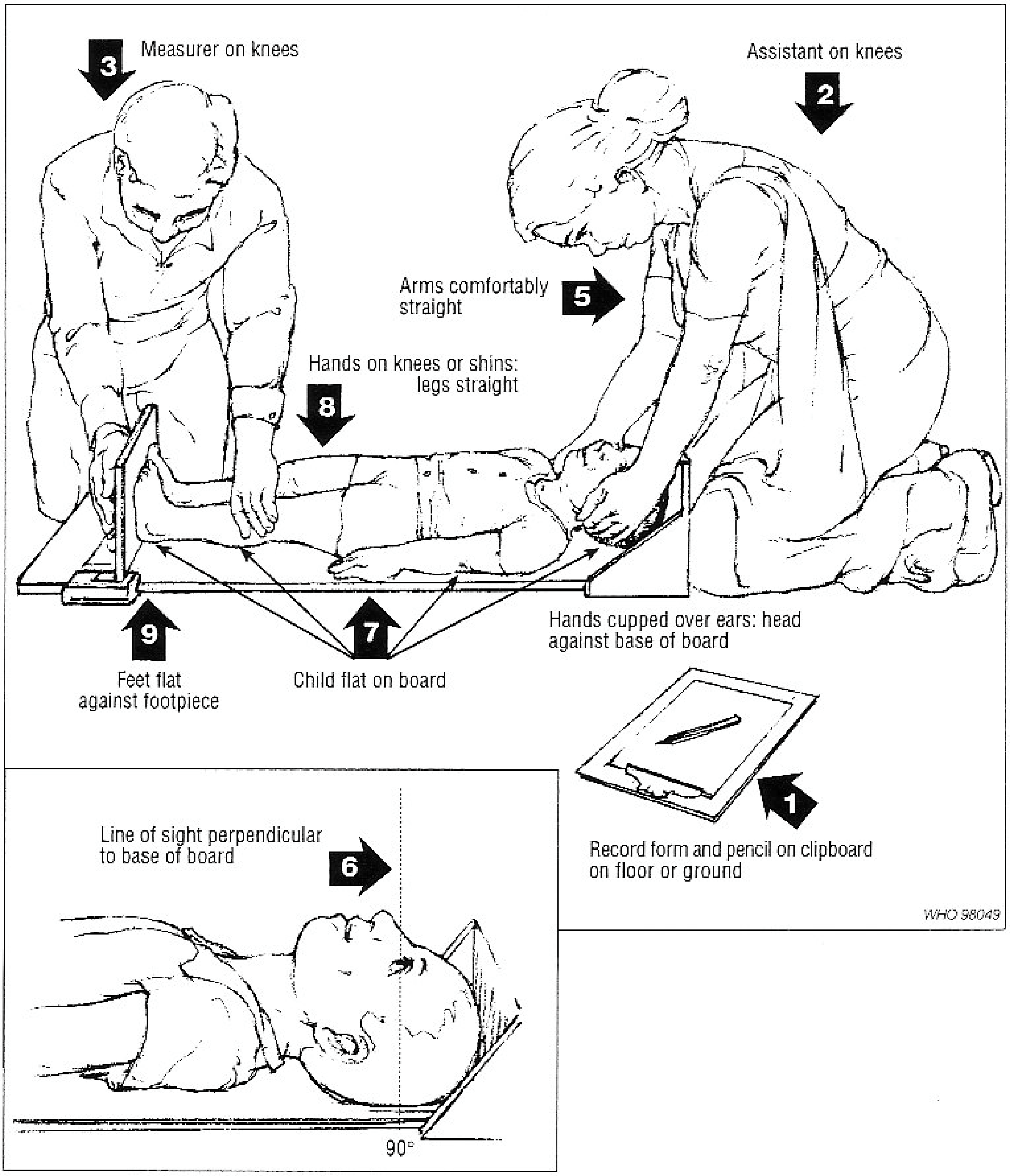

Figure A2.2 How to measure height in a young child (<=85cm)

Figure A2.3 shows the correct procedure for measuring the height of a child more than 85cm. Additional notes are provided below:

1. Explain the procedure to the child's mother or carer.
2. Place the measuring board upright in a location where there is room for movement around the board
3. Remove the child's shoes and stand her or him on the middle of the measuring board.
4. An assistant should firm press the child's ankles and knees against the board.
5. Ensure that the child's head, shoulders, buttocks, knees and heals touch the board.
6. The measurer should position the head and the cursor at right angles — the mid-ear and eye socket should be in line and hair should be compressed by the cursor.
7. The measurer reads and announces the height to the nearest 0.1cm.
8. The assistant repeats and verifies the measurement and then records it.

A2.2.4 Adjustment for children above 85cm who were measured lying down

As explained above, individuals measured in the lying position are taller (on average between 0.5 and 1.5 cm) than individuals measured in the standing position. Children in the NCHS/CDC/WHO references were measured standing up if they were more than 85cm and lying down if they were less than 85cm. If you measure children in a different way from that used to measure the children in these reference tables, then you have to adjust for this when you are comparing their heights.

If children of more than 85cm are measured lying down, you should remove 1cm from their length to obtain their height, before you compare them to the references.[50]

Example A2.1
You measured all the children in your survey lying down. What is the real height of a boy whose length was 94cm? This boy should have been measured standing up as he is more than 85cm, so you need to take 1cm away from its length to calculate his real height.

Real height = 94 cm –1 cm
= 93cm

Example A2.2
You measured all the children in your survey lying down. What is the real height of a girl whose length was 80cm? You were correct to measure this girl lying-down as she is less than 85cm, so her real height is the same as her length.

Real height = 80cm

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[50] The 1cm adjustment is an average of 0.5cm and 1.5cm. Adjustments should probably increase as the height of the child increases, but for an emergency survey it is acceptable to use 1cm for all children measured lying-down whose length is more than 85cm.

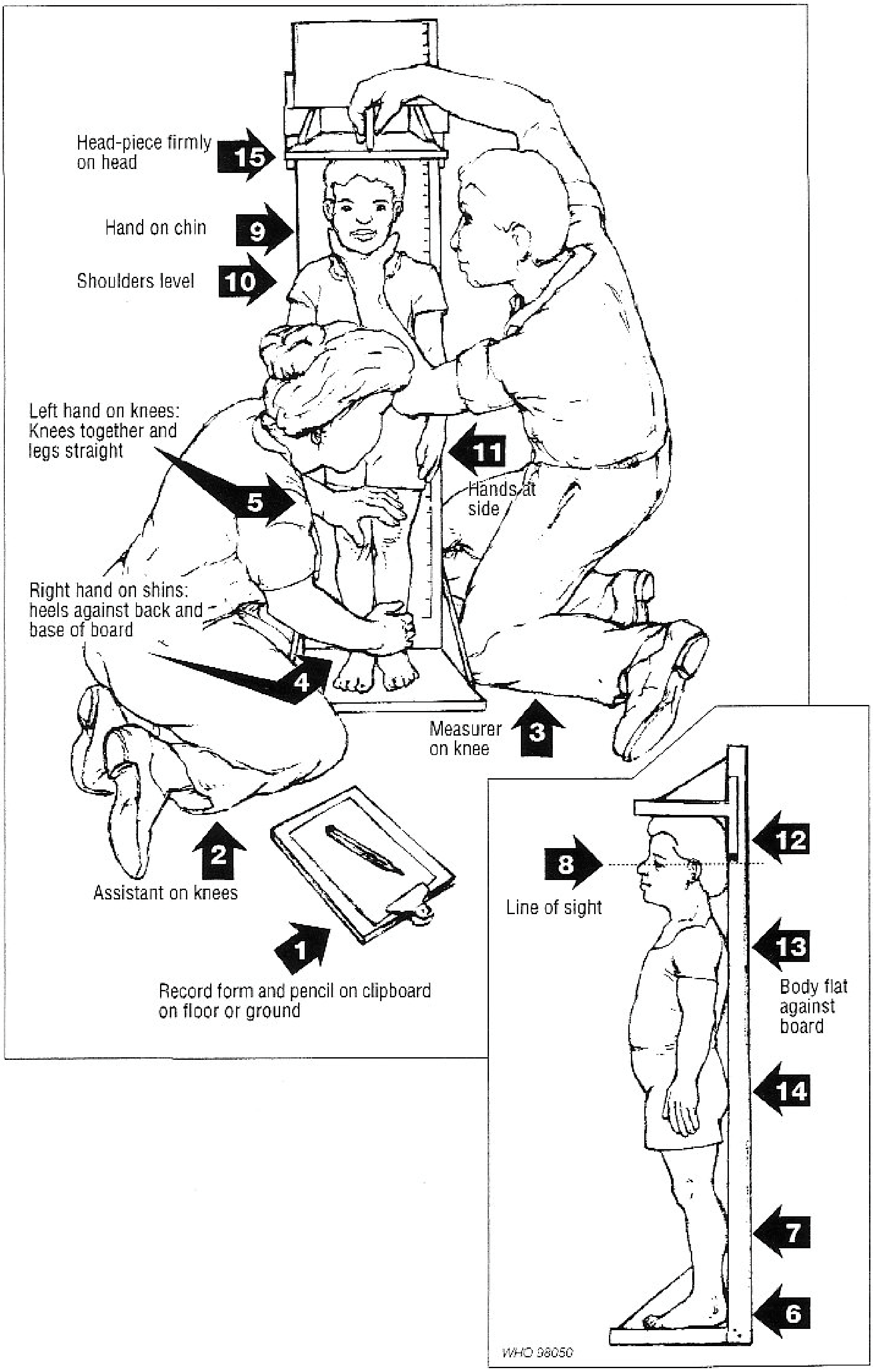


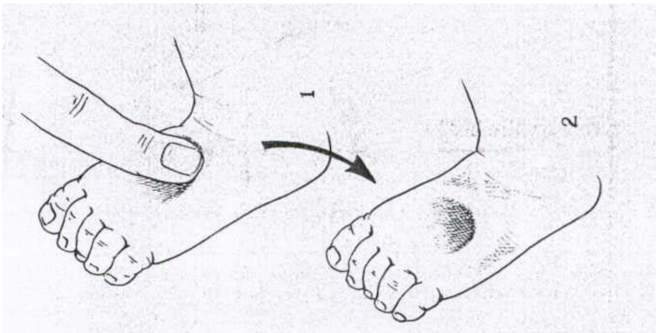
Figure A2.3 How to measure length in a young child (more than 85cm)

A2.2.5 Oedema

Oedema is the retention of water and sodium in the extra-cellular spaces. Generally it accounts for ten to thirty per cent of body-weight but in the most severe cases of kwashiorkor, the proportion can reach fifty per cent. To diagnose oedema, moderate thumb pressure is applied to just above the ankle or the tops of the feet for about three seconds (if you count "one thousand and one, one thousand and two, one thousand and three" in English, pronouncing the words carefully, this takes about three seconds). If there is oedema, an impression remains for some time (at least a few seconds) where the oedema fluid has been pressed out of the tissue. The child should only be recorded as oedematous if both his feet have oedema.

Figure 1.1 in Chapter 1 shows a picture of a child with oedema. Figure A2.4 shows how to check for oedema.

Figure A2.4 How to check for oedema



A2.2.6 MUAC

Arm circumference is measured on the upper left arm. Measurements should be made to the nearest millimetre. Remember MUAC measurements should only be made on children more than 12 months old.

Figure A2.5 shows the correct procedure for measuring the MUAC of a child. Additional notes are provided below:

1. Explain the procedure to the child's mother or carer.
2. If possible, the child should stand erect and sideways to the measurer.
3. Bend the left arm at 90 degrees to the body.
4. Place a measuring tape along the upper arm and find the mid-point of the upper arm. The mid-point is between the tip of the shoulder (olecranon) and the elbow (acromion process).
5. Mark the mid-upper arm point with a pen.
6. Let the left arm hang relaxed at the side of the body.
7. Place the MUAC measuring tape on the midway point.
8. Pull the tape until it fits securely around the arm. The tape should not be left too slack nor pulled too tightly.
9. Read the measurement at the window of the tape measure.
10. Record mid-arm circumference to the nearest 0.1cm.

Note: MUAC measurement is fast and simple, but not easy, and variations in measurements often occur between different measurers. This is mainly related to how the tape is pulled or "squeezed" around the arm.

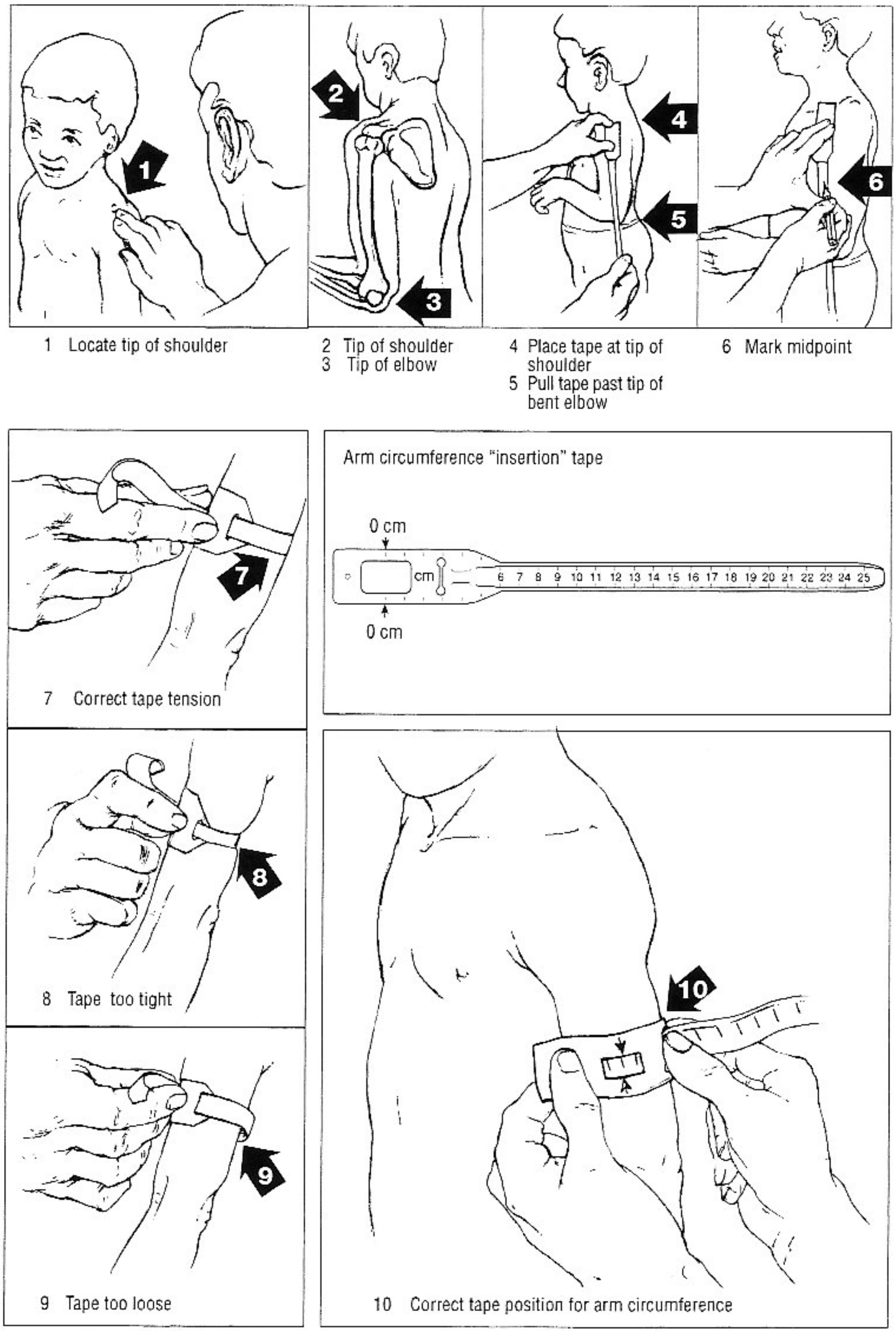


Figure A2.5 How to measure MUAC

A2.3 How to standardise measurements among team members

The training of personnel on specific measurements and recording techniques includes not only theoretical explanations and demonstrations, but also an opportunity for participants to practise the measurement techniques, as well as reading and recording the results. Once all trainees have adequately practised the measurement and recording techniques, and feel comfortable with their performance, standardisation exercises can be carried out.

Each exercise is performed with a group of ten children whose ages fall within the pre-established range for the study (normally 6-59 months). Before carrying out the standardisation exercise, the supervisor carefully weighs and measures each child and records the results without any of the trainees seeing the results.

For each exercise, a group of trainees will conduct the measurements in a pre-determined order. Each child will remain at a fixed location. The distance between each child should be big enough to prevent the trainees seeing or hearing each other's results.

At the beginning of an exercise, position a pair of trainee measurers with each child. Then the supervisor should instruct the measurers to begin the measurements following the pre-established sequence:

1. The trainees carefully conduct the measurements and clearly record the results on the anthropometric standardisation form (see Figure A2.6) next to the child's identification number.
2. The trainee measurers remain with the child until the supervisor instructs them to move (once results are recorded, corrections are not allowed).
3. When all the trainee measurers have conducted their measurements, the supervisor should instruct them to move to the next child, following the numerical order, and requests that they wait for instructions to begin the measurement.
4. This process is repeated until all children have been weighed and measured by all the measurers.
5. Use the same equipment to measure each child's weight and height. Trainee measurers and assistants should rotate to conduct the measurement, but the equipment remains stationed next to each child.
6. Only one pair of measurers should be with a child at any one time. Talking between pairs of trainee measurers during this exercise should not be allowed.

The supervisor should take advantage of the standardisation exercises to observe systematically each trainee's performance. Observations should include checking their positioning of the equipment, adjustment to zero, positioning of child, child's clothing and angle at which the reading is taken, etc. If necessary, the supervisor should make notes on any errors to discuss with the team later.

Once all the children have been measured by all the pairs of trainee measurers, the supervisor should meet with the group to analyse the results of the exercise:

- The standard measures (those taken by the supervisor) are read out. The trainees should record these results on their respective forms, under the "standard measure" column.
- Next, each of the trainees should calculate the difference between "my measure" and "standard measure" for each measurement and child, and record the result on the same form under the "difference" column, using the corresponding + or – sign, if the trainee's measurement is larger or smaller than the supervisor's measurement.

The trainees then interpret the standardisation exercise results with the supervisor's help. The purpose is to detect differences, identify their possible causes, and correct them. To achieve this, it is important to take into account the size of the differences in measurements taken by each measurer and the supervisor, as well as the positive or negative sign of the differences.

The exercises should be repeated as many times as necessary until none of the trainees have large differences,[51] and until the tendency to obtain larger or smaller values than those of the supervisor disappears. Generally, this is accomplished after two or three exercises for weight and height.

[51] There is no standard definition of "large differences", but trainees and supervisors should aim not to have measurements more than 0.1cm or 0.1kg different.

*Figure A2.6	Form for Anthropometric standardisation of weight and height*

Name of measurer: ________________________

Date: ___/___/___

No.	Name of child	Age in months	Height (cm)			Weight (kg)		
			My measure	Standard measure	Difference	My measure	Standard measure	Difference
1								
2								
3								
4								
5								
6								
7								
8								
9								
10								

A2.4 MUAC cut-offs for children aged 12-59 months recommended by INGOs

The following MUAC cut-offs have been proposed by MSF and ACF for use on children aged 12-59 months. MUAC is not recommended for younger children as MUAC increases on average 1-2cm between the ages of 6-12 months.

Table A2.2 MUAC cut-off points for children aged 12-59 months, as recommended by MSF (MSF, 2001)

Acute malnutrition using MUAC	**MSF MUAC cut-offs (mm)**
Severe	< 110mm
Moderate	110 to 124mm
Global	< 125mm
At risk	125 to 135mm

The severe and moderate acute malnutrition cut-offs recommended by MSF are the same as those recommended by Sphere (Sphere Project, 2000).

Table A2.3 MUAC cut-off points for children aged 12-59 months, as recommended by ACF (ACF, 2000)

Acute malnutrition using MUAC	**ACF MUAC cut-offs (mm)**
Severe malnutrition	< 110mm
Moderate malnutrition	110 to 119mm
High risk of malnutrition	120 to 124mm
Moderate risk of malnutrition	125 to 134mm
Satisfactory nutrition status	< 135mm

A2.5 Height-for-age cut-off points

The following cut-offs are commonly used to classify chronic malnutrition, or stunting.

Table A2.4 Height-for-age cut-off points in children aged 6-59 months

Category	**Percentage of the median**	**Z-scores**
Severe	< 80 %	< -3 z-scores
Moderate	< 90% to >= 80%	< -2 z-scores to -3 z-scores
Global	< 90%	< - 2 z-scores

Annex 3

NCHS/CDC/WHO reference tables

Table A3.1 *NCHS/CDC/WHO normalised reference weight for length/height (49-115 cm) by sex*

Length/ height (cm)	**Boys' weight (kg)**				**Girls' weight (kg)**			
	Median	**-1 SD**	**-2 SD**	**-3 SD**	**Median**	**-1 SD**	**-2 SD**	**-3 SD**
49	3.1	2.8	2.5	2.1	3.3	2.9	2.6	2.2
49.5	3.2	2.9	2.5	2.1	3.4	3.0	2.6	2.2
50	3.3	2.9	2.5	2.2	3.4	3.0	2.6	2.3
50.5	3.4	3.0	2.6	2.2	3.5	3.1	2.7	2.3
51	3.5	3.1	2.6	2.2	3.5	3.1	2.7	2.3
51.5	3.6	3.1	2.7	2.3	3.6	3.2	2.8	2.4
52	3.7	3.2	2.8	2.3	3.7	3.3	2.8	2.4
52.5	3.8	3.3	2.8	2.4	3.8	3.4	2.9	2.5
53	3.9	3.4	2.9	2.4	3.9	3.4	3.0	2.5
53.5	4.0	3.5	3.0	2.5	4.0	3.5	3.1	2.6
54	4.1	3.6	3.1	2.6	4.1	3.6	3.1	2.7
54.5	4.2	3.7	3.2	2.6	4.2	3.7	3.2	2.7
55	4.3	3.8	3.3	2.7	4.3	3.8	3.3	2.8
55.5	4.5	3.9	3.3	2.8	4.4	3.9	3.4	2.9
56	4.6	4.0	3.5	2.9	4.5	4.0	3.5	3.0
56.5	4.7	4.1	3.6	3.0	4.6	4.1	3.6	3.0
57	4.8	4.3	3.7	3.1	4.8	4.2	3.7	3.1
57.5	5.0	4.4	3.8	3.2	4.9	4.3	3.8	3.2
58	5.1	4.5	3.9	3.3	5.0	4.4	3.9	3.3
58.5	5.2	4.6	4.0	3.4	5.1	4.6	4.0	3.4
59	5.4	4.8	4.1	3.5	5.3	4.7	4.1	3.5
59.5	5.5	4.9	4.2	3.6	5.4	4.8	4.2	3.6
60	5.7	5.0	4.4	3.7	5.5	4.9	4.3	3.7
60.5	5.8	5.1	4.5	3.8	5.7	5.1	4.4	3.8
61	5.9	5.3	4.6	4.0	5.8	5.2	4.6	3.9
61.5	6.1	5.4	4.8	4.1	6.0	5.3	4.7	4.0
62	6.2	5.6	4.9	4.2	6.1	5.4	4.8	4.1
62.5	6.4	5.7	5.0	4.3	6.2	5.6	4.9	4.2
63	6.5	5.8	5.2	4.5	6.4	5.7	5.0	4.4
63.5	6.7	6.0	5.3	4.6	6.5	5.8	5.2	4.5
64	6.8	6.1	5.4	4.7	6.7	6.0	5.3	4.6
64.5	7.0	6.3	5.6	4.9	6.8	6.1	5.4	4.7
65	7.1	6.4	5.7	5.0	7.0	6.3	5.5	4.8
65.5	7.3	6.5	5.8	5.1	7.1	6.4	5.7	4.9
66	7.4	6.7	6.0	5.3	7.3	6.5	5.8	5.1
66.5	7.6	6.8	6.1	5.4	7.4	6.7	5.9	5.2
67	7.7	7.0	6.2	5.5	7.5	6.8	6.0	5.3
67.5	7.8	7.1	6.4	5.7	7.7	6.9	6.2	5.4
68	8.0	7.3	6.5	5.8	7.8	7.1	6.3	5.5
68.5	8.1	7.4	6.6	5.9	8.0	7.2	6.4	5.6
69	8.3	7.5	6.8	6.0	8.1	7.3	6.5	5.8
69.5	8.4	7.7	6.9	6.2	8.2	7.5	6.7	5.9

Table A3.1 NCHS/CDC/WHO normalised reference weight for length/height (49-115 cm) by sex - continued

Length/ height (cm)	Boys' weight (kg) Median	-1 SD	-2 SD	-3 SD	Girls' weight (kg) Median	-1 SD	-2 SD	-3 SD
70	8.5	7.8	7.0	6.3	8.4	7.6	6.8	6.0
70.5	8.7	7.9	7.2	6.4	8.5	7.7	6.9	6.1
71	8.8	8.1	7.3	6.5	8.6	7.8	7.0	6.2
71.5	8.9	8.2	7.4	6.7	8.8	8.0	7.1	6.3
72	9.1	8.3	7.5	6.8	8.9	8.1	7.2	6.4
72.5	9.2	8.4	7.7	6.9	9.0	8.2	7.4	6.5
73	9.3	8.6	7.8	7.0	9.1	8.3	7.5	6.6
73.5	9.5	8.7	7.9	7.1	9.3	8.4	7.6	6.7
74	9.6	8.8	8.0	7.2	9.4	8.5	7.7	6.8
74.5	9.7	8.9	8.1	7.3	9.5	8.6	7.8	6.9
75	9.8	9.0	8.2	7.4	9.6	8.7	7.9	7.0
75.5	9.9	9.1	8.3	7.5	9.7	8.8	8.0	7.1
76	10.0	9.2	8.4	7.6	9.8	8.9	8.1	7.2
76.5	10.2	9.3	8.5	7.7	9.9	9.0	8.2	7.3
77	10.3	9.4	8.6	7.8	10.0	9.1	8.3	7.4
77.5	10.4	9.5	8.7	7.9	10.1	9.2	8.4	7.5
78	10.5	9.7	8.8	8.0	10.2	9.3	8.5	7.6
78.5	10.6	9.8	8.9	8.1	10.3	9.4	8.6	7.7
79	10.7	9.9	9.0	8.2	10.4	9.5	8.7	7.8
79.5	10.8	10.0	9.1	8.2	10.5	9.6	8.7	7.9
80	10.9	10.1	9.2	8.3	10.6	9.7	8.8	8.0
80.5	11.0	10.1	9.3	8.4	10.7	9.8	8.9	8.0
81	11.1	10.2	9.4	8.5	10.8	9.9	9.0	8.1
81.5	11.2	10.3	9.5	8.6	10.9	10.0	9.1	8.2
82	11.3	10.4	9.6	8.7	11.0	10.1	9.2	8.3
82.5	11.4	10.5	9.6	8.8	11.1	10.2	9.3	8.4
83	11.5	10.6	9.7	8.8	11.2	10.3	9.4	8.5
83.5	11.6	10.7	9.8	8.9	11.3	10.4	9.5	8.6
84	11.7	10.8	9.9	9.0	11.4	10.5	9.6	8.7
84.5	11.8	10.9	10.0	9.1	11.5	10.6	9.6	8.7
85	12.1	11.0	9.9	8.9	11.8	10.8	9.7	8.6
85.5	12.2	11.1	10.0	8.9	11.9	10.9	9.8	8.7
86	12.3	11.2	10.1	9.0	12.0	11.0	9.9	8.8
86.5	12.5	11.3	10.2	9.1	12.2	11.1	10.0	8.9
87	12.6	11.5	10.3	9.2	12.3	11.2	10.1	9.0
87.5	12.7	11.6	10.4	9.3	12.4	11.3	10.2	9.1
88	12.8	11.7	10.5	9.4	12.5	11.4	10.3	9.2
88.5	12.9	11.8	10.6	9.5	12.6	11.5	10.4	9.3
89	13.0	11.9	10.7	9.6	12.7	11.6	10.5	9.3
89.5	13.1	12.0	10.8	9.7	12.8	11.7	10.6	9.4
90	13.3	12.1	10.9	9.8	12.9	11.8	10.7	9.5
90.5	13.4	12.2	11.0	9.9	13.0	11.9	10.7	9.6
91	13.5	12.3	11.1	9.9	13.2	12.0	10.8	9.7
91.5	13.6	12.4	11.2	10.0	13.3	12.1	10.9	9.8
92	13.7	12.5	11.3	10.1	13.4	12.2	11.0	9.9
92.5	13.9	12.6	11.4	10.2	13.5	12.3	11.1	9.9
93	14.0	12.8	11.5	10.3	13.6	12.4	11.2	10.0
93.5	14.1	12.9	11.6	10.4	13.7	12.5	11.3	10.1

Table A3.1 NCHS/CDC/WHO normalised reference weight for length/height (49-115 cm) by sex - continued

Length/ height (cm)	Boys' weight (kg)				Girls' weight (kg)			
	Median	-1 SD	-2 SD	-3 SD	Median	-1 SD	-2 SD	-3 SD
94	14.2	13.0	11.7	10.5	13.9	12.6	11.4	10.2
94.5	14.3	13.1	11.8	10.6	14.0	12.8	11.5	10.3
95	14.5	13.2	11.9	10.7	14.1	12.9	11.6	10.4
95.5	14.6	13.3	12.0	10.8	14.2	13.0	11.7	10.5
96	14.7	13.4	12.1	10.9	14.3	13.1	11.8	10.6
96.5	14.8	13.5	12.2	11.0	14.5	13.2	11.9	10.7
97	15.0	13.7	12.4	11.0	14.6	13.3	12.0	10.7
97.5	15.1	13.8	12.5	11.1	14.7	13.4	12.1	10.8
98	15.2	13.9	12.6	11.2	14.9	13.5	12.2	10.9
98.5	15.4	14.0	12.7	11.3	15.0	13.7	12.3	11.0
99	15.5	14.1	12.8	11.4	15.1	13.8	12.4	11.1
99.5	15.6	14.3	12.9	11.5	15.2	13.9	12.5	11.2
100	15.7	14.4	13.0	11.6	15.4	14.0	12.7	11.3
100.5	15.9	14.5	13.1	11.7	15.5	14.1	12.8	11.4
101	16.0	14.6	13.2	11.8	15.6	14.3	12.9	11.5
101.5	16.2	14.7	13.3	11.9	15.8	14.4	13.0	11.6
102	16.3	14.9	13.4	12.0	15.9	14.5	13.1	11.7
102.5	16.4	15.0	13.6	12.1	16.0	14.6	13.2	11.8
103	16.6	15.1	13.7	12.2	16.2	14.7	13.3	11.9
103.5	16.7	15.3	13.8	12.3	16.3	14.9	13.4	12.0
104	16.9	15.4	13.9	12.4	16.5	15.0	13.5	12.1
104.5	17.0	15.5	14.0	12.6	16.6	15.1	13.7	12.2
105	17.1	15.6	14.2	12.7	16.7	15.3	13.8	12.3
105.5	17.3	15.8	14.3	12.8	16.9	15.4	13.9	12.4
106	17.4	15.9	14.4	12.9	17.0	15.5	14.0	12.5
106.5	17.6	16.1	14.5	13.0	17.2	15.7	14.1	12.6
107	17.7	16.2	14.7	13.1	17.3	15.8	14.3	12.7
107.5	17.9	16.3	14.8	13.2	17.5	15.9	14.4	12.8
108	18.0	16.5	14.9	13.4	17.6	16.1	14.5	13.0
108.5	18.2	16.6	15.0	13.5	17.8	16.2	14.6	13.1
109	18.3	16.8	15.2	13.6	17.9	16.4	14.8	13.2
109.5	18.5	16.9	15.3	13.7	18.1	16.5	14.9	13.3
110	18.7	17.1	15.4	13.8	18.2	16.6	15.0	13.4
110.5	18.8	17.2	15.6	14.0	18.4	16.8	15.2	13.6
111	19.0	17.4	15.7	14.1	18.6	16.9	15.3	13.7
111.5	19.1	17.5	15.9	14.2	18.7	17.1	15.5	13.8
112	19.3	17.7	16.0	14.4	18.9	17.2	15.6	14.0
112.5	19.5	17.8	16.1	14.5	19.0	17.4	15.7	14.1
113	19.6	18.0	16.3	14.6	19.2	17.5	15.9	14.2
113.5	19.8	18.1	16.4	14.8	19.4	17.7	16.0	14.4
114	20.0	18.3	16.6	14.9	19.5	17.9	16.2	14.5
114.5	20.2	18.5	16.7	15.0	19.7	18.0	16.3	14.6
115	20.3	18.6	16.9	15.2	19.9	18.2	16.5	14.8

Table A3.2 Values for one standard deviation of NCHS/CDC/WHO reference median weight-for-height/length (49-115cm)

Length (cm)	**One SD of median height (kg)**	
	Male	**Female**
49	0.341	0.365
49.5	0.362	0.375
50	0.382	0.386
50.5	0.401	0.397
51	0.42	0.409
51.5	0.438	0.42
52	0.455	0.431
52.5	0.471	0.442
53	0.487	0.454
53.5	0.502	0.465
54	0.516	0.477
54.5	0.529	0.488
55	0.542	0.499
55.5	0.555	0.511
56	0.567	0.522
56.5	0.578	0.534
57	0.589	0.545
57.5	0.599	0.556
58	0.608	0.568
58.5	0.618	0.579
59	0.627	0.59
59.5	0.635	0.601
60	0.643	0.612
60.5	0.651	0.623
61	0.658	0.634
61.5	0.665	0.644
62	0.671	0.655
62.5	0.678	0.665
63	0.684	0.676
63.5	0.689	0.686
64	0.695	0.696
64.5	0.7	0.705
65	0.705	0.715
65.5	0.71	0.724
66	0.715	0.733
66.5	0.72	0.742
67	0.724	0.751
67.5	0.729	0.759
68	0.733	0.767
68.5	0.738	0.775
69	0.742	0.783
69.5	0.747	0.791
70	0.751	0.798
70.5	0.756	0.804
71	0.76	0.811

Table A3.2 Values for one standard deviation of NCHS/CDC/WHO reference median weight-for-height/length (49-115cm) - continued

Length (cm)	One SD of median height (kg)	
	Male	Female
71.5	0.765	0.817
72	0.77	0.823
72.5	0.774	0.829
73	0.779	0.834
73.5	0.785	0.839
74	0.79	0.844
74.5	0.795	0.848
75	0.801	0.852
75.5	0.806	0.856
76	0.812	0.86
76.5	0.818	0.863
77	0.823	0.867
77.5	0.829	0.87
78	0.835	0.873
78.5	0.841	0.876
79	0.847	0.879
79.5	0.853	0.881
80	0.859	0.884
80.5	0.865	0.887
81	0.871	0.889
81.5	0.877	0.892
82	0.884	0.894
82.5	0.89	0.897
83	0.896	0.9
83.5	0.902	0.902
84	0.908	0.905
84.5	0.914	0.908
85	1.087	1.069
85.5	1.094	1.074
86	1.101	1.08
86.5	1.108	1.086
87	1.116	1.092
87.5	1.124	1.099
88	1.132	1.106
88.5	1.14	1.114
89	1.148	1.122
89.5	1.157	1.13
90	1.166	1.138
90.5	1.175	1.147
91	1.184	1.156
91.5	1.194	1.166
92	1.203	1.176
92.5	1.213	1.186
93	1.223	1.196
93.5	1.233	1.206
94	1.243	1.217
94.5	1.253	1.228
95	1.264	1.239

Table A3.2 Values for one standard deviation of NCHS/CDC/WHO reference median weight-for-height/length (49-115cm) - continued

Length (cm)	**One SD of median height (kg)**	
	Male	**Female**
95.5	1.274	1.25
96	1.285	1.262
96.5	1.296	1.273
97	1.306	1.285
97.5	1.317	1.297
98	1.329	1.309
98.5	1.34	1.321
99	1.351	1.333
99.5	1.362	1.345
100	1.374	1.358
100.5	1.385	1.37
101	1.397	1.382
101.5	1.408	1.395
102	1.42	1.407
102.5	1.431	1.419
103	1.443	1.432
103.5	1.455	1.444
104	1.467	1.456
104.5	1.478	1.469
105	1.49	1.481
105.5	1.502	1.493
106	1.513	1.505
106.5	1.525	1.517
107	1.537	1.528
107.5	1.549	1.54
108	1.56	1.551
108.5	1.572	1.563
109	1.584	1.574
109.5	1.595	1.585
110	1.607	1.596
110.5	1.618	1.607
111	1.629	1.618
111.5	1.641	1.629
112	1.652	1.64
112.5	1.663	1.652
113	1.674	1.663
113.5	1.685	1.675
114	1.696	1.687
114.5	1.707	1.7
115	1.717	1.713

Table A3.3 NCHS/CDC/WHO references expressed as percentages of the median by sex (49-115cm)

Length/ height (cm)	Boys' weight (kg) Median	80%	70%	60%	Girls' weight (kg) Median	80%	70%	60%
49	3.1	2.5	2.2	1.9	3.3	2.6	2.3	2.0
49.5	3.2	2.6	2.2	1.9	3.4	2.7	2.4	2.0
50	3.3	2.6	2.3	2.0	3.4	2.7	2.4	2.0
50.5	3.4	2.7	2.4	2.0	3.5	2.8	2.5	2.1
51	3.5	2.8	2.5	2.1	3.5	2.8	2.5	2.1
51.5	3.6	2.9	2.5	2.2	3.6	2.9	2.5	2.2
52	3.7	3.0	2.6	2.2	3.7	3.0	2.6	2.2
52.5	3.8	3.0	2.7	2.3	3.8	3.0	2.7	2.3
53	3.9	3.1	2.7	2.3	3.9	3.1	2.7	2.3
53.5	4.0	3.2	2.8	2.4	4.0	3.2	2.8	2.4
54	4.1	3.3	2.9	2.5	4.1	3.3	2.9	2.5
54.5	4.2	3.4	2.9	2.5	4.2	3.4	2.9	2.5
55	4.3	3.4	3.0	2.6	4.3	3.4	3.0	2.6
55.5	4.5	3.6	3.2	2.7	4.4	3.5	3.1	2.6
56	4.6	3.7	3.2	2.8	4.5	3.6	3.2	2.7
56.5	4.7	3.8	3.3	2.8	4.6	3.7	3.2	2.8
57	4.8	3.8	3.4	2.9	4.8	3.8	3.4	2.9
57.5	5.0	4.0	3.5	3.0	4.9	3.9	3.4	2.9
58	5.1	4.1	3.6	3.1	5.0	4.0	3.5	3.0
58.5	5.2	4.2	3.6	3.1	5.1	4.1	3.6	3.1
59	5.4	4.3	3.8	3.2	5.3	4.2	3.7	3.2
59.5	5.5	4.4	3.9	3.3	5.4	4.3	3.8	3.2
60	5.7	4.6	4.0	3.4	5.5	4.4	3.9	3.3
60.5	5.8	4.6	4.1	3.5	5.7	4.6	4.0	3.4
61	5.9	4.7	4.1	3.5	5.8	4.6	4.1	3.5
61.5	6.1	4.9	4.3	3.7	6.0	4.8	4.2	3.6
62	6.2	5.0	4.3	3.7	6.1	4.9	4.3	3.7
62.5	6.4	5.1	4.5	3.8	6.2	5.0	4.3	3.7
63	6.5	5.2	4.6	3.9	6.4	5.1	4.5	3.8
63.5	6.7	5.4	4.7	4.0	6.5	5.2	4.6	3.9
64	6.8	5.4	4.8	4.1	6.7	5.4	4.7	4.0
64.5	7.0	5.6	4.9	4.2	6.8	5.4	4.8	4.1
65	7.1	5.7	5.0	4.3	7.0	5.6	4.9	4.2
65.5	7.3	5.8	5.1	4.4	7.1	5.7	5.0	4.3
66	7.4	5.9	5.2	4.4	7.3	5.8	5.1	4.4
66.5	7.6	6.1	5.3	4.6	7.4	5.9	5.2	4.4
67	7.7	6.2	5.4	4.6	7.5	6.0	5.3	4.5
67.5	7.8	6.2	5.5	4.7	7.7	6.2	5.4	4.6
68	8.0	6.4	5.6	4.8	7.8	6.2	5.5	4.7
68.5	8.1	6.5	5.7	4.9	8.0	6.4	5.6	4.8
69	8.3	6.6	5.8	5.0	8.1	6.5	5.7	4.9
69.5	8.4	6.7	5.9	5.0	8.2	6.6	5.7	4.9
70	8.5	6.8	6.0	5.1	8.4	6.7	5.9	5.0
70.5	8.7	7.0	6.1	5.2	8.5	6.8	6.0	5.1

Table A3.3 NCHS/CDC/WHO references expressed as percentages of the median by sex (49-115cm) - continued

Length/ height (cm)	Boys' weight (kg) Median	80%	70%	60%	Girls' weight (kg) Median	80%	70%	60%
71	8.8	7.0	6.2	5.3	8.6	6.9	6.0	5.2
71.5	8.9	7.1	6.2	5.3	8.8	7.0	6.2	5.3
72	9.1	7.3	6.4	5.5	8.9	7.1	6.2	5.3
72.5	9.2	7.4	6.4	5.5	9.0	7.2	6.3	5.4
73	9.3	7.4	6.5	5.6	9.1	7.3	6.4	5.5
73.5	9.5	7.6	6.7	5.7	9.3	7.4	6.5	5.6
74	9.6	7.7	6.7	5.8	9.4	7.5	6.6	5.6
74.5	9.7	7.8	6.8	5.8	9.5	7.6	6.7	5.7
75	9.8	7.8	6.9	5.9	9.6	7.7	6.7	5.8
75.5	9.9	7.9	6.9	5.9	9.7	7.8	6.8	5.8
76	10.0	8.0	7.0	6.0	9.8	7.8	6.9	5.9
76.5	10.2	8.2	7.1	6.1	9.9	7.9	6.9	5.9
77	10.3	8.2	7.2	6.2	10.0	8.0	7.0	6.0
77.5	10.4	8.3	7.3	6.2	10.1	8.1	7.1	6.1
78	10.5	8.4	7.4	6.3	10.2	8.2	7.1	6.1
78.5	10.6	8.5	7.4	6.4	10.3	8.2	7.2	6.2
79	10.7	8.6	7.5	6.4	10.4	8.3	7.3	6.2
79.5	10.8	8.6	7.6	6.5	10.5	8.4	7.4	6.3
80	10.9	8.7	7.6	6.5	10.6	8.5	7.4	6.4
80.5	11.0	8.8	7.7	6.6	10.7	8.6	7.5	6.4
81	11.1	8.9	7.8	6.7	10.8	8.6	7.6	6.5
81.5	11.2	9.0	7.8	6.7	10.9	8.7	7.6	6.5
82	11.3	9.0	7.9	6.8	11.0	8.8	7.7	6.6
82.5	11.4	9.1	8.0	6.8	11.1	8.9	7.8	6.7
83	11.5	9.2	8.1	6.9	11.2	9.0	7.8	6.7
83.5	11.6	9.3	8.1	7.0	11.3	9.0	7.9	6.8
84	11.7	9.4	8.2	7.0	11.4	9.1	8.0	6.8
84.5	11.8	9.4	8.3	7.1	11.5	9.2	8.1	6.9
85	12.1	9.7	8.5	7.3	11.8	9.4	8.3	7.1
85.5	12.2	9.8	8.5	7.3	11.9	9.5	8.3	7.1
86	12.3	9.8	8.6	7.4	12.0	9.6	8.4	7.2
86.5	12.5	10.0	8.8	7.5	12.2	9.8	8.5	7.3
87	12.6	10.1	8.8	7.6	12.3	9.8	8.6	7.4
87.5	12.7	10.2	8.9	7.6	12.4	9.9	8.7	7.4
88	12.8	10.2	9.0	7.7	12.5	10.0	8.8	7.5
88.5	12.9	10.3	9.0	7.7	12.6	10.1	8.8	7.6
89	13.0	10.4	9.1	7.8	12.7	10.2	8.9	7.6
89.5	13.1	10.5	9.2	7.9	12.8	10.2	9.0	7.7
90	13.3	10.6	9.3	8.0	12.9	10.3	9.0	7.7
90.5	13.4	10.7	9.4	8.0	13.0	10.4	9.1	7.8
91	13.5	10.8	9.5	8.1	13.2	10.6	9.2	7.9
91.5	13.6	10.9	9.5	8.2	13.3	10.6	9.3	8.0
92	13.7	11.0	9.6	8.2	13.4	10.7	9.4	8.0
92.5	13.9	11.1	9.7	8.3	13.5	10.8	9.5	8.1
93	14.0	11.2	9.8	8.4	13.6	10.9	9.5	8.2
93.5	14.1	11.3	9.9	8.5	13.7	11.0	9.6	8.2
94	14.2	11.4	9.9	8.5	13.9	11.1	9.7	8.3

Table A3.3 NCHS/CDC/WHO references expressed as percentages of the median by sex (49-115cm) - continued

Length/ height (cm)	Boys' weight (kg) Median	80%	70%	60%	Girls' weight (kg) Median	80%	70%	60%
94.5	14.3	11.4	10.0	8.6	14.0	11.2	9.8	8.4
95	14.5	11.6	10.2	8.7	14.1	11.3	9.9	8.5
95.5	14.6	11.7	10.2	8.8	14.2	11.4	9.9	8.5
96	14.7	11.8	10.3	8.8	14.3	11.4	10.0	8.6
96.5	14.8	11.8	10.4	8.9	14.5	11.6	10.2	8.7
97	15.0	12.0	10.5	9.0	14.6	11.7	10.2	8.8
97.5	15.1	12.1	10.6	9.1	14.7	11.8	10.3	8.8
98	15.2	12.2	10.6	9.1	14.9	11.9	10.4	8.9
98.5	15.4	12.3	10.8	9.2	15.0	12.0	10.5	9.0
99	15.5	12.4	10.9	9.3	15.1	12.1	10.6	9.1
99.5	15.6	12.5	10.9	9.4	15.2	12.2	10.6	9.1
100	15.7	12.6	11.0	9.4	15.4	12.3	10.8	9.2
100.5	15.9	12.7	11.1	9.5	15.5	12.4	10.9	9.3
101	16.0	12.8	11.2	9.6	15.6	12.5	10.9	9.4
101.5	16.2	13.0	11.3	9.7	15.8	12.6	11.1	9.5
102	16.3	13.0	11.4	9.8	15.9	12.7	11.1	9.5
102.5	16.4	13.1	11.5	9.8	16.0	12.8	11.2	9.6
103	16.6	13.3	11.6	10.0	16.2	13.0	11.3	9.7
103.5	16.7	13.4	11.7	10.0	16.3	13.0	11.4	9.8
104	16.9	13.5	11.8	10.1	16.5	13.2	11.6	9.9
104.5	17.0	13.6	11.9	10.2	16.6	13.3	11.6	10.0
105	17.1	13.7	12.0	10.3	16.7	13.4	11.7	10.0
105.5	17.3	13.8	12.1	10.4	16.9	13.5	11.8	10.1
106	17.4	13.9	12.2	10.4	17.0	13.6	11.9	10.2
106.5	17.6	14.1	12.3	10.6	17.2	13.8	12.0	10.3
107	17.7	14.2	12.4	10.6	17.3	13.8	12.1	10.4
107.5	17.9	14.3	12.5	10.7	17.5	14.0	12.3	10.5
108	18.0	14.4	12.6	10.8	17.6	14.1	12.3	10.6
108.5	18.2	14.6	12.7	10.9	17.8	14.2	12.5	10.7
109	18.3	14.6	12.8	11.0	17.9	14.3	12.5	10.7
109.5	18.5	14.8	13.0	11.1	18.1	14.5	12.7	10.9
110	18.7	15.0	13.1	11.2	18.2	14.6	12.7	10.9
110.5	18.8	15.0	13.2	11.3	18.4	14.7	12.9	11.0
111	19.0	15.2	13.3	11.4	18.6	14.9	13.0	11.2
111.5	19.1	15.3	13.4	11.5	18.7	15.0	13.1	11.2
112	19.3	15.4	13.5	11.6	18.9	15.1	13.2	11.3
112.5	19.5	15.6	13.7	11.7	19.0	15.2	13.3	11.4
113	19.6	15.7	13.7	11.8	19.2	15.4	13.4	11.5
113.5	19.8	15.8	13.9	11.9	19.4	15.5	13.6	11.6
114	20.0	16.0	14.0	12.0	19.5	15.6	13.7	11.7
114.5	20.2	16.2	14.1	12.1	19.7	15.8	13.8	11.8
115	20.3	16.2	14.2	12.2	19.9	15.9	13.9	11.9

Annex 4

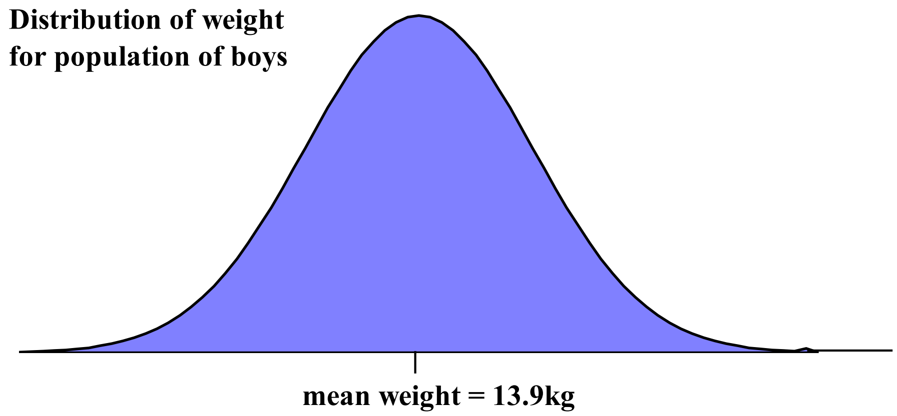
Statistics needed for nutrition surveys

A4.1 Basic Statistics

A4.1.1 Describing distributions

In any normal population there are variations in body shape and constitution between individuals. This can be illustrated by weighing all children that are one metre tall and plotting their weights in a graph. The graph will approach a bell-shaped curve, symmetrical around the median. This bell-shaped curve is called a Gauss curve or normal distribution curve. Although the shapes of the curve for each height are similar, the dispersion will be different. One curve will be more flat and wide, another will be more narrow and steep. This is the result of the variation of the weights of the children according the age groups to which they belong.

Figure A4.1 The distribution of weight for a population of boys who are all 92.5cm tall



This distribution can be summarised by presenting the mean or median (an average or central value) and the standard deviation (a measure of the spread of the distribution).

A4.1.2 The mean and median

A mean is calculated by summing all the observations and dividing by the total number of observations. So, the mean weight for the boys is calculated by adding all the weights and dividing by the total number of boys.

$$\text{mean weight} = \frac{\text{sum of all weights}}{\text{total number of boys}}$$

An alternative to the mean is the median. The median is the weight that divides the distribution in half.

Example A4.1
The weights for a sample of 11 boys is shown below:

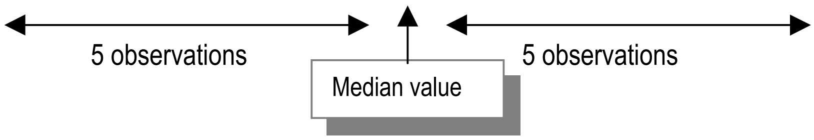
ID number	1	2	3	4	5	6	7	8	9	10	11
Weight (kg)	13.6	12.3	14.7	12.8	13.2	15.1	14.4	13.9	13.0	15.2	12.6

The mean weight for this sample is calculated as

Mean = (13.6+ 12.3 + 14.7 + 12.8 + 13.2 + 15.1 + 14.4 + 13.9 + 13.0 + 15.2 + 12.6) / 11
= 150.8 / 11
=13.7 kg

To obtain the median value, put the weights into ascending order. The weight that divides the sample into two equal parts, is the median weight. This means there are the same number of observations above and below it.

ID number	2	11	4	9	5	1	8	7	3	6	10
Weight (kg)	12.3	12.6	12.8	13.0	13.2	13.6	13.9	14.4	14.7	15.1	15.2



Note: For large sample sizes and distributions that are symmetrical (known as normally distributed) the mean and the median are equal. In nutrition surveys it is usually the median that is used as a central measure.

A4.1.3 The standard deviation

The spread of the distribution is described by the standard deviation. This is an average of the distance of each observed value from the mean, an average deviation. A simple average will not work because there are negative and positive differences and they cancel each other out so the differences must be squared before they are added together. The square root is taken to get back to the original scale.

$$\text{standard deviation} = \sqrt{\frac{\sum(\text{observed value - mean value})^2}{(\text{n - 1})}}$$

where n= total number of observations (sample size)

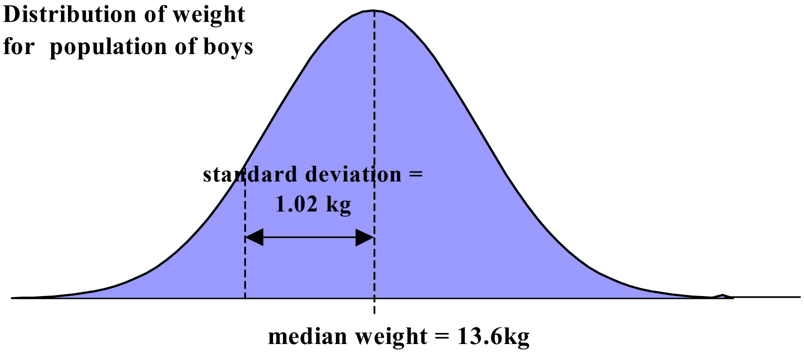
Example A4.2
For the sample of 11 boys the mean was 13.7kg. From the observed values shown below the standard deviation can be calculated as:

ID number	1	2	3	4	5	6	7	8	9	10	11
Weight (kg)	13.6	12.3	14.7	12.8	13.2	15.1	14.4	13.9	13.0	15.2	12.6

$$\text{Standard deviation} = \sqrt{\frac{\sum (13.6 - 13.7)^2 + (12.3 - 13.7)^2 + \ldots\ldots\ldots + (12.6 - 13.7)^2}{(11 - 1)}}$$

$$= \sqrt{\frac{10.47}{10}} = 1.02$$

The more variation in the weights in a population, the wider the distribution and the larger the standard deviation.



A4.1.4 Calculating a proportion or a prevalence

The prevalence, or proportion, of malnutrition is the number of children who are malnourished in relation to the total number of children in the sample. This is calculated by:

$$\text{prevalence malnourished} = 100 \times \frac{\text{(number of malnourished children)}}{\text{total number of children measured}}$$

Example A4.3
If a total of 908 children are measured and 101 children are found to be malnourished, the prevalence of malnutrition is

$$\text{prevalence malnutrition} = 100 \times \frac{101}{908}$$

$$= 11.1\%$$

A4.2 Confidence intervals and standard error

We study a sample to try to learn something about the population as a whole (without having to interview and measure the whole population). Usually we will want to estimate the characteristics of the whole population, for example the proportion of malnutrition.

If we take a series of samples, the sample proportions would not be exactly equal to the true population proportion, but would be scattered around it. We need to know how large the "error" is between our estimate of the proportion and the real proportion. In other words, we need to know how precise (or accurate) our estimation of the true population value is.

Sampling errors (variability occurring because of chance) occur because we have observed only a section of the whole population. The larger the sample size that we take, the smaller will be the sampling error, that is, the more accurately (or precisely) we are likely to reproduce the characteristics of the population.

Another factor that influences the size of the sampling error is how variable the characteristic is within the population. If the variability of malnutrition is large, or high, then we would expect the sampling error to be larger. If the variability of malnutrition is small, or low, then we would expect the sampling error to be smaller.

Therefore we use sample size (n) and the variability of the estimated result (SD) to work out the standard error of the proportion (SE(p)):

$$SE\ (p) = \frac{SD}{\sqrt{n}}$$

so, if n increases then the SE will decrease
if SD increases then the SE will increase

If we took a series of samples from the population, the values of the proportion that would be obtained would follow a normal distribution. Thus, the properties of normal distributions can be applied to the distribution of the sample proportions. For example, only in about one in twenty samples (five per cent) will the sample proportion depart from the population proportion (σ) by more than 1.96 standard errors, that is outside the limits $p = \pm \frac{1.96 \times \sigma}{\sqrt{n}}$

Thus the interval $d = \pm \frac{1.96 \times \sigma}{\sqrt{n}}$ will include 95% of repeated sample proportions.

However, in practice we only take one sample and only one sample proportion is obtained. Therefore there is a 95% chance (a probability of 0.95) of getting the sample proportion within the interval (d)

$$d = \pm\ 1.96\ SE(p)$$

This interval is called the **95% confidence interval** of the estimate. It is a measure of the precision of the sample estimate proportion. The wider the confidence interval, the less precise the results.

We say that the probability that the confidence interval contains the true population proportion is 95%.

Example A4.4
The prevalence of malnutrition was estimated at 9.5%.
The standard error is estimated at 1.17

The 95% confidence intervals = d = ± 1.96 SE(p)
= 9.5 ± (1.96 × 1.17)
= 9.5 ± 2.29
= 7.2-11.8%

A4.3 Statistics for estimating sample sizes

A4.3.1 Estimating sample sizes required for nutrition surveys

The sample size is the number of individuals to be included in the survey to "represent" the population of interest. The sample size is related to three factors:

1. the expected precision. The greater the precision, or accuracy, required, the more people needed in the sample
2. the probability of error chosen. The smaller the probability of error, the more people needed in the sample. If the whole population is surveyed, the probability of error is zero. In nutrition surveys, an error risk of five per cent is usually accepted
3. the expected prevalence of malnutrition. The smaller the expected proportion of children presenting with malnutrition, the greater the size of the sample required for a given level of precision. So as the prevalence of malnutrition approaches 50 per cent, smaller sample sizes are required.

In practice, the selection of sample size almost always involves a trade-off between the ideal and the feasible. A sample that is too small gives results of limited precision and, therefore, of questionable usefulness.

Example A4.5
A result of 10% malnutrition in a sample of 100 children would give a confidence interval ranging from approximately 4-16% — a result that cannot be interpreted usefully.

Beyond a certain level, however, increases in sample size produce only small improvements in precision, but involve disproportionate increases in costs.

A4.3.2 Formulae for calculating sample sizes

For simple random sampling:

$$n = \frac{t^2 \times (1-p)\,p}{\varepsilon^2}$$

For cluster sampling:

$$n = \frac{k \times t^2 \times (1-p)\,p}{\varepsilon^2}$$

where:

n = sample size required
t = parameter linked to the standard error, equal to 1.96 for a standard error of 5% (corresponding to a 95% confidence interval)

p = estimated prevalence of malnutrition in the population (as the prevalence of malnutrition is not known before the survey is done, an estimate must be used — this is usually an experienced guess, or derived from a small pilot survey)

ε = relative precision required

k = design factor, which is a measuring of the clustering of the characteristic being measured (k=1 when you are undertaking a simple random survey or systematic survey, but k=2 when you are undertaking a cluster survey as there are two stages in the sample design).

P and ε can both be expressed either as percentages or as fractions of (10%=0.1), but both must be expressed in the same terms.

The sample size for a cluster survey is larger than that for a random sample of the same precision. This is because the units within a cluster tend to be similar in their characteristics (hence k=2). Poor (and therefore) malnourished people, for example, are more likely to be found living together in the same areas.

Example A4.6

Expected prevalence of malnutrition: 15%, so p=15%

Relative precision required (ε): 20% of the estimated prevalence.

For random sampling:

$$n = \frac{1.96^2 \times (0.85)\ 0.15}{(0.20 \text{ x } .15)^2} = 544$$

For cluster sampling:

$$n = \frac{2 \times 1.96^2 \times (0.85)\ 0.15}{(0.20 \times 0.15)^2} = 1{,}088$$

Example A4.7

Expected prevalence of malnutrition: 15%, so p=15%

Relative precision 3%

For random sampling

$$n = \frac{1.96^2 \times (0.85)\ 0.15}{0.03^2} = 544$$

For cluster sampling:

$$n = \frac{2 \times 1.96^2 \times (0.85)\ 0.15}{0.03^2} = 1{,}088$$

Example A4.8

Expected prevalence of malnutrition: 40%, so p=40%

Relative precision required (ε): 20% of the estimated prevalence.

For random sampling:

$$n = \frac{1.96^2 \times (0.6)\ 0.4}{(0.2 \times 0.4)^2} = 144$$

For cluster sampling:

$$n = \frac{2 \times 1.96^2 \times (0.6)\,0.4}{(0.2 \times 0.4)^2} = 288$$

These examples clearly show how important an effect the required precision (ε) and the expected prevalence (p) have on the sample size. In nutrition surveys in major emergencies in Ethiopia, the prevalence of acute malnutrition is usually 5-20 per cent, and the precision must be defined accordingly. A relative precision of around 20-25 per cent is generally appropriate.

The size of the total population does not normally affect the size of the sample required. However, if the population is smaller and the calculated sample size turns out to be more than 10% of the total population, a correcting factor can be applied to the formula. This correction factor is used whenever the sample size is more than one tenth of the total population. The revised sample size is given by the following formula:

$$\text{Revised } n_s = \frac{n}{1 + f}$$

where,

n_s = adjusted sample size for small population
n = sample size for large population (calculated as described above)
N = population size
f = n/N

Example A4.9
In example A4.6, if the total population of children aged 6-59 months was 5,000, the revised sample size for the random sampling would be:

$$\text{Revised } n = \frac{544}{1 + (544/5000)} = 490$$

A4.4 How to choose a random number

Sampling techniques rely heavily on the ability to be able to choose a random individual, household or area to survey. Choosing a random number means that there is no bias in selecting someone or somewhere to start a survey.

There are many ways to chose a number randomly, these include:

- drawing numbers from a hat
- using random number tables

Both methods rely on giving an area/household/individual an identification number. Once the numbers have been randomly selected you can identify which area/household/individual has been selected by referring to your original identification list.

Drawing numbers from a hat or a bag
Determine the range from which you need a random number, for example 1-15. Then simply write down all the numbers on separate pieces of paper (you will have 15 pieces of paper in this example). Fold the pieces of paper and put them in a hat or plastic bag. Draw as many pieces of

paper out of the bag or hat as you need. Each piece of paper that you draw out will have a number on it, representing a household or individual that you need to visit or measure.

Drawing numbers from a hat may be the simplest way to chose a random number. In addition, if you use this method, everyone will understand what you are doing. This method is obviously only practical if you need a relatively low random number — say below a hundred, as otherwise it will take you a long time to write down all the numbers on little pieces of paper and put them in a bag.

Using a random number table

Numbers can be read off with any required total numbers of digits. The steps involved in using this, or any other set of random numbers are:

1. Decide on the direction which numbers will be read; e.g. left to right going down the page.
2. Specify the required numbers of digits. If a random number is required in the interval 0001 to 1342, 4 digits are needed (any of which may be zero).
3. Close your eyes and stick a pin (or other sharply pointed object) in the table. Read off the required number of digits in the direction chosen in step 1, starting with the first digit to the left of the point. If the resulting number falls within required interval, use this number. If not, repeat the process until an eligible number is drawn or move to the next number.

Random Numbers

13118	50901	57493	96647	46146	65512	97571	49679	92251	36599
81111	33653	61544	90072	61635	94254	98222	49594	99403	56952
07124	56894	00475	09815	05299	17082	80775	11320	98562	68957
55155	23168	83063	80324	51450	68094	71844	68302	49552	12682
46406	44641	45461	75174	33268	86032	40355	58288	05532	29419
10616	17092	76614	04950	67982	28515	16782	86129	44391	64419
38497	57435	46124	37302	10783	93043	06903	77158	49638	26211
83203	45840	75843	75843	74567	75971	97779	98047	68916	35038
19236	62703	12863	14452	72228	55022	070245	43615	74802	02110
79024	60592	93692	29737	09314	26191	2484	11588	14078	85947
76073	57252	52795	67673	62267	29552	68244	49280	58583	42190
50568	66590	38807	30061	26336	46147	04554	44562	72604	63031
11838	73906	55981	23668	22627	88438	96686	73645	81410	10942
57618	30523	16757	11956	58411	41647	67884	30084	14500	66058
61846	47265	09508	11030	10462	93922	17022	7131	07827	94722
60935	25351	11687	07679	73455	58617	24415	56921	88450	50471
63328	21749	74262	77143	55995	50707	91516	38002	60552	00634
75937	07127	11014	00738	46159	09866	87587	41648	36538	24398
11981	89485	54965	08300	67724	24919	65682	50101	45470	07232
12311	17067	42758	64557	46297	28414	93801	81180	12176	08536
45160	76932	00433	42228	73696	27478	65321	22979	30198	86708
26427	48280	53441	44543	95231	39939	09251	09755	26671	89392
54568	17774	95705	28018	26507	63504	98872	22449	56423	59133
80855	94883	08969	16949	86045	68398	46164	57147	35104	37262
96203	73918	77875	48444	08167	58460	87945	52145	20330	77172
91210	89152	93904	27666	51080	00487	12073	41639	28717	33909
37808	11431	03351	82979	96677	41588	17592	5111x	84657	25427
47738	40686	00948	46598	99095	67011	05786	05642	26282	97486
03255	71561	78549	15611	49097	58375	70087	10066	83530	26684
92658	11755	39005	72386	20601	49630	85266	78939	89931	99674
86040	48908	88153	05616	91381	88378	28263	34725	80739	15251
87806	60615	14520	04557	72939	71060	10650	58769	07497	00808
46138	03111	47053	89391	83636	05877	17980	63940	23003	23737
81514	46994	77869	72054	22819	89316	77195	20194	65043	27706
28419	60216	07640	80670	84427	98368	99656	10214	04023	39899
99109	64711	06962	56790	96313	54470	18568	04319	31680	39507
15045	85129	03531	06107	93785	38290	00911	68388	68686	53357
61398	94861	90462	09438	53920	59996	91957	39255	86563	20781
58455	18205	39389	18286	22994	78421	22241	04228	86679	47840
81025	70374	79493	39986	41707	57491	35647	43409	37182	73435

Annex 5

Sample questionnaires

Some sample questionnaires which have been used in nutrition surveys are presented below. These questionnaires are given as examples only and *should not* be used as templates or models (with the exception of the children's anthropometric data form).

The questionnaires presented do not cover all the information required for a thorough analysis of the nutrition situation, because some of the information was obtained through other sources. For example, the questionnaires for the agricultural area (Welayita Zone) do not ask about relief distributions. This is because the survey team knew (from the DPPC and zone administration) that no relief had gone into the area in the past four months. Hence there was no point in wasting the correspondent's time asking questions about relief. However, questions about relief deliveries were asked in the pastoral questionnaire (near Moyale), as the administration was unsure whether or not the population had received food aid in the last three months.

Similarly, the mortality questionnaire does not cover all possible causes of death. You may want to change the causes of death for different surveys, according to the situation.

The definitions of all terms such as "cause of death", or "major" and "small" markets should be discussed during survey training and defined in the surveyor's manual.

A5.1 Sample household questionnaires

A5.1.1 Example of a household questionnaire for an agricultural area

(Welayita zone). Ask every three households.

Survey PA:_____________ Gott: ____________________ Cluster Number: _____________

Household number: ____________ Survey Date: ______________ Team Number: ______________

1. What sex is the head of the household? *(1= male, 2= female)*	
2. How many people slept in the household last night?	
FOOD SOURCES	
3. What is normally your main food at this time of year? (most important only and up to 3 choices) *(1=maize, 2=sweet potato, 3=enset, 4=godere, 5=relief food, 6=beans, 7=chickpeas, 8=other – specify)*	____ ____ ____
4. What was your main food in the past four weeks? (most important only and up to 3 choices) *(1=maize, 2=sweet potato, 3=enset, 4=godere, 5=relief food, 6=beans, 7=chickpeas, 8=other – specify)*	____ ____ ____
5. What was the most important source of food in the past four weeks? (indicate 2) *(1=own production, 2=borrowed, 3=bought, 4=relief food, 5= other – specify)*	____ ____
6. What is the most important source of food in the next three months? (indicate 2) *(1=own production, 2=borrowed, 3=bought, 4=relief food, 5= other – specify)*	____ ____
ANIMALS AND LAND OWNED	
7. How much land do you own? (write)	
8. A) How is the condition of any animals in your house? *(0=no animals, 1=good, 2=bad)* **B) What type of animals do you have?** (record all types including relatives animals) *(1=ox, 2=cow, 3=shoat, 4=donkey, 5=horse, 6=chicken, 7=fat oxen, 8=other - specify)* **C) If you have a fat ox is it yours or shared?** *(1=own, 2=share)*	
INCOME SOURCES	
9. Were any members of your household involved in income-generating activities in the last four weeks? *(0=no, 1=yes)*	
10. If yes, activities involved (record all type activities and product sold) **A) Sale of produce and product** *(1=coffee, 2=ginger, 3=root crops, 4=teff, 5=vegetable, 6=timber, 7=cotton, 8=enset, 9=maize, 10=charcoal, 11=firewood, 12=grass, 13=other)* **B) Sale of animal and their produce** *(1=butter, 2=cheese, 3=skimmed milk/arera, 4=sale of animal, 5=sale of fattening)* **C) Other income sources** *(1=waged labour (not including EGS), 2=petty trading (including brewery), 3=loan, 4=remittance, 5=other - specify)*	

CARE Ask these questions if there is a child aged 6-36 months in the house, otherwise go to question 16	
11. At what age did you start giving weaning foods to your youngest child? (write down age)	
12. How many times a day do the children aged 6-36 months eat on average (not including breast feeding)? (Write down)	
13.Do you prepare special food for the young children aged 6-36 months? *(0=no, 1=yes)*	
14. Did your child drink milk yesterday? *(0=no, 1=yes)*	
15. Can the mother of the youngest child in this house read and write? *(0=no, 1=yes)*	
16. Is the family using family planning? *(0=no, 1=medical/(contraceptive), 2=traditional, 3=timing)*	
WATER	
17. What is your main source of water? *(1=river, 2=spring, 3=pipe water, 4=pump well, 5=pond, 6=other – specify)*	
18. How long does it take to collect water (to go there, take water and come back)?	
19. Do your animals live in the house *(0=no animals, 1=yes, 2=separate)*	
FERTILISER	
20. Did you buy fertiliser since last January? (If bought, go to question 22) *(0=no, 1=bought on credit, 2=bought from market)*	
21. If no, why did you not buy fertiliser? *(0=no fertiliser, 1=no land, 2=no money, 3=no credit scheme, 4=not important for the land)*	
22. If bought on credit, do you still owe any money? *(0=no fertiliser, 1=no debt, 2=paid some, 3=whole loan still owed)*	
23. If fertiliser is used, did you take… *(0=no fertiliser, 1=full package, 2=shared with others)*	
24. If shared, how many households is it shared with? *(0=not shared)*	

A5.1.2 Example of a household questionnaire for a predominantly pastoral area

(Near Moyale, on the Kenyan border). Ask every three households.

PA:____________________ Ketena:______________ Cluster number:_____________

Household number:_____________ Date:________________ Team number:______________

1. What sex is the head of the household? *(M=male, F=female)*	
2. Is this household depending more on agriculture or animals? *(1=agriculturist, 2=animals, 3=agriculture and animals, 4=other – specify)*	
FOOD SOURCES	
3. What was the main food for people >5 years old in the past four weeks? (2 most important, in order) *(1=maize, 2=sorghum, 3=wheat, 4=milk, 5=meat, 6= other - specify)*	____ ____
4. What was the most important source of the main foods in the past four weeks? (2 most important, in order) *(1=own crop production, 2=own animal production, 3=cereal purchase, 4=animal product purchase, 5=relief food, 6=borrow, 7=other - specify)*	____ ____
5. What will you depend on for your main food source for the next two months? (2 most important, in order) *(1=own crop production, 2=own animal production, 3=cereal purchase, 4=animal product purchase, 5=relief food, 6=borrow, 7=other - specify)*	____ ____
6a) Are you eating any wild foods? *(0=no, 1=yes) If yes then specify*____________ **b) Do you normally eat wild foods at this time of year?** *(0=no, 1=yes)*	
ANIMALS OWNED	
7a. What is the physical condition of your animals? (if no animals go to question 9) *(0=do not have animals, 1=excellent, 2=good, 3=poor, 4=very poor)* **b. Why is the animals' condition poor/very poor?** *(0=not poor, 1=lack of grazing/water, 2=disease, 3=other – specify)* **c. What type of animals do you have?** (record all types) *(1=camel, 2=cattle, 3=shoats, 4=donkey, 5=other - specify)* **d. Has the size of your livestock herd changed since the last Gu?** *(1=increased, 2=same, 3=decreased)* **e. If decreased or remained the same, why?** *(0=increased/same, 1=drought, 2=disease, 3=raids, 4=oversell, 5=other - specify)*	
8a. Have you got treatment or drugs for your animals from a modern veterinary service (paravet) since the last Gu? *(0=no, too far, 1=no, too expensive, 2=no, poor service, 3=no, because not sick, 4=no, other reason – specify, 5= yes)* **b. Have you treated your animals by yourself since the last Gu?** *(0=no, 1=yes with modern drugs (from pharmacy), 2=yes with traditional medicine, 3 =other - specify)*	

INCOME SOURCES	
9. What were your income sources in the last three months? (record all types of sources) *(0=none, 1=sell livestock, 2=sell livestock products, 3=sell grain, 4=petty trade, 5=waged labour, 6=sell charcoal/fire wood, 7=sell poles, 8=other – specify)*	
CARE Ask this question if there is a child aged 6-36 months in the house, otherwise go to question 11	
10a. At what age did you start giving weaning foods to your youngest child? Write down months **b. How many times a day does the child eat, on average (not including breast-feeding)?** Write down **c. What did your child eat yesterday?** (record all answers) *(0=only breast milk, 1=porridge, 2=animal milk, 3=tea with milk, 4= meat, 5=rice, 6=wild food, 7=fruit, 8=other)* **d. If the child did not receive animal milk ask why?** (record all answers) *(0=did receive milk, 1=animals migrated, 2=no lactating animals, 3=no money to buy milk, 4=child sick, 5= other)*	
11. Do you practice family planning? *(0=no, 1=yes, modern FP, 2=traditional FP, 3=don't know)*	
12a. Have you been to the health centre since the last Gu rains?, *(0=no, 1=yes for my child, 2=yes for myself, 3=yes for child and myself, 4=other -specify)* **b. If did not go to health centre since last Gu, ask why?** (record all answers) *(0=did go, 1=not ill, 2=too far, 3=no money, 4=poor service, 5=other - specify)*	
13a. Have you been to the traditional healer since the last Gu rains? *(0=no, 1=yes for my child, 2=yes for myself, 3=yes for child and myself, 4=other -specify)* **b. If did not go to traditional healer since last Gu, ask why?** (record all answers) *(0=did go, 1=not ill, 2=too far, 3=no money, 4=poor service, 5=other - specify)*	
14. Can the mother of the youngest child in this house read and write? *(0= no, 1=yes)*	
WATER	
15. What is your source of water at this time of year? *(1=river, 2=pump well, 3=pond, 4=traditional wells, 5=other – specify)*	
16. Who collects water at this time of year? *(1=mother, 2=children, 3=father/older son, 4=other - specify)*	
17. How do you carry the water? *(1=human, 2=camel, 3=donkey, 4=other –specify)*	
18. How long does it take to collect water at this time of year (round trip)? (write down hours)	

A5.2 Sample community questionnaires

A5.2.1 Example of a community questionnaire for an agricultural area
(Welayita Zone)

Survey PA: ______________ Gott: ________________ Cluster number: ____________

Survey date: ____________ Team number: __________

General questions

1). How many households are there in this gott?____

2). How long does it take to walk from the centre of this gott to a major market?__________________

3). How long does it take to walk from the centre of this gott to a small market? __________________

4). What is the altitude zone of this gott?____
(1=dega, 2=woina-dega, 3=kola, 4=extreme kola)

5). Which rains are you dependent on (prioritise importance) _______ _______ _______
(1=belg, 2=meher, 3=sape) NB: If all seasons of rains are equally important write down, 1=2=3

Agricultural activities

6). A). When was the most recent food grains harvest here?______________________________
(0=not yet harvested, 1=September 2=October, 3=November, 4=December, 5=January)

B). How many households received the last food grain harvest? __________________________
(If no households have received a meher harvest write "0" and go to question 7)

C). Compared to the year before (1992/93) how was the 1993/94 meher harvest? ______________
(1=same, 2=better, 3=worse)

7). A). When was the most recent root crop harvest here? ______________________________
(0=not yet harvested, 1=September 2=October, 3=November, 4=December, 5=January)

B). How many households received the last root crop harvest? __________________________
(If no households have received root crop harvest write "0" and go to question 8)

C). Compared to the year before (1993) how was the 1994 root crop harvest? ________________
(1=same, 2=better, 3=worse)

8). A). When was the most recent cash crop harvest here? ______________________________
(0=not yet harvested, 1=September 2=October, 3=November, 4=December, 5=January)

B). How many households received the last cash crop harvest? __________________________
(If no households have received a meher harvest write "0" and go to question 8)

C). Compared to the year before (1992/93) how was the 1993/94 cash crop harvest? ____________
(1=same, 2=better, 3=worse)

9). If the harvest was "worse" explain why? (Indicate the most important only)

A). Food grain harvest ____
(1=excess rain, 2=shortage of rain, 3= hail, 4=disease, 5=pest, 6=lack of input, 7=other – specify)

B). Root crop harvest ___________________________

(1=excess rain, 2=shortage of rain, 3= hail, 4=disease, 5=pest, 6=lack of input, 7=other – specify)

C). Cash crop harvest ___________________________

(1=excess rain, 2=shortage of rain, 3= hail, 4=disease, 5=pest, 6=lack of input, 7=other – specify)

Rains and planting for meher 1993/94

10). Have the *sape* rains been sufficient in this gott? ___________________________

(0=no,1=yes)

11). A). Have you planted root crop yet this year? ___________________________

(0=no,1=yes) (If no, go to question 11)

B). If you have planted, what crop have you planted? (Indicate more than one) ______________

(1=coffee, 2=enset, 3=ginger, 4=root crop - specify)

12). If you have not planted, why not? ___________________________

(1=no rains, 2=no cuttings, 3=no seedlings, 4=plan to plant short-term varieties, 5= other - specify)

Livestock & pasture

13). A). What is the condition of the livestock at the moment in this gott? ______________

(1=good, 2=medium, 3=poor)

B). If poor, what are the main problems? ___________________________

(1=disease, 2=insufficient grazing land, 3=inadequate pasture and fodder, 4=other –specify)

Health

14). How long does it take to walk to the nearest health post? ______________________

15). How long does it take to walk to the nearest clinic? ______________________

16). When was the last vaccination campaign here? ______________________

17). A) have there been any epidemics in the last three months (measles, malaria, typhoid, typhus, whooping cough etc) in this gott? *(0=no, 1=yes)* ______________________

B). If yes, what was the epidemic? ______________________

Storage/use

18). Why do you sell/eat all green maize?

____

____

____

19). Why didn't you store the green maize?

____

____

____

20). Is there any ways of maximising (increasing) the storage of maize?

Fertiliser

20). How many households in this gott used credit scheme of fertiliser? (bought the package)

21). How many households shared fertiliser on average?

22). What are the problems with the fertiliser credit scheme?

Migration in the past three months

23). Was there any normal migration of people from this gott in the last three months?
(0 =no, 1=yes)

24). Was there any unusual migration of whole families (households) from this gott in the last three months?
(0 =no, 1=yes)

Other information

What is your general impression of how these people are managing to survive?

A5.2.2 Example of a community questionnaire for a predominantly pastoral area

(near Moyale, on the Kenyan border)

PA____________________ Ketena ______________________ Cluster number_________________
Date__________________ Team number__________________

General questions

1). How many households are there in this ketena? ____

2a) How long does it take to walk from the centre of this ketena to Moyale town ? ____________________
b) How long does it take to walk from the centre of this ketena to the nearest small market? ___________

Livestock

3). How were the last Deyr rains?
A)very poor B)poor C)average D)good E)excellent

4). How is the condition of the pasture compared to a normal/good year?
A)very poor B)poor C)good D)excellent

5). How is the water availability for livestock compared to a normal/good year?
A)very poor B)poor C)good D)excellent

6). How is the condition of livestock compared to a normal/good year?
A)very poor B)poor C)good D)excellent

7). Is there a livestock epidemic/outbreak in this ketena at the moment?
A)yes B)no
If yes, then what diseases (i) ________________________(ii)___________________________

8). Has there been any unusual migration of livestock into the area in the last three months? *(record all answers)*
A)No B)Kenya C)inside the woreda D)outside the woreda E)Other – specify

9). Has there been any unusual migration of livestock out of the area in the last three months?
A)No B)Kenya C)inside the woreda D)outside the woreda E)Other – specify

Price changes

10). In the past three months, have there been any price changes in the following items?

Cereal	Decreased	Same	Increased
Camel	Decreased	Same	Increased
Cattle	Decreased	Same	Increased
Shoat	Decreased	Same	Increased

Agricultural activities

11). In a normal/good year do you plant crops?
A) yes B) no
If the answer is no, go to question on health

12). How was last year's production?
A)None B)very poor C)poor D)average E)good F)excellent

13). How many households received a harvest of more than one quintal? ____________________

14). If only a few or no households had a harvest last year, what was the reason? *(most important only)*
A) insufficient rain B)no seeds/tools C)land not suitable D)other-specify

Human health

15). How long does it take to walk to the nearest functional health post/clinic/hospital? _______

16). a) When was the last polio vaccination campaign here? ____________________________
b) When was the last measles vaccination campaign here? ___________________________

17). Have there been any epidemics in the last month (measles, diarrhoea, etc) ?
A) yes B)No

If yes, what was the epidemic? ______________ (*you can cross-check this by asking to see sick children)*

Relief in the past three months

18a). Has any relief food been distributed to the ketena in the past four months? *(if no, go to education)*
A) yes B)no

b) If yes, when? *(record all months when they received food)*___________________________
(1=November, 2=December, 3=January, 4=February)

19). How many households in this ketena received relief food? __________________________

20). Who was the target group for the last relief food distribution? (*record all answers)*
(A)people without livestock, B)disabled/old people, C)everyone, D)other -specify)

Education

21) Do you have any schools in the ketena?
A) None B)Government C) informal/ Koranic D)both

22) How long does it take to walk to the nearest government school? ____________________

Migration in the past three months

23). How many whole households have gone with their children to look for pasture and water as usual?

24a). Was there any unusual migration of whole families (households) from this ketena in the last three months?
A)yes B)no

b). If yes, roughly how many (whole families) households have moved and are still away? _________

c). What is the most important reason for leaving?
A) look for pasture & water for animals B) look for labour, C) look for food D)other – specify

A5.3 Example of a mortality data questionnaire

Survey PA:____________________Gott:__________________________Cluster number:________________
Date:__________________________Team number:__________________

HH number	Total people in HH	Total under 5 in HH	Total deaths after Ramadan	No. deaths of people > 5 years after Ramadan	No. < 5 deaths after Ramadan	Causes of death in <5	Causes of death people >5
1							
2							
3							
4							
5							
6							
7							
8							
9							
10							
11							
12							
13							
14							
15							
16							
17							
18							
19							
20							
21							
22							
23							
24							
25							
26							
27							
28							
29							
30							

Key for cause of death: 1=diarrhoea, 2=ARI, 3=fever, 4=measles, 5=accident, 6=unknown, 7=other

Note: "deaths after Ramadan" could be exchanged for deaths after Timkat, Fasika or any other event that the population will be able to remember easily.

A5.4 Example of an anthropometric data form with extra information

Survey PA: ____________________Gott:__________________ Cluster number:________________

Date:_________________________Team number: __________

HH. no.	Child no.	Name	Age in months	Sex (F/M)	Oedema (Y/N)	Weight (kg) ±100g	Height (cm) ±0.1cm	% W/H	Registered in SFP/TFC (Y/S/T)	Need to refer (Y/N)	Vaccination			Illness
											BCG Mark (Y/N)	Measles card=1 yes but no card=2 No=0	Vit A (Y/N)	No=N Diarrhoea=D Cough=C Fever=F Other=O
	1													
	2													
	3													
	4													
	5													
	6													
	7													
	8													
	9													
	10													
	11													
	12													
	13													
	14													
	15													
	16													

Diarrhoea=more than three loose stools/day; C=cough or difficulty breathing; Fever=high temperature; Other=other illness in two weeks before survey.

HH. no.	Child no.	Name	Age in months	Sex (F/M)	Oedema (Y/N)	Weight (kg) ±100g	Height (cm) ±0.1cm	% W/H	Registered in SFP/TFC (Y/S/T)	Need to refer (Y/N)	Vaccination			Illness
											BCG Mark (Y/N)	Measles card=1 yes but no card=2 No=0	Vit A (Y/N)	No=N Diarrhoea =D Cough=C Fever=F Other=O
	17													
	18													
	19													
	20													
	21													
	22													
	23													
	24													
	25													
	26													
	27													
	28													
	29													
	30													
	31													
	32													

Diarrhoea= more than three loose stools/day; C=cough or difficulty breathing; Fever=high temperature; Other=other illness in two weeks before survey.

Annex 6

Example surveyor's manual and equipment list

A6.1 Example of a nutrition team member's manual for standard anthropometric and mortality questionnaires

The sample questionnaire forms which accompany this manual can be found in Annex A5.3 and A5.2.

General

This survey must be representative of the whole survey area, so every team must follow this method!

Arriving at the PA

When you arrive in the PA or kebele, try to locate the PA leader and give him the letter of permission from the woreda. If he is not available, ask where someone else in authority is. Locate this person. You then need to choose which locations you need to visit in this PA.

1. Make a list of all the names of the locations in the PA — it is important this list is complete. Make sure even the smallest, furthest away locations are included.
2. Give each location a number.
3. Chose a number from the random numbers in the bag. If this number corresponds to one of the numbers listed for a location, then this is one of the locations that you will visit in the PA. If the number you chose from the bag does not correspond to one of the locations, then select another number until you find one which corresponds to a location.
4. Continue with the process until you have enough locations for the PA. (For example, in some PAs you will need only one location, but in others you may need more.)
5. Discuss with the PA leaders the distance of each location from the centre of the PA, and work out a sensible timetable for surveying the locations you have chosen

Remember the location selection must be random. Do not choose the nearest location for reasons of convenience.

Arriving at the location

Once you arrive in the location, try to locate the location leader and explain why you are there. Once you have permission to undertake the survey, start as below:

1. Go to the centre of the selected locality (ask local people for information).
2. Randomly choose a direction by spinning a pencil or pen on the ground and noting the direction in which it points when it stops.
3. Walk in the direction indicated by the pen, from the centre to the outer perimeter of the locality, counting the number of households along this line.
4. Select the first household to be visited by drawing a random number between one and the number of households counted when walking. For example, if the number of households counted was twenty-seven, then select a random number between one and twenty-seven. If the number five was chosen, then the fifth household on the walking line is the first you should visit.

At the first house

1. At the house, introduce your organisation and the purpose of the survey to the head of the household.
2. Start by doing the mortality questionnaire, then do the anthropometric questionnaire if necessary. Measure *all* children aged 6-59 months in the household.
3. The subsequent households are chosen by proximity. In a locality where there is a high population concentration, proceed by always choosing the next house to the right or left (decide which, left or right, and stick with this from the beginning of the survey). Continue going to the left/right until the required number of children has been measured. The same method should be used for all clusters. However, if the locality has a very spread-out population, then just proceed by choosing the nearest house. The nearest house is the one with the door nearest to the last house surveyed, whether it is on the right or left (this should save you a lot of time in an area where the dwellings are very spread out). Continue the process until the required number of children has been measured.
4. If there are no children under five in a household, do the mortality questionnaire, and then proceed to the next house.
5. All eligible children are included and should be measured and weighed. This means that all children in the last house should be measured, even if this means exceeding the number "required". If a child is not present at the time of the survey, go back to the house later to find the child (you should continue to look for the missing children until you leave the survey area). If you cannot find a child then you need to replace it with another, by continuing the sampling methodology. If a child has been admitted to an intensive feeding centre, the team must go to the centre and measure him there.

It is extremely important to follow this house-to-house method of selecting children if you are undertaking a random survey. If you simply called for children to be brought to the centre of the locality, it is likely that some of the children could be missed. This could result in bias. In addition to preventing bias, the house-to-house method also allows you to ask household questionnaires at someone's home, which makes it easier to verify what they are saying.

6. If you run out of houses to measure in a locality and have not found sufficient children (that is you have not found 30 children) then you should proceed to the nearest locality. When you arrive at the nearest locality you should repeat the process of spinning a pen and randomly selecting a house to start at (steps 1-4 described above). Proceed from house to house until you have measured sufficient children
7. If a child aged 6-59 months is not present when you visit a house, then make arrangements to visit the house later. You should make every effort to look for missing children until you leave the survey area.

Randomness is the key to the success of the survey. Follow the above methodology as closely as possible. If a difficulty arises, then adapt the methodology as best you can, but remember randomness is the key. Record the change in methodology that you use

Mortality questionnaires

You need to get mortality information on the first 30 households you visit, whether or not they have any children aged 6-59 months. The procedure for the mortality questionnaires is described below:

1. fill in all the general information (name of survey, PA, etc)
2. for each house then fill in all the data below:

Total people in household
This is defined as the number of people who normally share meals with the household.

Total under-five in household
This is defined as the number of people aged less than five years, who normally share meals with the household.

Total deaths after Ramadan
This is defined as the total number of people from this household , who have died between Ramadan and the day of the survey.

Deaths of people >5 years after Ramadan
This is defined as the total number of people from this household, aged more than five years, who have died between Ramadan and the day of the survey.

Number deaths <5 after Ramadan
This is defined as the total number of people from this household, aged less than five years, who have died between Ramadan and the day of the survey.

Cause of death
You should enter the appropriate code for cause of death according to the definitions below:

1. = diarrhoea — any episode of more than three (liquid-like) stools per day (can be bloody or not)
2. = acute respiratory tract infection — any episode with associated fever and cough and at least one of the following signs: sputum, thoracic pain, dyspnoea, wheezing
3. = fever — elevated body temperature
4. = measles — any episode of fever accompanied by cutaneous eruption, may be accompanied by rhino-pharyngitis and/or conjunctivitis
5. = accident
6. = unknown
7. = other — specify presumed cause.

Normally, the person interviewed will not describe the cause of death using direct medical terminology, but by describing symptoms. The supervisor should be able to identify the major symptom that most probably explains cause of death.

Children's anthropometric questionnaire

You need to measure at least 30 children. Fill-up the children's form as you go from house to house. When you have measured 30 children there is no need to measure more.

Choosing the people to interview and measure

1. After you fill out the mortality data for a household, you should know if there are any children under five. So, ask for all the names of children aged 6-59 months. If a child's age is uncertain, then only children 65-110cm should be included. Any child outside these measurements should *not* be measured, unless their age is known for sure.
2. If a child is temporarily absent, ask the caretaker all the information about the child, arrange a return time and come back to measure the child. If a child in a selected household is admitted to a TFC, take details of the child (name, age, sex, which TFC, date of admission). You will need to measure this child in the TFC at a later date.
3. Fill in the household number column. Remember that the household number should be the same for each house on the mortality and anthropometric questionnaires.
4. Then, for each child, fill in the data below:

Age in months
If the date of birth and age are difficult to determine with precision, children measuring less than 110cm are considered to be aged below 59 months and should be measured.

Sex
Note the sex of the child by assigning an "F" to females and an "M" to males

Oedema
Only bilateral oedemas are considered to be of nutritional significance. Oedema can be diagnosed by placing a medium pressure (with a thumb) on the forepart of the leg (tibia) or on the upper side of the foot for three seconds, Oedema is present if a skin depression the shape of a thumb-print remains after the pressure is released.

The result is denoted by: N=absence of oedema: Y=presence of oedema.

Weight
The child is undressed and weighed on a Salter (25 kg) scale. One of the assistants reports the measurement to the nearest 100g and the supervisor records this value immediately on the data collection sheet. The supervisor repeats the value to the assistant in order to verify that the value was correctly recorded

Height (to the nearest mm)
Children aged above two years are measured in an upright standing position, whereas those younger than two years are measured in a reclined position. When age is difficult to determine, children measuring less that 85cm are measured in a reclined position and those measuring 85cm or above are measured in a standing position.

Measuring boards must be set on a flat surface and shoes must be removed. Feet must be placed correctly on the base of the board, with the child looking straight ahead

As with weight measurement, the person conducting the measurements announces the value to the nearest 0.1cm and the supervisor records it and repeats the value for verification.

% W/H
Calculate this index from the WFH tables provided.

Registered in SFP/TFC
(This question is only used if there is an SFP or TFC in the area.)
Ask if the child attends a feeding centre. Use the following code to specify the answer
N = not admitted
S = admitted to a supplementary feeding centre
T = admitted to a therapeutic feeding centre

Need to refer
If the child is malnourished and not admitted to a feeding centre, then you need to refer him or her. Standard referrals are:

- <70% W/H median and/or oedema refer to TFC
- 70-80% W/H median refer to SFC

Make sure the carer knows where the nearest SFC, TFC or health facility is, and assist them with transport if necessary.

BCG
Check for the BCG scar on the child's upper arms. If the scar is present, answer "y", otherwise answer "n".

Measles
Ask to see the child's MCH card. Check the MCH card to see if a measles vaccination has been given. If the child has no card, or the measles vaccination has not been filled in the card ask the carer whether or not the child has had a measles vaccination. Try to make sure the mother understands you are talking about a measles vaccination, not polio, BCG or DPT3. Use the following code to specify the answer
1 = measles vaccination confirmed by card
2 = measles vaccination not confirmed by card, but confirmed by carer
0 = no measles vaccination

Vitamin A status
Show the mother/carer a sample vitamin A capsule. Ask the mother whether or not her child has received one of the capsules in the last six months.
Y = yes, has received a capsule
N = no, has not received a capsule

Illness
Ask the carer if the child has had any illness in the past 15 days. If the answer is yes, then probe to find out what kind of illness. Use the code below:
N = no illness
D = diarrhoea — any episode of more than three (liquid-like) stools per day (can be bloody or not)
C = cough — chest pain or shortness of breath
F = fever — elevated body temperature
O = other — specify presumed cause

End of the day
Return to the houses where children were missed and try to find and measure them.
Check data-collection sheets completed by the teams. Has the data been correctly collected? Does any of the data appear to be erroneous? If so, go back to the household and double check.

A6.2 Example of equipment needed for a nutrition survey.

	Item	Items per Team	Total*
Weighing	Children's scale	2	12
	Hooks	1	6
	Poles	1	6
	Pairs of pants	2	12
	Standard weight	1	1
Measuring	Board	1	6
	Moving plate	1	6
Recording	Pencil	3	18
	Bic pen	3	18
	Eraser	3	18
	Pencil sharper/razor	1	6
	Notepad (small)	3	18
	Clipboard	3	18
	Calculator	1	6
Other	Equipment bags for scales	1	6
	Document bag	1	6
Tents etc	Blankets/sleeping bags	3	18
	Plastic sheeting	1	6
	Tents	1	6
	Cooking equipment	1	6
	Lamp	1	6
	Torch	1	6
	Insect repellent spray	1	6
	Water bottle	3	18

** this total assumes six teams*

You will also need transport and fuel, money for per diems and letters of introduction, from the woreda or zone administration office to the PA leaders.

Annex 7

Analysis of results

A7.1 Detailed calculations of standard error and confidence intervals for a prevalence

The standard error is relatively simple to calculate. There are two formulas: one for random sampling and one for cluster sampling.

Random sampling

The formula for the calculation of the S.E. for random sampling is:

$$S.E.(p) = \sqrt{\frac{p \times (1-p)}{N}}$$

Where, p = estimated proportion
N = sample size

Example A7.1

In a survey when 510 children were measured using random sampling, you estimated that the prevalence of acute malnutrition was 7.6%. The standard error would be

$$S.E.(p) = \sqrt{\frac{0.076 \times (1-0.076)}{510}}$$

$$= \sqrt{\frac{0.076 \times 0.924}{510}}$$

= 0.0117

= 1.17%

So, the 95% confidence interval, d, is equal to

d = ± 1.96 SE(p)

= ± (1.96×1.17)

= ± 2.29

Our 95% confidence intervals around the estimated prevalence of malnutrition are:

95% C.I. = estimated prevalence ± d
= 7.6 ± 2.29
= 5.3% - 9.9%

Hence, in this example we would say that the prevalence of malnutrition was estimated at 7.6%, with 95% confidence intervals between 5.3 and 9.9%.

Cluster surveys

The formula for the calculation of standard errors in a cluster survey is slightly more complicated:

$$\text{S.E.(p)} = \sqrt{\frac{\sum (\text{pi} - \text{p})^2}{\{\text{c} \times (\text{c} - 1)\}}}$$

Where, p= proportion of malnutrition in whole sample
pi= proportion of malnourished in cluster i
c= total number of clusters

This looks complicated — but is easy to calculate if taken step by step.

Example A7.2

We will use real survey data from Gola Oda (East Haraghe) — 919 children were measured in 30 clusters.

To calculate sum$(p_i\text{-}p)^2$ make a table with six columns with your survey results in it:

Column 1 the number of each cluster
Column 2 the number of children in each cluster
Column 3 the number of children malnourished in each cluster
Column 4 the proportion of malnourished children in each cluster
Column 5 subtract the proportion of malnourished children in the total sample (figure at the bottom of column 4) from the proportion of malnourished children in each cluster
Column 6 square the figure in column 5 (multiply it by itself). Calculate the total of this column.

Table A7.1 The calculation of the standard error for a cluster survey

1	2	3	4	5	6
Cluster	**Number**	**Number malnourished**	**Proportion malnourished**	**Difference**	**Difference squared**
c_i	x_i	y_i	p_i	$(p_i\text{-}p)$	$(p_i\text{-}p)^2$
1	32	5	15.6	-3.8	14.5
2	30	10	33.3	13.9	193.1
3	29	6	20.7	1.3	1.6
4	31	5	16.1	-3.3	11.0
5	31	4	12.9	-6.5	42.7
6	30	4	13.3	-6.1	37.3
7	30	5	16.7	-2.8	7.7
8	30	2	6.7	-12.8	163.1
9	30	9	30.0	10.6	111.5
10	34	8	23.5	4.1	16.7
11	30	2	6.7	-12.8	163.1
12	30	6	20.0	0.6	0.3
13	30	5	16.7	-2.8	7.7
14	34	3	8.8	-10.6	112.7
15	30	3	10.0	-9.4	89.1
16	30	7	23.3	3.9	15.2
17	30	4	13.3	-6.1	37.3
18	30	2	6.7	-12.8	163.1
19	30	7	23.3	3.9	15.2
20	32	4	12.5	-6.9	48.1
21	30	10	33.3	13.9	193.1
22	30	8	26.7	7.2	52.2
23	31	7	22.6	3.1	9.9
24	32	3	9.4	-10.1	101.3
25	33	3	9.1	-10.3	107.1
26	33	3	9.1	-10.3	107.1
27	34	10	29.4	10.0	99.5
28	31	9	29.0	9.6	92.0
29	30	14	46.7	27.2	741.4
30	29	12	41.4	21.9	481.4
30	**926**	**180**	**19.4**		**3235.8**
c	**n**	**Y**	**p**		**sum(p-pi)^2**

In this example the standard error is:

$$S.E.(p) = \sqrt{\frac{\sum (pi - p)^2}{\{c \times (c - 1)\}}}$$

$$= \sqrt{\frac{3235.8}{\{30 \times (30 - 1\}}}$$

$= \sqrt{3.719}$

= 1.93

So, the 95% confidence interval, d, is equal to

d = ± 1.96 SE(p)

= ± (1.96×1.93)

= ± 3.78

Our 95% confidence intervals around the estimated prevalence of malnutrition are:

95% C.I. = estimated prevalence ± d

= 19.4± 3.78

= 15.6 – 23.2%

Hence, in this example from Gola Oda we would say that the prevalence of malnutrition was estimated at 19.4%, with 95% confidence intervals between 15.6-23.2%.

These calculations for the standard error of a cluster survey are very time consuming. It is probably easier to do this in a computer programme like Microsoft Excel, if possible.

A7.2 Population mean WFH measurements

The mean WFH is sometimes used to describe a population's nutritional status. This is calculated as:

$$\text{mean WFH} = \frac{\text{sum of all WFHs}}{\text{number of children measured}}$$

Example A7.3

Using the survey data from Gola Oda, we can calculate the mean percentage WHM of all the children in the sample. The sum of all the WHM data was 81,572 (obtained by adding together the WHM values for each child). So,

$$\text{Mean WFH percentage median} = \frac{81{,}572}{926} = 88.0\%$$

You also need to present confidence intervals for this value. You do this in much the same way as you calculate it for the prevalence (Section A7.1). Design a table like the one below:

Column 1	the number of each cluster
Column 2	the number of children in each cluster
Column 3	sum of WHM for each cluster (add up each child's WHM)
Column 4	mean WHM for each cluster
Column 5	subtract the mean WHM for the total sample (figure at the bottom of column 4) from the mean WHM in each cluster
Column 6	square the figure in column 5 (multiply it by itself). Calculate the total of this column.

Table A7.2: The calculation of the standard error of mean WHM for a cluster survey

1 Cluster	2 Number	3 Sum WHM	4 Mean WHM	5 Difference	6 Difference squared
c_I			m_I	$(m_i\text{-}m)$	$(m_i\text{-}m)^2$
1	32	2845	88.9	0.9	0.7
2	30	2541	84.7	-3.3	11.2
3	29	2582	89.0	1.0	1.0
4	31	2705	87.3	-0.8	0.6
5	31	2704	87.2	-0.8	0.7
6	30	2643	88.1	0.1	0.0
7	30	2773	92.4	4.4	19.3
8	30	2715	90.5	2.5	6.0
9	30	2602	86.7	-1.3	1.7
10	34	3001	88.3	0.2	0.0
11	30	2729	91.0	2.9	8.6
12	30	2616	87.2	-0.8	0.7
13	30	2642	88.1	0.0	0.0
14	34	3079	90.6	2.5	6.3
15	30	2747	91.6	3.5	12.4
16	30	2564	85.5	-2.6	6.6
17	30	2618	87.3	-0.8	0.6
18	30	2662	88.7	0.7	0.5
19	30	2710	90.3	2.3	5.2
20	32	2840	88.8	0.7	0.5
21	30	2562	85.4	-2.6	7.0
22	30	2580	86.0	-2.0	4.2
23	31	2664	85.9	-2.1	4.4
24	32	2811	87.8	-0.2	0.0
25	33	2998	90.8	2.8	7.9
26	33	2945	89.2	1.2	1.4
27	34	2912	85.6	-2.4	5.7
28	31	2744	88.5	0.5	0.2
29	30	2505	83.5	-4.5	20.6
30	29	2488	85.8	-2.2	5.1
30	**926**	**81527**	**88.0**		**139.3**
c	**n**	**total**	**m**		**$\text{Sum}(m\text{-}m_i)^2$**

Doing the calculations for the standard error of the mean is very time consuming. It is probably easier to do this in a computer programme like Microsoft Excel, if possible.

Example 7.4
(using the Gola Oda data from Table A7.2)

$$\text{S.E.(p)} = \sqrt{\frac{\sum (\text{mi - m})^2}{\{c \times (c - 1)\}}}$$

$$= \sqrt{\frac{139.3}{\{30 \times (30 - 1\}}}$$

$= \sqrt{0.160}$

$= 0.400$

So, the 95% confidence interval, d, is equal to

d = ± 1.96 SE(p)

= ± (1.96×0.4)

= ± 0.784

Our 95% confidence intervals around the estimated prevalence of malnutrition are:

95% C.I. = estimated mean WHM ± d

= 88.0 ± 0.784

= 87.2– 88.8%

Hence, in this example from Gola Oda we would say that the mean WHM was estimated at 88.0%, with 95% confidence intervals between 87.2-88.8%. And you would fill in the results like this:

Table A7.3: Example of how to show population mean WHM

	6-59 months n=926
Mean weight-for-height percentage median	88.0% (87.2-88.8%)

The mean WFH z-score is also sometimes used to describe a population's nutritional status. This is calculated as:

$$\text{mean WFH z-scores} = \frac{\text{sum of all WFHs z-scores}}{\text{number of children measured}}$$

You can carry out exactly the same procedure as described above for mean WFH medians to show population data in terms of mean WFH z-scores.

Annex 8

Interpretation of nutrition data

A8.1 Comparison of prevalence of malnutrition in two surveys

The comparison of the prevalence of malnutrition in two surveys can be conducted using the chi-squared test. In terms of statistics this method is more powerful than the one described in Section 8.2.2, which looks at the confidence intervals only.

The chi-squared test is used to compare actual results compared to expected values. In nutrition surveys we can use it to see if the proportion of malnutrition in survey one is the same as the proportion of malnutrition in survey two, by assuming that the two proportions would be the same.

The general equation for the chi-squared test is:

$$\text{chi-squared} = \text{sum} \; \frac{(\text{observed value - expected value})^2}{\text{expected value}}$$

You need to create a 2×2 contingency table with your data. Organise the data like in Table A8.1. The various letters in the table represent numbers of children in each category. So, A will equal the number of malnourished children in survey one.

Table A8.1 Generalised 2×2 contingency table

	Survey one	**Survey two**	**Totals**
Malnourished	A	B	E
Not malnourished	C	D	F
Total	G	H	n

A quick formula for calculating the chi-squared value of the table is then:

$$\text{chi-squared} = \frac{n\times\{[A\times D-B\times C\}-n/2\}^2}{E\times F\times G\times H} \qquad \text{(Kirkwood, 1988)}$$

If your chi-squared value is more than 3.84, then there is a significant difference in the prevalence of acute malnutrition between the two surveys.[52]

Example A8.1
Two surveys were conducted at a one-year interval in the same woreda. In the first survey, 973 children were measured and the prevalence of malnutrition was estimated at 14%. In the second survey 897 children were measured and the prevalence was estimated at 9.8%.

The first step is to fill in the contingency table. To do this you have to work out how many children were malnourished in each survey and how many were not.

[52] This is a statistical fact. At one degree of freedom (which 2×2 contingency tables have), then the percentage point of the chi-squared distribution at p-value equal to 0.05 (5%) is equal to 3.84 (Kirkwood, 1988).

A = malnourished in survey one
= 0.14×973
= 136 children

B = malnourished in survey two
= 0.098×897
= 88 children

C = well nourished children in survey one
= 973-136
= 837 children

D = well nourished children in survey two
= 897-88
= 809 children

Now you are ready to fill in the contingency table. Table A8.2 is the completed contingency table.

Table A8.2 Completed contingency table

	Survey one	Survey two	Totals
Malnourished	136	88	224
Not malnourished	837	809	1646
Total	973	897	1860

Using the formula,

$$\text{chi-squared} = \frac{n \times \{ [A \times D - B \times C\} - n/2\}^2}{E \times F \times G \times H}$$

$$= \frac{1860 \times \{ [136 \times 809] - [88 \times 837] - [1860/2] \}^2}{224 \times 1646 \times 973 \times 897}$$

$$= 7.75$$

If your chi-squared value is more than 3.84 then there is a significant difference in the prevalence of acute malnutrition between the two surveys. So, in this example there is a significant difference in the prevalence of malnutrition between the two surveys.

Try another example so that you are more comfortable with this method

Example A8.2
Two surveys were conducted at a one-year interval in the same woreda. In the first survey, 901 children were measured and the prevalence of malnutrition was estimated at 11%. In the second survey 910 children were measured and the prevalence was estimated at 13%.

The first step is to fill in the contingency table. To do this you have to work out how many children were malnourished in each survey and how many were not.

A = malnourished in survey one
= 0.11×901
= 99 children

B = malnourished in survey two
= 0.13×910
= 118 children

C = well nourished children in survey one
= 901-99
= 802 children

D = well nourished children in survey two
= 910-118
= 792 children

Now you are ready to fill in the contingency table. Table A8.3 is the completed contingency table.

Table A8.3 Contingency table for two surveys

	Survey one	Survey two	Totals
Malnourished	99	118	217
Not malnourished	802	792	1594
Total	901	910	1811

Using the formula,

$$\text{chi-squared} = \frac{n\times\{[A\times D-B\times C\}-n/2\}2}{E\times F\times G\times H}$$

$$= \frac{1811\times\{[99\times 792]-[118\times 802]-[1811/2]\}2}{217\times 1594\times 901\times 910}$$

$$= 1.5$$

This value of chi-squared is less than 3.84 so there is no significant difference in the prevalence of acute malnutrition between the two surveys.

A8.2 Comparison of the population mean weight-for-height in two surveys

To compare the mean WFH between two populations you need to use the t-test. The equation for the t-test is:

$$t = \frac{\text{survey two mean WFH} - \text{survey one mean WFH}}{\text{estimated standard error for the mean WFH for both surveys}}$$

To calculate the estimated standard error for the mean WFH for both surveys you need to use the following equation:

$$S^2 = \frac{(n_1-1)\times(SD_1)^2 + (n_2-1)\times(SD_2)^2}{(n_1-1)+(n_2-1)}$$

where, n_1= number of clusters in survey 1
SD_1= standard deviation of WHM for survey 1
n_2= number of clusters in survey 2
SD_2 = standard deviation of WHM for survey 2

Then, the estimated S.E. is calculated by:

$$\text{estimated S.E.}^2 = \frac{S^2}{n_1} + \frac{S^2}{n_2}$$

(Kirkwood, 1988)

Example A8.3

Legambo		*Gola Oda*	
Mean WHM	= 90.4	Mean WHM	= 88.0
SD of WHM	= 6.8	SD of WHM	= 7.3
Number of clusters	= 30	Number of clusters	= 30

So we need to start by calculating the estimated standard error for the mean WFH for both surveys:

$$S^2 = \frac{(n_1 - 1) \times (SD_1)^2 + (n_2 - 1) \times (SD_2)^2}{(n_1 - 1) + (n_2 - 1)}$$

$$= \frac{(30-1)\times(6.8)^2 + (30-1)\times(7.3)^2}{(30-1)\times(30-1)}$$

$$= \frac{2880}{8410}$$

$$= 1.2$$

Then, to calculate the estimated S.E. use this equation:

$$\text{estimated S.E.}^2 = \frac{S^2}{n_1} + \frac{S^2}{n_2}$$

$$= \frac{1.2}{30} + \frac{1.2}{30}$$

$$= 0.08$$

Therefore, the estimated S.E. $= \sqrt{0.08}$
$= 0.28$

So, to calculate the t-test statistic we use the original equation:

$$t = \frac{\text{survey two mean WFH} - \text{survey one mean WFH}}{\text{estimated standard error for the mean WFH for both surveys}}$$

$$= \frac{90.4 - 88.0}{0.28}$$

$$= 8.57$$

To find out whether or not this is significant, first we need to work out the degrees of freedom for this test. We use the following equation to calculate the degrees of freedom:

Degrees of freedom = (number of clusters in survey one – 1) + (number of clusters in survey two–1)
= $(n_1\text{-}1) + (n_2\text{-}1)$
= 58

We then look up the t-value for 58 degrees of freedom at probability value p=0.05 (5%). This table is given in Section A8.3 (an explanation of how to use the table is also given). The t-value for 58 degrees of freedom is equal to 2.00. The t-value we get in our survey must be bigger than this to show a statistical difference.

Our t-statistic, 8.57, is larger than the critical t-statistic, 2.00, so we can say that there is a significant difference in the mean WFH between the population of Legambo and Gola Oda.

We can try another example so that you are clear about this method.

Example A8.4
We will use two surveys undertaken in Welayita in January 2002. One survey covered the highland PAs and the other survey covered the lowland PAs.

Welayita Highlands		*Welayita Lowlands*	
Mean WHM	= 94.32	Mean WHM	= 94.64
SD of WHM	= 7.36	SD of WHM	= 7.61
Number of clusters	= 30	Number of clusters	= 30

So we need to start by calculating the estimated standard error for the mean WFH for both surveys:

$$S^2 = \frac{(n_1 - 1) \times (SD_1)^2 + (n_2 - 1) \times (SD_2)^2}{(n_1 - 1) + (n_2 - 1)}$$

$$= \frac{(30-1)\times(7.36)^2 + (30-1)\times(7.61)^2}{(30-1)\times(30-1)}$$

$$= \frac{3249}{8410}$$

$$= 0.386$$

Then, to calculate the estimated S.E. use this equation:

$$\text{estimated S.E.}^2 = \frac{S^2}{n_1} + \frac{S^2}{n_2}$$

$$= \frac{0.386}{30} + \frac{0.386}{30}$$

$$= 0.026$$

Therefore, the estimated S.E. $= \sqrt{0.026}$
$= 0.16$

So, to calculate the t-test statistic we use the original equation:

$$t = \frac{\text{survey two mean WFH – survey one1 mean WFH}}{\text{estimated standard error for the mean WFH for both surveys}}$$

$$= \frac{94.64 - 94.32}{0.16}$$

$$= 2.00$$

To find out whether or not this is significant, first we need to work out the degrees of freedom for this test. We use the following equation to calculate the degrees of freedom:

Degrees of freedom =(number of clusters in survey one – 1) + (number of clusters in survey two –1)
= $(n_1-1) + (n_2-1)$
= 58

We then look up the t-value for 58 degrees of freedom at probability value p=0.05 (5%). This table is given in section A8.3 (an explanation of how to use the table is also given). The t-value for 58 degrees of freedom is equal to 2.00.

Our t-statistic, 2.00, is equal to the critical t-value statistic, so there is no significant difference in the mean WFH between the highland and lowland populations of Welayita. In other words, the nutritional status of the two populations is similar.

A8.3 Critical values of t at p < 0.05

The column v is the degrees of freedom, which is the figure to look up.

The column t is the critical t value when p<0.05.

This means if your t value from your results is greater than the critical t value given for your degrees of freedom, then it is statistically 95% probable that this difference has not been found by chance. That means that a real difference exists between the two sets of results.

The degrees of freedom are calculated as follows:-

Survey one's sample size - 1 + Survey two's sample size - 1

v (degrees of freedom)	t (critical value of t-statistic)		v (degrees of freedom)	t (critical value of t-statistic)
1	12.71		21	2.08
2	4.30		22	2.07
3	3.18		23	2.07
4	2.78		24	2.06
5	2.57		25	2.06
6	2.45		26	2.06
7	2.37		27	2.05
8	2.31		28	2.05
9	2.26		29	2.05
10	2.23		30	2.04
11	2.20		40	2.02
12	2.18		50	2.01
13	2.16		60	2.00
14	2.15		70	1.99
15	2.13		80	1.99
16	2.12		90	1.99
17	2.11		100	1.98
18	2.10		-	-
19	2.09		More than 100	1.96
20	2.09			-

Annex 9

Format for the model nutrition assessment report

Summary of the report (one to two pages only)

- area surveyed
- date of survey
- methodology employed
- main anthropometric results (prevalence of global and severe acute malnutrition in terms of z-scores and/or oedema and 95 per cent confidence intervals)
- other important results (mortality rates, food security indicators, etc)
- explanation of the causes of malnutrition in the area
- recommendations.

1. Introduction

1.1 Introduction to survey population

Description of survey area

- survey area
- name of town/woreda/zone/region/country
- name of nearest large town/city — administrative centre.

Population data

- number of people living in survey area
- population density
- ethnic group.

Geography of area

- town/camp/rural, etc
- altitude/mountainous/flat, etc
- total area (hectares).

Way in which people live

- agriculturalists/pastoralists/agro-pastoralists/refugees/merchants, etc
- type of land farmed or animals kept.

Any important political/security information

- if refugees, how long have they been there?
- any instability in the area?

Services available

- health
- education
- markets, roads.

Assistance received by the population

- relief programmes in area
- number of people on food aid, etc
- other initiatives, particularly work of your agency in the area.

Date survey undertaken

Other survey results from the area or nearby areas

1.2 Survey objectives

For example,

- estimate the prevalence of acute malnutrition
- estimate retrospective mortality rates
- understand the causes of malnutrition
- estimate the coverage of a feeding programme
- estimate the measles vaccination rate
- make recommendations for a programme.

2. Methodology

2.1 Survey methodology

General approach

- type of sampling (for example, 30×30 cluster)
- age of children measured
- number of children measured
- date of survey.

2.2 Sampling procedure and sample size

How did you choose the children?

- What sampling methodology did you chose? Why?
- What population figures did you get and from whom (for example, kebele population figures from woreda council)?
- How did you calculate the sampling interval? (for example, the cumulative population was calculated and a sampling interval determined)
- How did you assign the clusters? (for example, 30 clusters were randomly selected by assigning probability proportional to population size)
- Did you alter the method from the standard method at all (for example, because of insecurity, etc)?
- Describe any changes to the selection of the clusters during the survey.

2.3 Selection of households and children

How did you choose the households and children within a cluster?

- Where was the starting place? (Middle of the kebele? Or did you randomly chose a gott within a kebele and start in the middle of the gott?)
- How did you choose the direction to follow? (spin a pen?)
- Did you walk to the end of the gott/kebele and count the houses?
- How did you choose subsequent houses?

How did you choose children within the houses?

- Did you measure all children aged 6-59 months in the houses selected?
- If age was unknown, how did you decide whether or not to measure children?
- What happened when a child was away?
- Did you measure all children in the last house?

2.4 Training and supervision

Training

- Who was trained?
- Who did the training?
- What did the training cover (survey design, anthropometric measurements, signs and symptoms of malnutrition, data collection and interview skills)?
- Did the survey teams measure children and compare their results? (inter-observer error)?

Pilot survey

- Was there a practice/pilot survey?
- Who supervised the teams during the practice survey?
- Were data collection forms piloted during the practice survey and changes made to them if necessary?

Supervision during the survey

- Who supervised the teams (a nutritionist, a nurse or someone else)?
- How many times did the supervisor visit the teams?
- Who were the team leaders, were they experienced?

2.5 Data collected

2.5.1 Children's data

Anthropometric data

- age (proxy heights used for age)
- weight (type of scales used, precision of measurement)
- height (type of height board used, how children were measured (standing-up/lying down/both), precision of measurement)
- oedema (how did you define oedema?).

Retrospective morbidity of children

- Who did you ask about the children's illnesses?
- Over how long were questions about illness asked?
- How did you define illness?

Vaccination status and coverage

- How did you check for vaccinations?
- Did you look at MCH cards?

Programme coverage

- How did you assess this?

- What did you do if you found a malnourished child who was not registered?

2.5.2 Mortality data
Retrospective mortality (under five and total population)

- In which households did you use the mortality questionnaires?
- Over how long did you estimate mortality (number of months)?
- Did you categorise deaths by age?
- Did you record cause of death? How did you define causes?

2.5.3 Household questionnaires

- How were the household questionnaires developed?
- Were the questionnaires adjusted after the practice survey?
- What kind of data did you collect in the household questionnaires (health/food/security/care/relief)?
- Were the data qualitative or quantitative?
- Who did you ask the questions to (how many households, which people in the household)?

2.5.4 Key informant questionnaires and interviews

- How were the key informant questionnaires developed?
- Were the questionnaires adjusted after the practice survey?
- What kind of data did you collect in the key informant questionnaires (health/food/security/care/relief)?
- Were the data qualitative or quantitative?
- Who did you ask the questions to (community leaders, women, etc)?
- Did you visit any woreda officials? Who? For what information? Any other NGOs?

2.6 Data analysis

- How did you analyse the data?
- What type of computer programme did you use or did you do it by hand?

3. Results

3.1 Anthropometric results: children
Definitions of acute malnutrition should be given (eg, global acute malnutrition is defined as <-2 z scores weight-for-height and/or oedema, severe acute malnutrition is defined as <-3z scores weight-for-height and/or oedema)

Table 1: Distribution of age and sex of sample

	Boys		**Girls**		**Total**		**Ratio**
	no.	**%**	**no.**	**%**	**no.**	**%**	**Boy:girl**
6-17 months							
18-29 months							
30-41 months							
42-53 months							
54-59 months							
Total							

Table 2: Prevalence of acute malnutrition based on weight-for-height z-scores and/or oedema

	6-59 months n=	6-29 months n=
Prevalence of global malnutrition (<-2 z-score and/or oedema)	(no.) % (95% C.I.)	(no.) % (95% C.I.)
Prevalence of severe malnutrition (<-3 z-score and/or oedema)	(no.) % (95% C.I.)	(no.) % (95% C.I.)

The prevalence of oedema is %

Table 3: Prevalence of malnutrition by age based on weight-for-height z-scores and oedema

		Severe malnutrition (<-3 z-score)		Moderate malnutrition (>= -3 and <-2 z-score)		Normal (> = -2 z score)		Oedema	
Age (mths)	**Total no.**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**
6-17									
18-29									
30-41									
42-53									
54-59									
Total									

Table 4: Distribution of acute malnutrition and oedema based on weight-for-height z-scores

	<-2 z-score	>=-2 z-score
Oedema present	Marasmic kwashiorkor No. (%)	Kwashiorkor No. (%)
Oedema absent	Marasmic No. (%)	Normal No. (%)

Table 5: Prevalence of acute malnutrition based on the percentage of the median and/or oedema

	6–59 months n=	6-29 months n=
Prevalence of global acute malnutrition (<80% and/or oedema)	(no.) % (95% C.I.)	(no.) % (95% C.I.)
Prevalence of severe acute malnutrition (<70% and/or oedema)	(no.) % (95% C.I.)	(no.) % (95% C.I.)

The prevalence of oedema is %

Table 6: Prevalence of malnutrition by age, based on weight-for-height medians and oedema

		Severe malnutrition (<70% median)		Moderate malnutrition (>=70% and <80% median)		Normal (> =80% median)		Oedema	
Age (mths)	**Total No**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**
6-17									
18-29									
30-41									
42-53									
54-59									
Total									

Table 7: Mean percentage of the median weight-for-height

	6-59 months n=	**6-29 months n=**
Mean percentage of weight-for-height median	% (95% C.I.)	% (95% C.I.)

3.2 Children's morbidity

Table 8: Prevalence of reported illness in children in the two weeks prior to interview (n=)

	6-59 months
Prevalence of reported illness	%

Table 9: Symptom breakdown in the children who reported illness in the two weeks prior to interview (n=)

	6-59 months
Diarrhoea	%
Cough	%
Fever	%
Measles	%
Other	%

3.3 Vaccination Results

Table 10: Vaccination coverage: BCG for 6-59 months and measles for 9-59 months

	BCG n=	**Measles (with card) n=**	**Measles (with card or confirmation from mother) n=**
YES	(No.) % (95% C.I.)	(No.) % (95% C.I.)	(No.) % (95% C.I.)

3.4 Mortality results (retrospective over x months prior to interview)

The crude mortality rate (CMR) for the total population is estimated at:
deaths/10,000/day

The under-five mortality rate (U5MR) for the population is estimated at:
deaths/10,000/day

Report the main causes of death.

The mean household size is calculated as … (mode =, range)

3.5 Programme coverage

The programme coverage = 100 × $\frac{\text{number of registered malnourished children}}{\text{number of malnourished children found}}$

3.6 Causes of malnutrition

Quantitative data

- Give proportions, or use frequency tables and/or bar-charts to show the results of the quantitative data
- For example, in answer to the question "what was the main source of staple food over last month?"
  - 43% sourced their main staple from EGS
  - 20% sourced their main staple from purchasing
  - 18% sourced their main staple from the sale of assets
  - 17% sourced their main staple from their own production.

Or,

Source of staple	Proportion
EGS	43%
Purchasing	20%
Sale of assets	18%
Own production	17%

Qualitative data

- Leave this for the discussion

4. Discussion

4.1 Nutrition status

- discuss sample sex ratio — any bias? If so, explain why you think there is bias
- prevalence of acute malnutrition
- if previous survey results are available, how do these results compare to before, or to other areas nearby?
- how does the prevalence compare to national/international benchmarks of malnutrition (eg, DPPC, MSF or WHO)?

- what is the community's current food source? What are they eating? Is their diet normal for the time of year?

4.2 Food security

Agriculture

- general discussion on agricultural practices in the area (belg-dependent/meher-dependent, etc)
- current situation — try to compare with a normal year. What are the farmers doing now? What would they normally be doing?
- what are the prices of the agricultural products compared to other years? Seasons?
- future prospects — for the next three to six months. What are the constraints (no seeds, rain, etc).

Livestock

- uses of livestock in the area
- current pasture and livestock condition
- current availability of water for livestock
- livestock migration patterns
- terms of trade data compared to other years/seasons/areas
- future prospects — what are the constraints?

Relief

- amount and type of relief food going into the area
- who is receiving the relief?
- is the targeting working (what are the constraints)?
- what are future plans for relief?
- what other relief projects are ongoing (restocking, supplementary feeding, etc) and what effects are they having on the community?

Income generating activities and migration

- what income generating activities are the community undertaking? Are they normal for this time of the year?
- are abnormal asset sales taking place?
- are more people than normal migrating to find work?
- are whole households migrating? Why?

4.3 Health and care

Mortality rates

- CMR and U5MR compared to international benchmarks
- causes of death — any epidemics?

Morbidity

- rates reported by mothers for children
- any epidemics?
- possible effects of morbidity reported on nutrition status.

Vaccination

- rates and 95 per cent confidence intervals for different vaccination rates and vitamin A supplementation rates
- any recent campaigns
- are rates high or low compared to internationally recommended standards?

Mother's caring practices

- information from questionnaires
- general information from discussions and observations
- possible effects of caring practices on nutrition status.

General health care in area

- number of clinics, etc, for the population (compare to Government policy guidelines)
- health education programmes
- access to clean water, etc
- living conditions
- possible effects of health care on nutritional status.

4.4 Programme coverage

Programme coverage

- rate of coverage for any SFP/TFC programmes
- explanation for rates (good/bad/why)
- given the prevalence of malnutrition found, how many children should be enrolled?

5. Conclusions

A diagram to show causal framework of malnutrition may be useful.

- nutrition status
- food security
- health and care
- other issues.

6. Recommendations and priorities

Remember to prioritise recommendations and try to give a time when action would be appropriate (eg, immediate, medium term or longer term).

Food security

- does the amount of relief food need to be increased? How should it be provided — EGS, free general ration, supplementary feeding programme, blanket feeding programme? For how long should relief be given? What should the ration be? Who should implement the programme? How should the ration be targeted?
- does the community need other inputs to promote food security (seeds, tools, restocking, fertilisers, water, veterinary care programmes)? Who should get these inputs? Who will carry out the programme?
- Are programmes needed to improve income generating opportunities?

Health and care

- has there been an epidemic — has it been treated or is action still needed? Who should act? When?
- vaccination — do the rates need to be improved? With a campaign or by increasing regular EPI?
- should access to clean water be improved as a priority?
- is a health education campaign needed? Who will carry out the training? Who will the beneficiaries be?

Other recommendations

Future nutrition monitoring

- is it necessary to carry out another nutrition survey in this area in the near future? Who should do it? Should there be any changes to the survey methodology? When should the survey take place?
- should there be food security indicator monitoring in this area? Who should do it?

7. References

List all documents to which you have referred in the text.

8. Annex

- maps of area
- questionnaires
- list of clusters (gott and kebele names).

Annex 10

Nutrition interventions

A10.1 Description of the main types of nutrition programmes

A10.1.1 General food distribution

A general food distribution (GFD)is intended to ensure that food is available and accessible for the entire population. The objective of GFD is to distribute sufficient food, which will maintain the nutritional health of the population, prevent deterioration of household food security and allow the restoration of productive assets and livelihoods. In food crisis and famine situations, adequate general food distribution is the key intervention to maintain health and ensure survival of a population.

In these guidelines, GFD includes employment generation schemes (EGS), gratuitous relief and general free food distributions to beneficiaries.

The Government of Ethiopia has adopted EGS as the principal tool for linking relief and development. It is clearly stated in the National Policy on Disaster Prevention and Management (NPDPM) that, wherever possible, all able-bodied persons should receive relief food assistance only through participation in EGS. In particular, the policy aims to increase the impact of food aid through participation of targeted beneficiaries in projects that build community assets, in order to promote development and mitigate future disasters. Gratuitous relief is the distribution of relief food without a work requirement, for those who are not able to participate in EGS. Gratuitous relied is needed to save lives, protect livelihoods and prevent malnutrition (DPPC, 2000).

Government policy generally discourages the practice of general free food distributions to able-bodied persons, because of the danger that such a practice may result in dependency and economic disincentives. However, there are situations when general free food distributions become absolutely necessary, for example, when the majority of beneficiaries are too weak to participate in EGS, or in areas affected by sudden onset disasters (DPPC, 2000).

A10.1.2 Blanket feeding programmes

Blanket feeding programmes are intended as a temporary measure (maximum three months) to compensate for an inadequate (in terms of quantity or quality) GFD. An integral part of a blanket feeding programme is a strong lobby for an adequate GFD, as a blanket feeding programme is meant as a damage control measure.

The chief goal of blanket feeding is to provide food rations to vulnerable groups and thus prevent deterioration in their nutrition status. The target groups might be: vulnerable families, excluded families, pregnant and lactating women, under-fives, older people, people suffering from specific diseases like HIV/AIDS and TB.

All members of the specific vulnerable group are included in the feeding programme, regardless of their nutrition status. There is no individual follow-up of the beneficiaries' health status, but sometimes nutrition and health screening is performed.

A10.1.3 Supplementary feeding programmes

Supplementary feeding programmes (SFP) are implemented for treatment of moderately malnourished individuals. The primary objective is to prevent severe malnutrition and reduce the risk of mortality and morbidity. Treatment involves an appropriate fortified food supplement, basic health care and individual follow-up.

Supplementary food should only be provided as a supplement to the general ration. It should not be used as a substitute for the general ration obtained from the GFD (RRC, 1989).

A10.1.4 Therapeutic feeding programmes

Therapeutic feeding programmes (TFP) are implemented for treatment of severely malnourished individuals. The main objective is to reduce mortality by providing intensive medical and nutritional therapy. Therapeutic feeding is typically administered in a 24-hour care setting and focuses on individual patient monitoring and follow-up.

Therapeutic feeding is a curative measure and should therefore, in theory, be only a short-term programme. The need for its continuation will depend on the effectiveness of the general and supplementary feeding programmes, as well as other factors, for example water and sanitation, which will influence the health and nutrition status of the population (RRC, 1989).

A10.2 Examples of nutrition interventions

Three different nutrition scenarios are given below. In each case, the most important results of a nutrition survey including both anthropometric and non-anthropometric information are given. The alert stage is classified. Suitable recommendations for nutrition-related interventions are then suggested.

A10.2.1 Settled population in Welayita Zone, January 2002

An NGO undertook a 30×30 cluster nutrition survey in Welayita Zone in January 2002. The population is almost entirely dependent on rain-fed agriculture. Three rains are necessary for the production of a good harvest — the belg, meher and sape[53] rains. This survey was undertaken soon after the sape rain season. The anthropometric results of the survey can be seen in Table A10.1.

Table A10.1 Prevalence of acute malnutrition in Welayita zone

	6–59 months n=901
Prevalence of global malnutrition (<-2 z-scores and/or oedema)	(40) 4.4% 95% CI (2.5-6.4%)
Prevalence of severe malnutrition (<-3 z-scores and/or oedema)	(4) 0.4% 95% CI (0.0 – 0.9%)

The prevalence of oedema is 0.1%

[53] The sape rains, which are particular to Welayita Zone, are normally due between October and December

Other information

- Generally, the food security situation in Welayita zone was normal during the survey period.
- According to the results of the household questionnaires 90 per cent of the population were consuming their own production in the month prior to the survey. This indicates that the current meher harvest was satisfactory.
- Sape rain development was satisfactory in 63 per cent of the surveyed villages.
- The number people who use fertiliser in Wolyaita Zone is gradually decreasing.
- No unusual coping strategies or migration was reported.
- No relief food had been distributed in the survey area during the past three months. However, as per the 2001 DPPC-led multi-agency crop assessment findings, there are areas in the zone that are structurally food deficit. The population in these areas will, therefore, face food insecurity later in the year. According to the Government's plan, some 105,0000 people are going to be assisted for a period of five months, starting from March 2002.
- The CMR was estimated at 0.37/10,000/day (lowland) and 0.66/10,000/day (highland).
- The BCG vaccination rate was estimated at thirty-six per cent. Measles vaccination coverage, as confirmed by card, is very low at three per cent.
- Health care facilities are limited in the surveyed PAs. There are very few functioning health posts. The ratio of health posts to population is far from the current national Government policy. On average, the population has to walk more than one-and-a-half half hours to reach a clinic.
- In general, land holding constraints are very severe in this area.

The nutritional situation of this population is probably typical for rural Ethiopia. The prevalence of global acute malnutrition is relatively low at 4.4 per cent (95 per cent confidence intervals 2.5-6.4 per cent). The food security situation is currently normal for most of the population. No unusual coping strategies are reported. In this situation there is no need to initiate new nutrition interventions.

Recommendations

- The Government's plan to give food to people living in chronically food deficit areas during the lean period should be followed through.
- The nutritional situation of the population living in areas where the sape rains were insufficient, should be closely monitored to ensure that there is no deterioration in their nutritional situation before the next harvest.
- Agricultural fertiliser should be provided on time, and at a reasonable price for the farmers. This should stop the decline in the use of fertiliser and a consequent decrease in future productivity.
- The health care in the zone is clearly below the Government's target standard. In particular, EPI coverage seems very low and should be improved. Advocate for a measles campaign throughout the Zone. Advocate to increase the number of functional health posts in the zone and hence improve MCH services.
- To improve the longer-term food security situation of the zone a development programme must be implemented. Given the very small landholdings and structural food deficits in many areas, it will be important to generate additional income sources for the population.

A10.2.2 Settled population in South Wollo, October 2000

An NGO undertook a 30×30 cluster nutrition survey in a woreda in South Wollo in October 2000. The population is dependent on rain-fed agriculture. Some communities depend entirely on the belg, others on the meher and others farm both the meher and belg seasons. The anthropometric results are shown in Table A10.2 below.

Table A10.2 Prevalence of acute malnutrition in a woreda in South Wollo

	6–59 months n=919
Prevalence of global malnutrition **(<-2 z-score and/or oedema)**	(127) **13.8%** (11.6-16.1%)
Prevalence of severe malnutrition **(<-3 z-score and/or oedema)**	(19) **2.1%** (1.0-4.0%)

The prevalence of oedema is 1.2%

Other information

- In July 2000 the DPPC estimated that, due to three years of consecutive drought, fifty-three per cent of the population require food aid.
- The overall food security status, especially of belg-dependant households, is extremely poor. The belg-dependent people have not had access to a harvest for 18 months and will not have another harvest until June 2001. Food and seed stocks, which would normally exist at this time of year, have been depleted.
- A high proportion of belg-dependant households are almost entirely dependant on food provided by EGS schemes. The EGS ration does not cover all vulnerable members in each household, and for each beneficiary meets only 66 per cent of the minimum energy requirement. Moreover, the ration only consists of wheat.
- The next belg harvest is dependent on sufficient seeds from an external source being available for the next planting season (January 2001).
- The coming meher harvest is expected to be much reduced in quantity and quality compared to a normal year. Fourteen per cent less meher land was planted than in 1999, and subsequent water logging has resulted in an increased plant disease burden.
- Key informants report that an elevated number of people have migrated (both permanently and temporarily) from the belg areas.
- In many areas up to 50 per cent of livestock — which serve as primary sources of income to purchase food — have died or been sold.
- Access to markets, health care and education is severely limited in the woreda due to its poor infrastructure and difficult topography. This negatively impacts on a community's ability to cope with prolonged drought.

The nutritional situation of this population is serious. The prevalence of acute global malnutrition is estimated at 13.8 per cent (95 per cent confidence interval 11.6-16.1 per cent). In particular, the population living in the belg-dependent areas has a very poor food security situation.

In this situation, with a relatively high level of malnutrition, no harvest expected for nine months and an insufficient ration, it is necessary to implement a supplementary feeding programme for malnourished children.

Recommendations

- Continue EGS programmes throughout the woreda and advocate for an increase in the number of beneficiaries in the belg-dependent areas.
- Ensure that a full ration is given to the EGS beneficiaries in the belg-dependent areas. This should include oil, sugar, pulses, extra grain or a blended food.
- Set up a supplementary food distribution programme. This programme should be targeted to malnourished children aged 6-59 months (children <80 per cent WFH and/or who have oedema). Belg-dependent areas should be prioritised for this intervention.
- Provide support to the MoH to assist them in the treatment of severely malnourished children in Dessie hospital.[54]
- In conjunction with the MoA, seeds should be provided to the most impoverished belg-dependent farmers, so that they can plant for the next harvest.

A10.2.3 IDP camps in Hartishek, March 2002

IDPs arrived in Hartishek in 2000. An initial nutrition survey of Hartishek IDP camp in May 2001 prompted the NGO to set up a TFC (June 2001) and SFP (September 2001). Since this time the NGO has been running a targeted supplementary feeding programme and TFC.

The camp population was estimated at 4,000 in June 2001. All the nutrition surveys used exhaustive sampling methods. The anthropometric results of several surveys are shown in Table A10.3 below.

Table A10.3 Results of acute malnutrition from different surveys (children aged 6-59 month) in the Hartishek

Date	Global acute malnutrition (<-2 z-scores and/or oedema)	Severe acute malnutrition (<-3 z-scores and/or oedema)
May 2001 (n=401)	29.1%	6.6%
November 2001 (n=419)	22.0%	0.7%
March 2002* (n=402)	26.6%	2.2%

The prevalence of oedema was 0.2%

Other information

- The last GFD was in October 2001. Food distributions were not done according to the recommended 12.5kg per household. Some households received 50kg and others none. The local administration has received food for IDPs in 2002. However, the administration wants the IDP population to share the food with the local population. Until the dispute is settled, the food remains undistributed. The IDPs have asked the DPPB to handle the problem.
- Major coping strategies include begging and child labour.
- Water and sanitation are very poor. There is no free water delivery and no toilet facilities in the camp.
- Major health problems are respiratory, malnutrition and diarrhoea. Free medication for IDPs is available from the clinic. No vaccination has been carried out in the last three months because of a lack of kerosene in the clinic. Free medical treatment is

[54] Given the very difficult terrain of this woreda, and the fact that the population is so spread out, it was decided that it was not practical to implement a therapeutic feeding programme in the area. Thus support was given to the MoH to treat the severely malnourished children instead.

available in the NGO's feeding centres to beneficiaries and caretakers/other children of caretakers.

- CMR is 0.15/10,000/day. No under-five deaths were reported in the last month.
- There are a relatively high proportion of older people and pregnant and lactating women

It is clear from the information above that this situation is critical. The prevalence of global acute malnutrition is very high at 26.6 per cent. In addition, the nutrition status of the population has not improved for many months. The general food distribution has been delayed for several months. Moreover, the people do not appear to have any sustainable coping mechanisms and thus no way to obtain food. Other important aggravating factors include the fact that the water and sanitation facilities are very poor and there has been no measles vaccination in the past three months.

In these circumstances, there is clearly a need to continue with both the SFP and the TFC in the IDP camp, until the nutrition situation improves. However, the nutrition situation of the population will not improve until a general ration is given to the population.

Recommendations

- Find a way to provide regular general rations to these people immediately.
- In the absence of a general distribution, initiate blanket food distribution to all children under five, for three months or until the general ration is provided regularly again.
- Consider also providing a blanket distribution for the pregnant/lactating women.
- Maintain the therapeutic feeding centre until the situation improves.
- Provide safe water, and improve sanitation.
- Ensure that all children under five are vaccinated and provided with a vitamin A supplement.
- Provide antenatal services to pregnant IDPs.
- Support the return of the IDPs.

Annex 11

Definition of terms used in this manual

Acute malnutrition: Reflects recent weight loss and is defined as weight-for-height <-2 z-scores or <80% weight-for-height median by NCHS standards and/or oedema, usually in children aged 6-59 months. This is also sometimes known as global acute malnutrition.

Agro-ecological zones: Ethiopia is composed of three major types of zones defined primarily by altitude. These are (i) Dega — altitude of more than 2,500 meters above sea level (also referred to as the highlands), (ii) Woina dega — altitude of 1,500 - 2,500 meters above sea level (also referred to as the midlands), and (iii) Kolla — altitude less than 1,500 meters above sea level (also referred to as the lowlands).

Anthropometry: Body measurements such as weight, height, and arm circumference, which are used as a direct measure of an individual's nutrition and growth — their nutrition status. Collectively, the nutrition status of a population of children may be used for making comparisons over time or with other populations.

Baseline data: A benchmark for analysis that depicts the nutrition status (and other resources, capacities and constraints) of a population in normal times, or before an intervention starts.

Bias: A consistent, repeated difference of the sample from the population, in the same direction; sample values that do not centre on the population values, but are always off in one direction.

Census: Includes all the people in a population (in contrast to a survey), also known as an exhaustive assessment.

Chi-squared test: The chi-squared test of association looks at the statistical significance of an association between a categorical outcome (such as wasted or not wasted) and a categorical determining variable (such as diarrhoea in the last two weeks, no diarrhoea).

Chronic food insecurity: A long-term inability of households to ensure sustained access to sufficient quantity and quality of food to live active and healthy lives.

Chronic malnutrition: Reflects a height deficit and is defined as <-2 z-scores or <80% height-for-age by NCHS standards, usually in children aged 6-59 months

Circumference measuring tape: A tool used to assess mid-upper-arm-circumference; a plastic, non-stretchable tape that is pulled taut around the mid-point of the upper arm to measure circumference of the arm.

Classification system: A system that establishes cut-off points using percentiles, percentages of the median, or z-scores and identifies different levels of nutritional risk.

Clean data: Data that has been checked and corrected for obvious mistakes or missing pieces of information.

Cluster sampling: The sampling technique that organises a population into smaller geographical areas for which the population size is estimated. Clusters are randomly selected from these geographical units according to the proportional population size. Individuals are then selected within each cluster.

Confidence interval: An interval that has a specified probability of covering the true population value of a variable or condition.

Criteria: A measure, standard, norm or condition, used in targeting to make judgments, for example, that one individual or household is needier than another.

Cross-sectional nutrition survey: A "one-off" assessment of the nutritional situation of a population, a "snapshot in time", which may be referred to as a cross-sectional survey.

Cut-off point: The point on a nutrition index, such as weight-for-height, used to categorise or screen individuals. For example, children below the cut-off point of 70 per cent weight-for-height median are categorised as severely malnourished.

Degree of confidence: Specification of the degree to which one can be confident that the estimate is reliably close to the actual value.

Disaster: An event in which a society or community undergoes acute deprivation of food and other basic necessities, due to natural and human-made calamities, to such an extent that the normal functioning of the society or community is disrupted and cannot subsist without outside intervention.

Distribution: A display that shows the number of observations (or measurements) and how often they occur.

Early warning: A process of monitoring indicators affecting livelihoods, with the view to warning of the threat of disaster ahead of time. This warning should normally trigger timely and appropriate preventive and/or mitigation measures.

Emergency: An extraordinary situation in which people are unable to meet their basic survival needs, or there are serious and immediate threats to human life and well being (see also disaster).

Employment generation schemes (EGS): Labour intensive works that are designed to provide temporary employment for able-bodied people affected by a disaster, or threatened by severe food shortage, and who have no other means of livelihood. EGS is primarily funded by a specific set of relief resources (food or cash) for wage payments.

Epi Info software: A series of microcomputer programmes produced by the CDC and WHO, for handling epidemiological data in questionnaire format, and for organising study designs and results into text and tables that may form part of written reports.

Exhaustive assessment: An assessment when the whole population is measured, or a census.

Famine: Famine is defined as extreme, geographically concentrated food-consumption shortfalls that result in loss of body weight and a rise in mortality. The key symptoms of famine include sharp shortfalls in food consumption (even when starting from low levels in absolute terms), increased reliance on foraged foods that are unusual to the diet, irretrievable disposal of productive assets, community dislocation (increased distress migration and out-migration of entire families), and a jump in excess mortality above "normal" rates due to undernutrition.

Food security (insecurity): The ability (inability) of all people to assure themselves sustained access to sufficient quantity and quality of food to live active and healthy lives (see also transitory and chronic food insecurity).

General free food distribution: Free food distribution without work requirement to all the intended target beneficiaries, regardless of age, gender or physical conditions.

General ration: A basket of food commodities in a quantity sufficient to meet requirements (see also supplementary ration).

Growth chart: A graph that is usually used to record a child's weight-for-age in months; a chart typically used by mothers and health workers to determine if a child is experiencing a normal gain in weight.

Growth monitoring and promotion: The practice of following changes in a child's physical development, by regular measurement of weight, and sometimes of length, with accompanying information to guide the care givers' nutritional and related care.

Height-for-age: An index of past or chronic nutrition status; used to assess the prevalence of stunting.

Household: One person who lives alone or a group of persons, related or unrelated, who share food or make common provisions for food and possibly other essentials for living; the smallest and most common unit of production, consumption and organisation in societies.

Hungry season or **hunger gap**: The period every year before harvests for agricultural populations, and before the rains for pastoral populations, when a population is not able to access enough food.

Internally displaced person (IDP): Persons or groups of persons who are forced or obliged to flee or leave their homes or places of habitual residence to avoid the effects of armed conflict, generalised violence, human rights violations, and/or natural or human made disasters and who have not crossed an internationally recognised state border.

Kwashiorkor: An extreme form of malnutrition that classically presents with bilateral pitting oedema beginning in the lower legs and feet, which may become more generalised (trunk, "moon" face, hands, arms). This is coupled with micronutrient deficiencies (vitamin A deficiency, iron deficiency, etc) and an apathetic disposition. Hair changes may occur (the hair becomes blonde, sparse or thin), as may widespread de-pigmentation and areas of cutaneous hyper-pigmentation on the torso and limbs. This may be accompanied by peeling of the skin's surface (desquamation). Kwashiorkor carries an extremely high risk of serious systemic or localised infections.

Local events calendar: A calendar that reflects important local events and seasons that might help a parent pinpoint the birth date of their child.

Marasmus: An extreme form of malnutrition that exhibits itself as a progressive loss of subcutaneous fat and muscle. The child becomes very thin. The condition can rapidly deteriorate with the onset of other illness such as diarrhoea, respiratory infections, measles, etc.

Mean: The average value for a set of data, calculated by summing all the values, divided by the number of values.

Measurement error: The error that can result in a survey from incorrect (anthropometric) measurements being taken.

Median: A measure of central tendency, defined as the point above and below which 50 per cent of the observations fall.

Methodology: A system of explicit rules and procedures on which research is based.

Mid-upper arm circumference (MUAC): A measurement done on the mid-upper arm; a measurement used to assess total body muscle mass and, in some circumstances, acute malnutrition.

Moderate acute malnutrition: A child who has weight for height <-2 z-scores and >=-3 z-scores, or weight-for-height median <80 per cent and >=70 per cent, and/or oedema is moderately acutely malnourished.

Morbidity: A condition resulting from or pertaining to disease; illness.

Mortality rate: Death rate; frequency of number of deaths in proportion to a population in a given period of time.

NCHS reference: Growth percentiles developed by the National Center for Health Statistics in the USA, that provide standards for weight-for-age, height-for-age and weight-for-height.

Normal curve: A theoretical distribution of great significance in the statistics. Some of its major properties are (i) it is symmetrical and bell-shaped, (ii) the mode, median and mean coincide at the centre of the distribution, (iii) a fixed proportion of the observations lie between the mean and the fixed units of standard deviation

Nutrition index: When an individual's body measurements, such as weight are related to age or height, and are compared to the measurements of a group of healthy people of the same height or age.

Nutrition indicator: A measure used at the population level to describe the proportion of a group below a cut-off point; example: 30 per cent of the woreda's children are below -2 z-scores for height-for-age.

Oedema: The presence of excessive amounts of fluid in the intercellular tissue. It is the key clinical sign of kwashiorkor, a severe form of protein energy malnutrition, carrying a very high mortality risk in young children.

Percentage of the median: A fraction or ratio based on a total of 100, where the median value of the data set equals 100; a value that equals a proportion or part of a distribution where the median represents 100 per cent.

Percentiles: A number that corresponds to one of a hundred equal divisions in a range of values; a measure of relative location; a value such that at least p% of the items in the data set are less then or equal to its value and at least (100 - p)% of the items are greater than or equal to it; example: the 60th percentile means that 60% of values in the data set are less than or equal to it and (100 - 60) 40% are greater than or equal to it.

Population: The entire group of people that is the focus of the study (everyone in the country, or those in a particular location, or a special ethnic, economic or age group).

Prevalence: the proportion of the population that has a condition of interest (eg, wasting) at a specific point in time; a value that is always between zero and one.

Protein energy malnutrition (PEM): A range of clinical disorders that occur as a direct result of an inadequate diet and/or infectious diseases. The two extreme syndromes are marasmus and kwashiorkor. It should be noted that PEM is no longer a correct term to use as nutrients, other than protein and energy, have a large part to play in determining the nutrition status of an individual.

Quantitative: Quantitative methods are intended to measure the degree to which some feature of interest is present, such as the prevalence of malnutrition.

Qualitative: Qualitative methods are usually exploratory and provide background descriptive information that may be used to describe relationships between points of interest, such as malnutrition and various causal factors.

Random sampling: The sampling technique that has a sample base available which lists every individual in the population and allows you to locate them. Individuals are randomly chosen from the list using a random number table.

Reference population: The group of healthy children whose measurements are used for comparison with those of individual children (see NCHS reference).

Representative sample: A subset of the population that is typical of the whole population.

Sample: A part or subset of the population used to supply information about the whole population.

Sample size: The number of individuals or households to be included in the survey to "represent" the population of interest.

Sampling: The technique of selecting a representative part of the population for the purpose of determining characteristics of the whole population.

Sampling error: The difference between the results obtained from the survey sample and those that would have been obtained had the entire population been surveyed.

Sampling frame: The study population for which we need to know the estimate of malnutrition.

Screening: The practice of distinguishing between individuals who should be enrolled in a programme/intervention and those who should not be enrolled; a tool for identifying individuals at risk; to examine carefully to determine suitability.

Secular trends: Increases in height between generations due to improved nutrition.

Severe acute malnutrition: A child who has weight-for-height <-3 z-scores or <70 per cent weight-for-height median and/or oedema is acutely malnourished.

Severe chronic malnutrition: Is defined as <-3z-scores or <85 per cent height-for-age by NCHS standards, usually in children aged 6-59 months

Spring scale: A scale that measures weight by the amount a spring is pulled by the object being weighed; a hanging scale.

Standard deviation: A commonly used measure of variability, whose size indicates the dispersion of a distribution, the square root of the variance.

Stunting: Reflects height deficit that develops over a long period of time and is defined as <-3z-scores or <85 per cent height-for-age by NCHS standards, usually in children aged 6-59 months

Supplementary ration: Foods that supplement the general ration to meet the needs of particular groups, such as malnourished individuals, young children, and/or pregnant or nursing mothers.

Survey: A method of gathering information about a large number of people by talking to, or measuring only a sample of them; a way to collect information on people's needs, behaviour, attitudes, environment and opinions, as well as on such personal characteristics as age, nutrition status, income and occupation.

Systematic sampling: A modification of a simple random sample that consists of picking individuals or households at regular intervals from a random list. Alternatively, a team can systematically select households when they are walking across the whole survey area (for example, in a refugee camp).

Transitory food insecurity: The short-term inability of households to ensure sustained access to sufficient quantity and quality of food to live active and healthy lives. Transitory food insecurity is further split up into temporary and cyclical food insecurity.

T-test: A statistical test to determine if there is a significant difference in means of a continuous variable between two groups.

Underweight: A condition measured by weight-for-age; a condition that can also act as a composite measure of stunting and wasting.

Variance: A statistical measure of dispersion away from the mean; the square of the standard deviation.

Vulnerability: The degree to which an individual, households, community or geographic area is likely to be affected by a disaster. Vulnerability is also a risk of exposure to different types of shocks or disaster events, combined with the ability of the population to cope with these disasters or shocks.

Vulnerable groups: Categories of people suffering from high degrees of risk and likely to be the most adversely affected by disasters. These may include, but are not limited to, women, children, elderly and disabled people, refugees, IDPs, food insecure families and the poor.

Wasting: Is defined as weight for height <-2 z-scores or <80 per cent weight-for-height median by NCHS standards, usually in children aged 6-59 months. A condition that results from the loss of both body tissue and fat.

Weighing trousers: A pair of (plastic) pants that a child can step into, and be suspended by, for weighing from a hanging scale.

Weight-for-age: An index of underweight; it is not possible to determine whether a child who has a low weight-for-age is either stunted or wasted unless height-for-age and weight-for-height are measured.

Weight-for-height: An index of current nutrition status also referred to as wasting.

Z-score: A statistical measure of the distance, in units of standard deviations, of a value from the mean. The z-score is calculated by subtracting the mean from the data value x and then dividing the results by the standard deviation.

Bibliography

ACF (1999) “Nutritional status and food security evaluation in Korahi Zone, Somali Regional State”, Addis Ababa.

Action Against Hunger (2000) “Module 2: evaluating the nutritional situation” A correspondence course, London.

Briend, A., Garenne, M., Marie, B., Fontaine, O. and Dieng K. (1989) “Nutritional status, age and survival: the muscle mass hypothesis” *European Journal of Clinical Nutrition*, vol. 43, pp. 715-26.

Buchanan-Smith, M. and Davies, S. (1995) *Famine Early Warning and Response – the Missing Link,* ITDG Publishing, London.

Central Statistical Authority and ORC Macro (2001) *Ethiopia Demographic Health Survey 2000,* CSA, Addis Ababa and ORC Macro, Maryland, USA.

Chapman, C. and Desta, H.K. (1998) “The Dynamics of the Current Early Warning System (with specific reference to Amhara Region)” SCF (UK): Addis Ababa.

Collins, S., Duffield, A. and Myatt, M. (2000) *The assessment of adult nutritional status in emergency-affected populations.* ACC/SCN, Geneva.

DPPC (1993) *National Policy on Disaster Prevention and Management*, Addis Abab

DPPC (1995) *Guidelines on nutritional status data and food relief.* Addis Ababa.

DPPC (2000a) *Training manual for the Early Warning System. Module 1: crop and livestock monitoring.* Addis Ababa.

DPPC (2000b) *Training manual for the Early Warning System. Module 2: price and market monitoring*. Addis Ababa.

DPPC (2000c) *Training manual for the Early Warning System. Module 3: rainfall and vegetation monitoring*. Addis Ababa.

DPPC (2000d) *Training manual for the Early Warning System. Module 4: field assessment missions*. Addis Ababa.

DPPC (2000e) *Training manual for the Early Warning System. Module 5: local food security monitoring.* Addis Ababa.

DPPC (2000f) *Training manual for the Early Warning System. Module 6: national food security monitoring*. Addis Ababa.

DPPC (2000g) *Training manual for the Early Warning System. Common module: foundation in early warning.* Addis Ababa.

DPPC (2000h) *National Food Aid Targeting Guidelines*. Addis Ababa.

Kelly, M. (1992); “Anthropometry as an indicator of access to food in population prone to famine” *Food Policy* pp. 443-454.

Kirkwood, B.R. (1988) *Essentials of Medical Statistics,* Blackwell Science Ltd, Oxford.

Lawrence, M. et al. (1994) “Nutritional status and early warning of mortality in southern Ethiopia 1988-1991” *European Journal of Clinical Nutrition*, vol. 48, pp. 38-45.

MoH (1993) *Health and health related indicators*, Department of Planning and Programming in the MoH, Addis Ababa.

Moren, A. (1995) “Health and nutrition information system among refugees and displaced persons” *Report of a workshop on the improvement of nutrition of refugees and displaced people in Africa*. University of Nairobi; ACC/SCN

MSF (1995) *Nutrition guidelines,* MSF, Paris.

MSF (2001) "Food insecurity and nutrition Dehanna Woreda Wag-Hamera Zone", Addis Ababa.

MSF (in press) New nutrition guidelines (forthcoming), MSF, Paris.

Rivers, J.P.W., Holt, J.F.J, Seaman, J.A., Bowden, M.R. (1976) "Lessons for epidemiology from the Ethiopian Famines". *Annales de la Societe Belge de Medecine Tropicale*, vol. 56(4/5), pp.345-356.

RRC (1989) *Nutritional guidelines for food relief rations,* Addis Ababa.

SC UK (1999) "NSP results: Wolayita post harvest report – December/January 1999", Addis Ababa.

SC UK (2000a) "NSP results: Wolayita report – March/April 2000", Addis Ababa.

SC UK (2000b) *The Household Food Economy Approach*, SC UK, London.

SC UK (2002) *Data processing and analysis of nutrition survey using Epi Info 6.04b*. Training manual for SC UK Ethiopia, SC UK.

SCF (2000) "The South Wollo Highland Belg Food Economy Zone Baseline Report", Addis Ababa.

SCF (2001) "Nutritional survey in Legambo woreda, February 2001", Addis Ababa.

Sen, A. (1997) *Poverty and famines: an essay on entitlement and deprivation*, Oxford University Press, Oxford.

Shoham, J. Watson, F. and Dolan, C. (2001) *The use of nutritional indicators in surveillance systems*. DFID technical support paper, ODI

The Sphere Project (2000) *Humanitarian Charter and Minimum Standards in Disaster Response*, Oxfam Publishing, Oxford.

USAID (2000) *Field Operations Guide for disaster assessment and response*. US Agency for International Development: Bureau for Humanitarian Response Office of Foreign Disaster Assistance, Washington D.C.

Webb, P., Von Braun, J. and Yohannes, Y. (1992) *Famine in Ethiopia: policy implications of coping failure at national and household levels,* Research report 92, International Food Policy Research Institute, Washington D.C.

WHO (1983) *Measuring change in nutritional status. Guidelines for assessing the nutritional impact of supplementary feeding programmes for vulnerable groups*, WHO, Geneva.

WHO (1985) *Energy and Protein Requirements. Report of a Joint FAO/WHO/UNU Meeting,* Technical Report Series 724, WHO Geneva

WHO (2000) *The management of nutrition in major emergencies*, WHO, Geneva.

Woodruff, B. and Duffield, A. (2000) *The assessment of adolescent nutritional status in emergency-affected populations,* ACC/SCN, Geneva.

Young, H. and Jaspars, S. (1995) *Nutrition Matters: People, Food and Famine*. ITDG Publishing, London.

Young, Helen (1992) *Food scarcity and famine: assessment and response*. Oxfam Practical Health Guide no.7, Oxfam, Oxford.

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