

A Manual: Measuring and Interpreting Malnutrition and Mortality





Acronyms

ASMR	Age-specific mortality rate
ASMR-U5	Age-specific mortality rate for children under 5
BMI	Body Mass Index
CDC	Centers for Disease Control and Prevention
CMR	Crude Mortality Rate/Crude Death Rate
DHS	Demographic and Health Surveys
ENA	Emergency Needs Assessment
EPI	WHO Expanded Programme on Immunization
HIV/AIDS	Human immunodeficiency virus/acquired immune deficiency syndrome
HPLC	High-performance liquid chromatography
ICCIDD	International Council for Control of Iodine Deficiency Disorders
IDD	Iodine deficiency disorders
IMR	Infant mortality rate
INACG	International Nutritional Anaemia Consultative Group
LBW	Low birth weight
MICS	Multi-indicator cluster surveys
MMR	Maternal mortality rate
MUAC	Mid-upper arm circumference
NCHS	National Center for Health Statistics
NGO	Non-governmental organization
PPS	Probability proportional to size
PSU	Primary sampling unit
RBM	Results-based management
SCN	United Nations Standing Committee on Nutrition
SRS	Systematic (or simple) random sampling
U5MR	Under-5 mortality rate
UI	Urinary iodine
UNICEF	United Nations Children's Fund
VAD	Vitamin A deficiency
VAM	Vulnerability Analysis and Mapping
WFP	World Food Programme
WHO	World Health Organization



Table of Contents

<i>Acknowledgements</i>		3
<i>Purpose of the Manual</i>		5
<i>Foreword</i>		7
<i>Introduction</i>		9
Chapter 1	Defining and measuring malnutrition	15
Chapter 2	Defining and measuring mortality	33
Chapter 3	Designing a survey	53
Chapter 4	Using and interpreting survey results for decision making	107
Chapter 5	Ethical issues	127
Chapter 6	The end point: example of a good survey report	131
Annexes		
1.1	Policy Paper Brief: Food for Nutrition	175
1.2	Policy Paper Brief: Micronutrient Fortification	177
1.3	Policy Paper Brief: Nutrition in Emergencies	179
2	Anthropometry	181
3.1	Weight for height reference in Z-scores	191
3.2	Weight for height reference in percentage of the median both boys and girls	195
3.3	Height for age index in Z-scores	197
3.4	Weight for age reference values for boys	199
3.5	Weight for age reference values for girls	201
4	Sample data collection forms for a nutrition and mortality survey	203
5	Random number table	207
6	Example of ethical clearance form	209
7	Resources	217
8	Glossary of terms	219
9	Q&A sheet	227



Acknowledgements

As a joint collaboration between the World Food Programme (WFP) and the Centers for Disease Control and Prevention (CDC), we would like to acknowledge the hard work of the persons involved in the development of this manual.

The key technical advisors were Bradley Woodruff and Reinhard Kaiser from the CDC. Many thanks for their technical wisdom, patience and persistence. In addition, warm thanks are given to Roodly Archer and Fiona Galloway of the CDC for their consistent support and input into the manual development process.

The core WFP team consisted of Rita Bhatia and Leah Richardson. Patrick Webb, Andrew Thorne-Lyman and Soha Moussa were also intimately involved in the development process - warm thanks for their technical input and illuminating visions.

Additional thanks to Kevin Sullivan for his technical review and comments.

There are many people who have contributed by providing comments on this manual and who deserve special mention, for without their help, advice and support, this manual would not have been possible. In particular, thanks are given to all the staff of Nutrition Service and to the staff involved in the accompanying Pilot Advanced Nutrition Training.



The Purpose of this Manual

WHY THIS MANUAL?

- To provide guidance on issues relating to nutrition and mortality surveys.
- To standardize survey methodology used by WFP staff, consultants and implementing partners as a means of ensuring quality.
- To standardize survey data interpretation and reporting.

WHO IS IT FOR?

- WFP staff involved in nutrition-related data collection and/or nutrition interventions.
- WFP staff involved in nutrition intervention decision-making.
- WFP consultants and partners involved in nutrition surveys and interventions.

WHAT DOES IT CONTAIN?

- A chapter on anthropometry and micronutrient deficiencies.
- A chapter on mortality.
- Guidance on deciding when secondary data are of sufficient quality for WFP purposes, thereby rendering a new survey unnecessary.
- A chapter on survey methodology, including an essential guide on selecting appropriate survey methods and calculating sample size.
- Guidance on interpreting and using survey results along with available complementary materials to make informed decisions.
- Guidance on reviewing survey reports for quality.
- Example of a good survey in comparison to a less valid one.

HOW SHOULD IT BE USED?

- As a reference guide.
- As complementary material for the WFP Advanced Nutrition Training.
- As a basis for framing questions/discussions with nutrition experts.

WHAT IT DOES NOT DO!

- Does not absolve you of carefully thinking about decisions.
- Does not provide programmatic guidance on what to do with survey results (guidance on such issues can be found in the WFP Food & Nutrition Handbook).
- Does not provide guidance on identifying malnutrition on an individual basis, but focuses on population-based malnutrition.
- Does not provide guidance on screening for either malnutrition or nutrition surveillance.



Foreword

While nutrition has been central to WFP's mandate for the past 40 years, its importance to WFP is growing. Already recognized as a key player in nutrition, WFP plays an increasingly visible role in micronutrient fortification, HIV/AIDS-nutrition programming, school nutrition and enhanced maternal and child interventions. Following the Executive Board's endorsement of three nutrition policies in 2004, WFP's Strategic Plan for 2006-2009 reconfirms the organization's commitment to support improved nutrition among children, mothers and other vulnerable people in both crisis and non-crisis settings.

However, achieving greater impact, and more clearly documenting results, will be a challenge. The adoption of nutrition indicators in the context of Results-Based Management represents a significant shift in WFP's use of nutrition data - going beyond monitoring and evaluation to the corporate reporting of nutrition and mortality outcomes. Enhancing the capacity of WFP staff, partners and national counterparts to collect and interpret survey-derived data will be a key to future successes. It is of utmost importance that such data are collected using appropriate methods, interpreted meaningfully (in light of complementary information on food security, health, markets, etc.), and presented and used in transparent, appropriate ways.

This manual was prepared to support such capacity-enhancement, providing rigorous yet accessible advice on survey "dos and don'ts". It provides step-by-step guidance intended not only for nutritionists and nutrition focal points, but for all staff involved with data management, programme design and reporting. This is not to suggest that WFP staff collect most nutrition information; such data are collected frequently by partners. However, even when they do not themselves design and conduct surveys, WFP staff must be conversant with data quality issues to be able to interpret and use information appropriately. In other cases, WFP country offices, often with headquarters and regional bureaux support, will indeed directly oversee data collection and analysis. This manual tells you how.

The manual (and its associated training modules) is a team product, combining input from many individuals whose contributions are much appreciated. Future editions are envisaged, with updates occurring according to developments in nutrition science, survey methods and WFP needs. Feedback is therefore always welcome. We hope that the information provided will be widely used and lead to further improvements both in programming and in our ability to report on successful interventions.

Patrick Webb and Rita Bhatia
Nutrition Service
WFP, Rome
July 2005



Introduction

“WFP will mainstream nutrition in its programmes, advocacy and partnerships in order to (i) tackle malnutrition directly, responding to and/or preventing malnutrition when food can make a difference, and (ii) enhance national and household capacities to recognize and respond to nutritional challenges. WFP will expand its efforts to achieve and document positive nutritional outcomes. This will include putting in place appropriate staff capacity at country, regional and Headquarters levels in nutritional assessment, programme design, project implementation and data collection and management. WFP will engage more fully in global and national policy dialogues on malnutrition problems and solutions in collaboration with appropriate partners.”

World Food Programme Executive Board Decision, 2004 Annual Session:
WFP/EB.A/2004/5-A/1

THE IMPORTANCE OF NUTRITION AND MORTALITY INFORMATION FOR WFP

Since its first operations in the early 1960s, the World Food Programme (WFP) has provided food to beneficiaries with the dual objectives of saving lives in crises and seeking to enhance lives and livelihoods in development settings. Very often this has required explicit attention to nutrition. For example, in emergencies malnutrition is an important determinant of mortality; food interventions therefore play a key role in saving lives through their impact on the nutrition and health of affected populations. That is, WFP emergency interventions seek to prevent the deterioration, or promote recovery, of nutritional status of crisis-affected people. Outside of emergencies, WFP also seeks to improve the nutrition of vulnerable subpopulations at critical times in their lives (particularly pregnant and lactating women, preschool children, and certain adolescents).

In both contexts, operational success (i.e., positive impacts on nutrition) depends on effective use of nutrition data - information that helps define the pro-

blem, design appropriate responses, document change and allow for reporting on effectiveness. Since 2004, the use of data on nutrition (and now mortality) has taken on a much higher significance. This can be traced to five important developments:

First, in 2004, WFP's Executive Board endorsed three new nutrition policy papers (see Annexes 1.1-1.3). These policies require WFP to more systematically analyse nutrition problems and define the most appropriate responses based on up-to-date knowledge and best practice. To determine the nature and scale of problems to be addressed by WFP requires greater investment in the collection of nutrition information. As noted in the Executive Board decision above, this means that WFP has to enhance staff capacity in nutritional assessment and data collection and management. Much needs to be done in terms of staff training, technical guidance, analytical support and interaction with field partners engaged in nutrition and other humanitarian work.

Second, in 2004, the Executive Board endorsed WFP's adoption of Results-Based

Management (RBM). Evidence-based programming is essential to achieve all of WFP's goals, but it is particularly critical in the domain of saving lives and protecting the world's most nutritionally vulnerable people. The adoption of nutrition and mortality indicators in the context of RBM represented a significant shift in WFP's approach.

Third, there has been increased attention to nutrition on the international development agenda in recent years. For example, the World Bank (2003) has stated that reducing malnutrition is central to reducing poverty. As long as malnutrition persists, development goals for the coming decade will not be reached. Similarly, the Hunger Task Force of the Millennium Project (2005) has argued that since "adequate nutrition lies at the heart of the battle to fight hunger [...] standardized methods and approaches are needed for measuring and documenting the effectiveness of humanitarian responses by measuring child malnutrition and mortality."

Fourth, WFP has developed an updated and fundamentally revised Memorandum of Understanding with UNICEF (2005) which states that while "UNICEF will generally take the lead in undertaking nutrition surveys representative at the national level, in geographic regions or among certain beneficiary groups where WFP intervenes, WFP can request UNICEF to collect data or WFP will organize collection itself. WFP will also take lead responsibility for baselines, M&E sample surveys, impact assessments and in the context of specific operations-research or pilot activities where nutrition is a key element of the activity." In other words, as of today WFP has a clearly recognized mandate - and hence responsibility - for collecting and using nutrition and mortality data where necessary (i.e., where UNICEF or other partners are not doing it).

Fifth, WFP has become increasingly involved in supporting local micronutrient fortifica-

tion of food aid commodities. While experiences in this area go back at least 10 years, the scale of local fortification activities has grown rapidly, as has WFP's role in the promotion of national fortification policies and its assessments of the prevalence of micronutrient deficiencies while seeking to affect changes in micronutrient status of nutritionally vulnerable populations. This requires WFP to be fully proficient in the collection and use of data on micronutrient malnutrition.

Given these important developments, it is imperative that WFP work more effectively with suitable nutrition and mortality information, particularly as they relate to the performance of various nutrition interventions. The WFP Food and Nutrition Handbook and related Food and Nutrition Training courses already provide extensive guidance to WFP staff and partners on these issues. However, understanding information, or ensuring that information about the prevalence of malnutrition simply exists, is no longer enough. It is equally essential that data are collected using reliable and sound methods, and that staff can appropriately interpret the information for programmatic purposes. This means that WFP staff have to take on greater responsibility to:

- 1) Engage in dialogue with partners on data collection issues before surveys are undertaken (to ensure that surveys meet relevant standards and fulfil WFP information needs);
- 2) Build WFP's capacity, and that of key partners, in the skills related to the review and analysis of nutrition information;
- 3) Collect nutrition information to help quantify WFP's contribution to achievement of the Millennium Development Goals (MDGs); and
- 4) Competently discuss and disseminate nutrition-related information to the outside world.

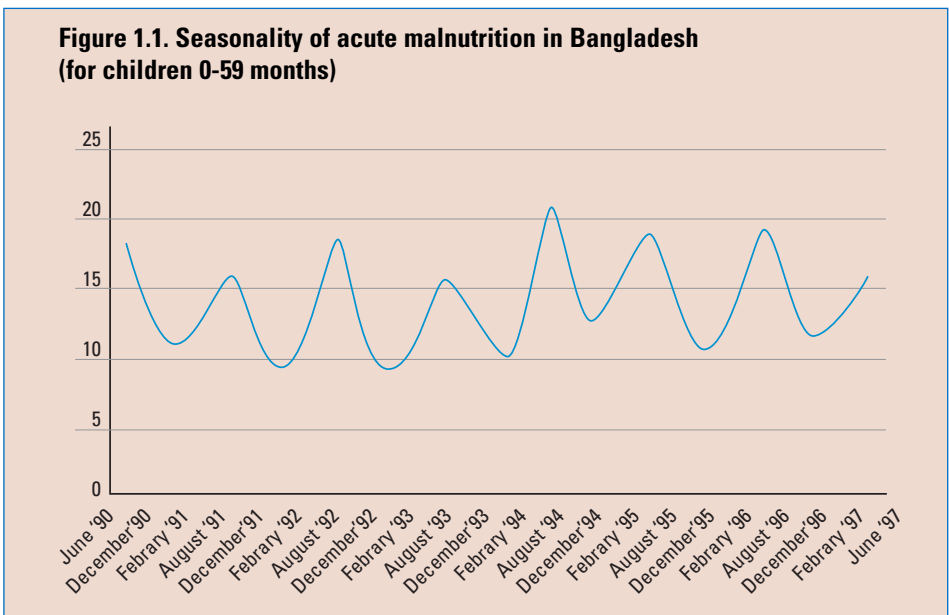
NUTRITION INFORMATION FOR TARGETING NUTRITIONALLY VULNERABLE PEOPLE

The effectiveness of WFP's programmes hinges on the organization's ability to identify people in need and to make decisions about where food, along with necessary non-food resources, can be delivered most effectively. While malnutrition has many causes, an extended shortage of food inevitably leads to potentially life-threatening malnutrition. In combination with food security indicators, indicators of malnutrition can therefore be a powerful instrument for identifying geographic areas where people are either already malnourished or are nutritionally vulnerable, including specific sub-groups of vulnerable populations who have priority needs. This holds true for WFP country programmes and for emergency needs assessments (ENA). Information about the prevalence of malnutrition during normal times, or in the early stages of an emergency, helps

WFP to judge the pre-crisis level of food insecurity. It also provides insights on the current status of entire populations (not just at-risk individuals) and suggests likely trends. The prevalence of malnutrition is therefore important as a "baseline" comparison and as a predictor of the expected effects of disruptive events.

Nutritional surveillance or repeated surveys can also reveal trends in the prevalence of malnutrition, as seen on a national level in Bangladesh over time (Figure 1.1). Such information can help interpret whether changes in malnutrition during a crisis are actually due to the crisis or whether they are associated with expected (normal) seasonal variations.

Indicators of malnutrition generally reflect what has happened to an individual or population in the past, while food security indicators tend to be more focused on the present and even the future.



Source: based on data published by Helen Keller International, 1999

Some indicators, such as child stunting, reflect the totality of conditions that have influenced children's growth over a number of years. Others, particularly wasting, are more likely to reflect recent processes related to weight loss that may be caused by short-term hunger or illness. As such, it is important to remember that nutrition information is most useful for purposes of assessment when it is used in conjunction with food security data.

NUTRITION INFORMATION FOR PROJECT DESIGN, IMPLEMENTATION AND DOCUMENTATION

Beyond assessments, nutrition survey information also has an important role in project design, monitoring and management. Collecting baseline information related to nutrition in a project area (as through a baseline survey, if needed) is a key part of designing the most appropriate nutrition activities. Prevalence information is useful to set objectives and indicators as part of preparing a logical framework and activity summary. An example is the goal of “reducing the prevalence of underweight by 15%” outlined in WFP’s Mother and Child Health Care activity for Nepal (2002-2006).

Baseline surveys ideally should try to explore the potential causes of malnutrition and document its prevalence before (or at the outset of) an intervention. In addition to a lack of food, those causes may include inadequate access to health services, a lack of clean water or sanitation, illness or sub-optimal caring practices. While Vulnerability Analysis and Mapping (VAM) and ENA identify populations in need of food aid, the same populations are often in need of many other interventions. Such complementary interventions and resources may need to be in place for food assistance to signi-

ficantly reduce the prevalence of malnutrition. Where malnutrition is linked to poor caring practices, baseline surveys can reveal more about the prevalence of such practices. The information can then be used to tailor communications and nutrition education interventions. Information from nutritional surveys about causes of malnutrition also can be invaluable in persuading partners to focus their activities in the same areas as WFP. Leveraging joint activities with such partners (governmental agencies, non-governmental organizations, UNICEF, etc.) can greatly enhance the effectiveness of those efforts.

Appropriately collected nutrition indicators are not only important for assessing corporate progress towards meeting strategic priorities (RBM), they are also critical to effective programming - for monitoring trends in nutritional status and effecting project design changes that may be needed to ensure measurable impact.

NUTRITION INFORMATION FOR ADVOCACY AND RESOURCE MOBILIZATION

The basic information that comes out of a nutrition survey can be a powerful advocacy tool for convincing experts and the general public of the need for action. Statements about the prevalence of malnutrition or the number of malnourished children are easy to understand and to put into a headline. For example, following the nutritional survey undertaken by WFP and CDC in Sudan, the following headline was picked up by the media: “More than one-fifth of Darfur children malnourished.” Such a statement quickly conveys to the reader the extent of the malnutrition problem in a given setting.

The results of nutrition surveys can also be used for advocacy with donors to fund “forgotten” emergencies. Those include the situations where “donor fatigue” stems from the protracted duration of a given situation, particularly those not being covered by the media. For example, funding for WFP’s 17-year operation supporting the Saharawi refugees in Algeria ran so low that the supplementary feeding program was phased out in 2002. To determine the extent of malnutrition in the resource-reduced setting, WFP and the United Nations High Commissioner for Refugees contracted the Institute of Child Health, London, to undertake a nutrition survey. The survey provided data on the prevalence of different indicators of malnutrition. Largely as a result of successful advocacy with the survey results, WFP was able to persuade donors to once again fund the supplementary feeding program and to address micronutrient deficiencies.

THE STRUCTURE OF THIS MANUAL

WFP staff will always collect nutrition and mortality data. While such data are normally and frequently collected by implementing partners, it is important that all such nutrition information provided by partners or other secondary sources in the future better conform to WFP reporting needs, be reported more systematically and be collected and analysed in statistically appropriate fashion. Additionally, there will be instances where WFP staff will need to work with counterparts to oversee data collection or conduct and analyse survey data themselves. Over time this will contribute to greater understanding and ownership of nutrition information within WFP.

The present manual, and its associated training modules (for which the manual serves as the main reference text), will enable WFP staff and its partners to gain the skills necessary in all of the above domains. The first chapter briefly reviews the many types of malnutrition (child and adult, macronutrient and micronutrient deficiencies) that matter to WFP, and it introduces the measures used to assess such problems. The second chapter focuses on the measurement of mortality (in the context of emergency settings). The third chapter elaborates on deciding whether a new survey is needed, and if so, the appropriate design and implementation of it. Chapter 4 discusses the analysis and interpretation of survey results, particularly in relation to programmatic decision-making needs. The fifth chapter focuses on ethical issues relating to surveys of distressed populations, be they questionnaire surveys or more invasive methods (involving, for example, a finger prick for blood to assess anaemia). The sixth and final chapter considers what “ideal” survey reports may look like (i.e., details of a well conducted survey and a survey report containing essential information).

The manual is a joint product of WFP’s nutrition service and the Centers for Disease Control and Prevention (CDC), intended for use by WFP staff and partners. Comments on how to improve it are always welcome.

Defining and Measuring Malnutrition

- Measurement of malnutrition in children and adults
- Anthropometric indices
 - What they are
 - How to calculate Z-scores and percentage of median
 - How to calculate body mass index (BMI)
- Micronutrient deficiencies: definitions, clinical and biochemical assessments, and commodity testing
 - Iron
 - Vitamin A
 - Iodine

Malnutrition literally means “bad nutrition” and technically includes both over- and under- nutrition. In the context of developing countries, under-nutrition is generally the main issue of concern, though industrialization and changes in eating habits have increased the prevalence of over-nutrition. Nonetheless, within the context of World Food Programme (WFP) programs and assessments, malnutrition refers to under-nutrition unless otherwise specified.

WFP defines malnutrition as “a state in which the physical function of an individual is impaired to the point where he or she can no longer maintain adequate bodily performance process such as growth, pregnancy, lactation, physical work and resisting and recovering from disease.”

Malnutrition can result from a lack of macronutrients (carbohydrates, protein and fat), micronutrients (vitamins and minerals), or both. Macronutrient

deficiencies occur when the body adapts to a reduction in macronutrient intake by a corresponding decrease in activity and an increased use of reserves of energy (muscle and fat), or decreased growth. Consequently, malnourished individuals can be shorter (reduced growth over a prolonged period of time) and/or thinner than their well-nourished counterparts. 'Hidden Hunger', or micronutrient malnutrition, is widespread in developing countries. It occurs when essential vitamins and/or minerals are not present in adequate amounts in the diet. The most common micronutrient deficiencies are iron (anaemia), vitamin A (xerophthalmia, blindness), and iodine (goiter and cretinism). Others, such as vitamin C (scurvy), niacin (pellagra), and thiamin or vitamin B1 (beriberi), also can occur during acute or prolonged emergencies when populations are dependent on a limited, unvaried food source.

MEASURING MALNUTRITION

Anthropometric¹ information can be used to determine an individual's nutritional status compared with a reference mean. It also can be used to determine the prevalence of malnutrition in a surveyed population. Acute and chronic malnutrition is measured and quantified through anthropometric tools. Within both emergency and development contexts, population-based nutrition indicators can be a useful tool for assessment, prioritization and targeting. The basic information and measurements that constitute anthropometric measurements in children are:

Age	Sex	Length	Height	Weight	Oedema
-----	-----	--------	--------	--------	--------

These measurements are the key building blocks of anthropometrics and are essential for measuring and classifying nutritional status in children under 5 years. More detailed information on anthropometric measurement techniques and recommended equipment can be found in Annex 2.

Measurement of malnutrition in children under 5 years

Physical growth of children (under 5 years) is an accepted indicator of the nutritional well-being of the population they represent. Adults and older children can access proportionally larger reserves of energy than young children during periods of reduced macronutrient intake. Therefore, the youngest individuals are most at risk for malnutrition. For assessment of acute malnutrition, children are more vulnerable to adverse environments and respond rapi-

dly to dietary changes, they are also more at risk of becoming ill, which will result in weight loss. Consequently, their nutritional status is considered a good gauge for population-based malnutrition. For assessment of chronic malnutrition, children during the developmental years are susceptible to skeletal growth failure in ways that adults are not and are a good reflection of long-term nutritional issues. Therefore, the survey results of the under-5-years population are used to draw conclusions about the situation of the whole population, not just of that age group.

Reference population

To determine a child's nutritional status, you need to compare that child's status with a reference for healthy children. References are used to compare a child's measurement(s) with the median for children of the same sex and age for height-for-age and weight-for-age, or to children of the same sex and height for weight-for-height. The internationally accepted reference was developed by the CDC and its National Center for Health Statistics (NCHS) using data collected from a population of healthy children².

The World Health Organization (WHO) adopted the NCHS reference curves for international use. Evidence has shown that the growth patterns of well-fed, healthy preschool children from diverse ethnic backgrounds are similar and consequently are applicable for children from all races and ethnicities. These references are used by agencies involved with nutritional assessments and analysis, including WFP.

1 Anthropometry is the measurement of the proportions of the human body.

2 The NCHS reference was established in 1977 using two different child populations: 0-36 months, lying recumbent, and 2-18 years, measured standing. Length measurement is always greater than height measurement for children. When interpreting data for children around 24 months it should be noted that wasting and stunting rates may peak as a result of the overlapping data sets.

EXPRESSIONS OF NUTRITION INDICES

Anthropometric indices can be expressed in relationship to the reference population in two different statistical terms: standard deviations from the median or percentage of the median.

1.1 Standard deviations, or Z-scores

This is the preferred expression for anthropometric indicators in surveys. It is the difference between the value for an individual and the median value of the reference population for the same age or height, divided by the standard deviation of the reference population. In other

words, by using the Z-score, you will be able to describe how far a child's weight is from the median weight of a child at the same height in the reference value.

1.2 Percentage of median

The percentage of median is commonly used and recommended for admission/discharge criteria for selective feeding programs.

Percentage of median is the ratio of the child's weight to the median weight of a child of the same height in the reference data, expressed as a percentage.

$$\text{Z-SCORE} = \frac{\text{measured value} - \text{median of reference population}}{\text{standard deviation of the reference population}}$$

$$\text{PERCENTAGE OF THE MEDIAN} = \frac{\text{measured weight of the child}}{\text{median weight of the reference population}} \times 100$$

Example 1.1 Calculation of Z-score for weight-for-length

A little boy measures 84 cm in length and weighs 9.9 kg.

By referring to the reference population data in Annex 3.1, you find that the reference median weight for boys of 84 cm is 11.7 kg and that the standard deviation for the reference distribution for boys of 84 cm is 0.908. Using these values, and the formula provided, you can calculate a weight-for-length Z-score for this child.

$$\begin{aligned} \text{Weight-for-length Z-score} &= \frac{9.9 \text{ kg} - 11.7 \text{ kg}}{0.908} \\ &= -1.98 \text{ Z-scores} \end{aligned}$$

Therefore, this child is 1.98 standard deviations (or Z-scores) below the mean weight-for-length. Similar calculations could be performed for height-for-age and weight-for-age.

Example 1.2 Calculation of percentage of the median weight-for-length

A little boy is 84 cm tall and his weight is 9.9 kg. Using the weight-for-height table in Annex 3.2, you can see that the median height for a boy measuring 84 cm is 11.5 kg. Using the percent median formula given, you can calculate the weight-for-height percentage of the median for this boy:

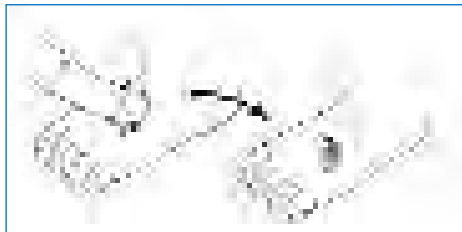
$$\begin{aligned}\text{Percentage of the median weight-for-length} &= \frac{9.9 \text{ kg} \times 100}{11.5\text{kg}} \\ &= 86.1\% \text{ of the median weight-for-length}\end{aligned}$$

Therefore, this child is 86.1% of the median weight-for-length. A similar approach can be used for height-for-age and weight-for-age.

1.3 Oedema as a confounding factor

Oedema as a confounding factor: Children with edema should always be classified as having severe acute malnutrition regardless of their weight-for-height or weight-for-age z-score or percent of median. These anthropometric indices can be calculated for children with edema, and computer programs, such as the EpiNut module of Epi Info, will automatically calculate them for children with edema along with all other children in the survey. Regardless, even if the indices are calculated and included in the final survey dataset, the weight-for-height and weight-for-age indices should be ignored when deciding which children have acute malnutrition. Of course, edema has no effect on height-for-age indices. Oedema increases weight due to the accu-

mulation of fluids; therefore, indices such as weight-for-height and weight-for age will not be representative of the true anthropometric status. Z-score should not be calculated for these children, as the weight measurement will not be valid. When oedema is present in both feet (bilateral pitting oedema) a child is considered severely malnourished, regardless of his weight-for-height Z-score



Oedemous pitting occurring as a result of malnutrition

3 Nutritional oedema is always bilateral. If the accumulation of fluid is only in one foot, it might be the symptom of another medical condition that will require further investigation from the medical team.

Reporting of survey results in Z-score or percentage of the median?

The preferred method of expressing prevalence of malnutrition obtained through survey results is in Z-scores, primarily because the percentage of the median does not take into account the standard deviation associated with the reference distribution of weight for each height category. As the child grows, the standard deviation associated with the reference median increases more slowly than the median weight. The weight of a child who is 100 cm tall is further from the reference distribution than that of the child who is 80 cm tall, and his weight deficiency, compared with the reference standard deviation, is greater than that of the child of 80 cm.

The Z-score expression takes into account the standard deviation of the distribution and thus standardizes weight deficiencies, regardless of the height of the child. Use of the median height-for-age and weight-for-age is also calculated without taking into account the distribution around the median in the reference population.

Moreover, the Z-score is a more statistically valid comparison to the reference population than the percentage of the median. When using Z-scores, all malnourished children, regardless of age and/or height, are likely to be actually classified as malnourished. Since the percentage of the median only uses two factors to calculate malnutrition, as opposed to the three factors used in Z-score calculations, percentage of the median has less likelihood of capturing all the malnourished children. Therefore, when Z-scores are used to define malnutrition, the number of children classified as malnourished is higher than if the percentage of the median is used, and it is a more statistically uniform approach to defining malnutrition.

Percentage of the median is primarily used as a programmatic tool for selective feeding programs (because of ease of calculation and understanding); therefore, program reports will often express malnutrition in percentage of the median. Bearing these points in mind, WFP recommends that anthropometric survey results are expressed foremost in Z-scores. If circumstances call for, results can be presented secondarily in percentage of the median along with Z-scores.

EXPRESSION OF NUTRITION INDICATORS

To define nutritional status based on anthropometric indices, cutoff values are used. Nutrition indicators are a tool to measure and quantify the severity of malnutrition and provide a summary of the nutritional status of all children in the measured group. It provides a method by which the nutritional status of a group can be compared easily over time or with other groups of interest.

Prevalence of malnutrition in children

Once the comparisons are made between individual nutritional status and the reference population, you can calculate the prevalence of malnutrition among the population the individuals represent. The prevalence of malnutrition is equal to the number of malnourished children divided by all children assessed in the population. To help you in your calculations, you can use statistical software, such as Epi Info™ or the newly developed Nutrisurvey, which will automatically calculate the nutritional indices.

Table 1.1 Classification of malnutrition for weight-for-height, height-for-age, and weight-for-age based on Z-scores

Classification	Z-score values
Adequate	$-2 < \text{Z-score} < + 2$
Moderately malnourished	$-3 < \text{Z-score} < - 2$
Severely malnourished	$\text{Z-score} < - 3$

Table 1.2 Classification of malnutrition for weight-for-height, height-for-age, and weight-for-age based on percentage of the median

Classification	Weight-for-height (%)	Height-for-age (%)	Weight-for-age (%)
Adequate	90-120	95-110	
Mildly malnourished	80-89	90-94	
Moderately malnourished	70-79	85-89	60-80
Severely malnourished	<70	<85	<60

Example 1.3 Calculation of prevalence of wasting

To calculate the prevalence of wasting, count all the children in the sample with a weight-for-height less than -2 Z-scores. Report the result as a percentage of the total sample. You measured 900 children.

101 had a weight-for-height less than -2 Z-scores.

The prevalence of wasting would be 101/900 or 11.2%.

Determining the prevalence of acute malnutrition in a population can be useful in many different ways. Malnutrition prevalences are used to define emergency levels, to justify initiation or suspension of nutrition programs and to verify needs assessment. However, the decision to implement nutrition programs should be based on thorough analysis of factors such as the environment, food security and public health issues. Even if the overall food needs of a population are met, there may be inequities in the distribution system, disease outbreaks and other social factors that can cause an increase in the prevalence of malnutrition among certain vulnerable groups.

Measuring malnutrition among adults

The anthropometric indices used with children (weight-for-height, height-for-age and weight-for-age) cannot be applied to adults. There is no internationally accepted anthropometry reference for adults, and the principles of a standardized growth curve are not applicable to adults. Consequently, an alternative measure is used for adults.

Body Mass Index (BMI)

The most useful measure of malnutrition in adults is the body mass index (BMI)⁴. BMI is calculated by dividing the weight (in kilograms) by the height (in meters squared). Pregnant women or adults with oedema are excluded from surveys to assess BMI because of the bias introduced by weight gain not related to nutritional status. BMI is calculated as:

$$\text{BODY MASS INDEX (BMI)} = \frac{\text{weight of the adult (kg)}}{\text{height of the adult}^2 \text{ (m}^2\text{)}}$$

An example of a BMI calculation is provided in Example 1.4. The BMI cutoff values are applied equally to both sexes (Table 1.3) and the same cutoffs are applicable to all adults except pregnant women and individuals with oedema. BMI is not used for pregnant women due to the weight gain associated with the pregnancy.

Table 1.3 Classification of adult malnutrition (also called Chronic Energy Deficiency) using Body Mass Index (BMI)

Malnutrition classification	Cutoff point using BMI
Mild	17 ≤ BMI <18.5
Moderate	16 ≤ BMI <17
Severe	BMI < 16

Example 1.4 Calculation of BMI
 A young, non-pregnant woman's height is 1.60 m and her weight is 50 kg. Using these values in the BMI formula, you would calculate her BMI as follows:

$$\text{BMI} = \frac{50\text{kg}}{1.6\text{m}^2} = 19.5$$

Therefore, the woman's BMI is 19.5

⁴ Some populations, such as the Kenyan Samburu and the Sudanese Dinke, are genetically very tall and should not be assessed using BMI cutoffs.

Low birth weight as a measurement of mother and infant nutritional status

Small babies - especially low-birth-weight (LBW) babies - are effectively born malnourished and are at higher risk of dying in early life. LBW is defined as a birth weight of less than 2,500 g. This indicator is widely used because it reflects not only the status (and likely nutritional health risks) of the newborn, but also the nutritional well-being of the mother. That is, while a low birth weight results from many other factors (including smoking, alcohol consumption during pregnancy, genetic background and other environmental factors), it remains a good marker for a mother's weight gain and the fetus' development during pregnancy. The growth and development of babies are affected by their mother's past nutritional history. Malnutrition is an intergenerational phenomenon.

A low-birth-weight infant is more likely to be stunted (low height-for-age) by the age of 5 years. Such a child, without adequate food, health and care, will become a stunted adolescent and later, a stunted adult. Stunted women are more likely to give birth to low-birth-weight babies, perpetuating the cycle of malnutrition from generation to generation. In addition, the low-birth-weight infant remains at much higher risk of dying than the infant with normal weight at birth. The proportion of low-birth-weight infants in a population is the major determinant of the magnitude of the mortality rates and a proxy indicator for maternal malnutrition.

Low birth weight as an indicator is usually collected through monitoring data such as birth records and clinic registrations. As such, there is usually uncertainty and bias associated with such records because it is

a self-selective sample. In some instances, where reliable birth weight data is available at the household level, birth weight can be collected through a survey. More information on equipment used to measure birth weight and infant weight can be found in Annex 2.

MICRONUTRIENT DEFICIENCIES

Micronutrient deficiencies represent a less visible, but often devastating, form of malnutrition that can be particularly prevalent among WFP's beneficiary populations already lacking sufficient quantity and/or quality of food. There is a close relationship between malnutrition, which is often linked to lack of food, and specific micronutrient deficiency diseases that are associated with consumption of foods poor in micronutrients. Since WFP's beneficiaries frequently have limited access to a varied diet, a large proportion of them are also likely to suffer multiple micronutrient deficiencies. WHO prevalence data for micronutrient problems suggest that 4 million women and young children are vitamin-A deficient, almost 7 million school children are iodine-deficient and 7 million women of childbearing age are anaemic. Deficiencies of one or more of these micronutrients usually means there are also deficiencies of other micronutrients, because the origin of these deficiencies, a deficient diet, means that other micronutrients are also present in insufficient amounts.

Currently, most international efforts are directed toward reducing the prevalence of deficiencies of iron, vitamin A, iodine, zinc and folic acid. According to WHO, deficiencies in iron, vitamin A and zinc each rank among the top 10 leading causes of

death in developing countries. Most people affected by micronutrient deficiencies do not show overt clinical symptoms, nor are they necessarily aware of the deficiency. Micronutrient deficiencies represent a particular threat to the health of children under 5 years and pregnant women.

The following section will focus on the three most common micronutrient deficiencies (iron, vitamin A and iodine). Known effects of these micronutrient deficiencies include impaired physical and mental growth among children, iron-deficiency anaemia, maternal mortality, low adult labor productivity and blindness. Although micronutrients are required in tiny amounts, the consequences of severe deficiencies can be crippling or fatal. However, deficiencies in other micronutrients can occur in a population where the food supply is inadequate or not diversified. Severe niacin deficiency causes pellagra, a disease affecting the skin, gastrointestinal tract and the nervous system. Pellagra is often called the “4 Ds”: dermatitis, diarrhea, dementia and death. Severe thiamine deficiency can cause beriberi, while severe vitamin C deficiency will cause scurvy. Scurvy is recognized by painful joints, swollen and bleeding gums, and slow healing or re-opening of wounds.

Recently zinc deficiency has been garnering more attention. Although severe zinc deficiency is rare, mild-to-moderate zinc deficiency is quite common throughout the world. It is estimated that some form of zinc deficiency affects about one-third of the world's population, with estimates ranging from 4% to 73% across subregions. Worldwide, zinc deficiency is responsible for approximately 16% of lower respiratory tract

infections, 18% of malaria and 10% of diarrhoeal disease. In total, 1.4% of deaths worldwide (2002) were attributable to zinc deficiency. Serum and plasma zinc concentrations are the most widely used biochemical markers of zinc status. Circulating zinc concentrations is a useful index in assessing zinc status at the population level. The collection and preparation of intravenous blood samples for zinc analysis should be performed in a controlled environment to ensure accurate assessment. Contaminant sources of zinc can also be introduced by the technician handling the blood, through sweat, fingernails or saliva (via sneezing or coughing), zinc being present on the equipment used (needles, tubes, etc), and transportation of dust particles; therefore, it requires an extremely controlled environment and special equipment to ensure that the results are accurate. In most settings be introduced by the technician handling the blood, through sweat, fingernails or saliva (via sneezing or coughing), and transportation of dust particles; therefore, it requires an extremely controlled environment to ensure that the results are accurate. In most settings in which WFP would be involved in a nutrition survey these conditions would be very hard to achieve. Expert advice should be sought before attempting to assess zinc status of the population.

To assess some micronutrient deficiencies, blood or urine needs to be collected. Trained phlebotomists or lab technicians should be hired to collect blood samples when necessary. Where only fingerprick samples are needed, survey staff can be trained. Because of the invasiveness of such procedures, care must be taken to assure and respect the rights of individuals by following each country's guidelines in this area.

It may be necessary in some regions to obtain written consent from parents to allow their children to participate in the survey. In addition, even given parental approval, consent from the child is necessary. Confidentiality of results also needs to be considered. Feedback to the individuals, families and communities regarding significant health problems should also be considered. For more information about ethical issues, please refer to Chapter 5.

If blood is going to be collected, always follow these universal precautions for your own safety and the safety of the others. These steps will prevent the transmission of diseases such as hepatitis B, HIV and other infections carried in the blood.

1. Always explain the procedure to the individual (child and adult). Some micronutrient deficiency testing is more invasive than measuring weight and height. The sight of blood or a needle prick might frighten some individuals. Use reassuring terms and be empathic.
2. Always obtain informed consent. If they do not agree, do not take a sample.
3. Always be careful around biohazardous materials. Never allow a child or any individual to play with a piece of equipment.
4. Always wear sterile latex gloves.
5. Only use one needle or lancet per person.
6. After pricking the skin, place the needle in a puncture-resistant container such as the commercially available red biohazardous containers with the logo for biohazardous content. Do not leave it on the table or the floor.

7. Always dispose of all biohazardous material properly. The biohazardous containers should be disposed at the local health facility that uses standard procedures for biohazardous contents.

WFP recommended tests for micronutrient deficiencies

- Anemia: Hemoglobin
- Vitamin A Deficiency: Night Blindness and/or Serum Retinol
- Iodine Deficiency: Urinary Iodine

Iron deficiency

Because anaemia is the most common indicator used to screen for iron deficiency, the terms anaemia, iron deficiency, and iron deficiency anaemia are often used interchangeably. There are differences between these conditions which are explained later. Prior to the development of iron deficiency anaemia, there are mild-to-moderate forms of iron deficiency, in which various cellular functions are impaired.

Iron deficiency

According to WHO, iron deficiency is the most common nutritional disorder in the world. It affects at least half of all pregnant women and young children in developing countries. Iron deficiency often results from a lack of bioavailable iron in the diet, but also can occur during a period of rapid growth (pregnancy and infancy), when the body needs more iron. Another common cause is increased blood loss, such as gastrointestinal bleeding due to hookworm or urinary blood loss due to schistosomiasis.

Anaemia

Anaemia is defined by low hemoglobin levels and can be caused by nutritional deficiencies of iron, vitamin B12, vitamin

A and folic acid. It also can result from chronic infections (malaria, worm infestation, etc.), severe blood loss or inherited abnormalities such as thalassaemia. Multiple causes of anaemia can coexist in an individual or populations and contribute to its severity; however, the most common cause of anaemia is iron deficiency. Children younger than 24 months are especially at risk for anaemia, which slows their mental and psychomotor development, only part of which may be reversible later in life. In older children, the ability to concentrate and perform well in school is hindered. Among adults, anaemia is a serious risk to mothers in childbirth: every day some 140 women die in childbirth because of severe anaemia.

Iron deficiency anaemia

A sufficiently large lack of iron can cause anaemia. Although some functional consequences may be observed in individuals who have iron deficiency without anaemia, cognitive impairment, decreased physical capacity and reduced immunity are commonly associated with iron deficiency anaemia. In severe iron deficiency anaemia, capacity to maintain body temperature may also be reduced. Severe anaemia is also life threatening.

Because anaemia can contribute to maternal mortality, infant morbidity, infant mortality, intrauterine growth retardation and low birth weight, WHO recommends screening of all pregnant women for anaemia.

Clinical signs and biochemical test for anaemia

Using clinical pallor of the nails or eyes (inferior conjunctiva) to diagnose anaemia on a population basis should be avoided because these clinical signs are very subjective and not precise. A more reliable

and easy method is to test the hemoglobin concentration in the blood. Specific equipment is needed for the testingo.

- latex gloves for you and your assistant
- alcohol pads
- sterile, dry gauze pads
- disposable needles (lancets such as Tenderlett)
- microphotometer (such as the HemoCue)
- microcuvettes for the photometer
- adhesive bandages

Hemoglobin testing using the HemoCue method

In the field, hemoglobin levels are determined by using a photometer, such as that manufactured by HemoCue. This company also offers essential training for the proper use and care of the testing equipment. A video is also available on HemoCue's Web site at URL:

http://www.hemocue.com/hemocueus/sida_3.asp.
The basic procedure is as follows:



Portable HemoCue machine

1. Ensure ethical clearance from the host government and obtain personal consent from each individual.
2. Have the analyser turned on and the cuvette holder in the outer position; the screen should say "READY."
3. Take a microcuvette out of the vial and reseal the vial.
4. After cleaning the finger of the child or adult with alcohol pads, hold the finger firmly and prick with a disposable lancet (small disposable needle).
5. After the puncture has been made, apply gentle pressure as needed to extrude a large drop of blood.

6. Release the pressure on the finger and wipe off the drop with a dry, lint-free wipe.
 7. Wipe away an additional one or two large drops, alternately applying and releasing pressure on the finger as needed.
 8. Apply the microcuvette of the HemoCue to a drop of blood from the same finger-prick. Blood is drawn into the cuvette by capillary action. Hold the cuvette in place until the entire teardrop-shaped cavity is filled with blood.
 9. After wiping off any excess blood from the sides of the cuvette, place it in the cuvette holder and insert it into the HemoCue.
 10. Read the hemoglobin concentration [Hb] and record the hemoglobin concentration to one decimal point.
 11. Apply an adhesive bandage on the finger of the individual.
- cuvette exposed to heat and humidity because of incorrect storage (i.e., when the lid is not closed properly). Note that once the container has been opened they may not stay active until the indicated expiry date.

Other methods, such as WHO's hemoglobin color scale and the Sahli method, have been used to determine hemoglobin concentration; however, these methods are both highly subjective and therefore less accurate than the more objective HemoCue method. are not recommended by WFP. Compared to the HemoCue method, an objective method, the hemoglobin color scale and the Sahli method have low accuracy. They are not recommended by WFP. A program officer presented with a report containing hemoglobin concentrations measured with the hemoglobin color scale or the Sahli method should be aware that such methods lack precision.

Errors that can occur due to incorrect handling of microcuvette are:

- microcuvette not completely filled;
- contamination of the optical eye within the hemoglobin instrument;
- introduction of air bubbles (i.e., when filled from the edge instead of the tip); and

Use of hemoglobin concentration to determine status

International cutoffs have been created to classify the status of individuals based on the amount of hemoglobin in the blood.

Table 1.4 Hemoglobin cutoffs to define anaemia in individuals living at an altitude <1000 m and non smokers

Age in years and sex	Hemoglobin cutoff (g/dL)
Children (both sexes)	
0.5 < age in years < 5.0	11.0
5.0 < age in years < 12.0	11.5
12.0 < age in years < 15.0	12.0
Non-pregnant females > 15.0 years	12.0
Men > 15.0 years	13.0

UNICEF/UNU/WHO (2001) and INACG (2002)

Adjustments should be made on the basis of pregnancy status, altitude and frequency of cigarette smoking. The concentration of hemoglobin in blood normally increases as children get older. During adolescence, hemoglobin production increases even more as a result of accelerated growth. For these reasons, age-specific values must be used to define anaemia in children. Also, men have higher hemoglobin concentrations than women.

In women with adequate iron nutrition, hemoglobin concentration starts to fall during the early part of the first trimester, reaches its lowest point near the end of the second trimester and then gradually rises during the third trimester; trimester-specific adjustments hence have been developed. At elevations above 1000 m, hemoglobin concentrations increase as an adaptive response to the lower partial pressure of oxygen and reduced oxygen saturation of blood.

Table 1.5 Adjustments to hemoglobin cutoffs for pregnancy, altitude and cigarette smoking (INACG 2002)

Stage of pregnancy (trimester)	Hemoglobin adjustment (g/dL)
First	-1.0
Second	-1.5
Third	-1.0
Trimester unknown	-1.0
Altitude (m) range	
m < 1000	No adjustment
1000 < m < 1250	+0.2
1250 < m < 1750	+0.5
1750 < m < 2250	+0.8
2250 < m < 2750	+1.3
2750 < m < 3250	+1.9
3250 < m < 3750	+2.7
3750 < m < 4250	+3.5
4250 < m < 4750	+4.5
4750 < m < 5250	+5.5
5250 < m	+6.7
Cigarettes smoked per day	
Fewer than 10 cigarettes/day	No adjustment
10 < cigarettes/day < 20	+0.3
20 < cigarettes/day < 40	+0.5
40 < cigarettes/day	+0.7
Smoker, amount unknown	+0.3

Note: the adjustment is subtracted from or added to the hemoglobin cutoff values presented in Table 1.4.

Vitamin-A Deficiency (VAD)

Vitamin A is a fat-soluble vitamin required for normal growth and development. It is involved in the functioning of the eyes as well as the immune and reproductive systems, while also helping to keep skin healthy. For children, lack of vitamin A may cause severe visual impairment and blindness. Note that clinical signs (nightblindness and other xerophthalmia) present the tip of the iceberg of VAD. Many more children, not suffering from clinical signs of VAD, have low circulating levels of vitamin A (biochemical indicator of VAD) and hence suffer consequences of higher risk of morbidity and mortality. VAD significantly increases the risk of severe illness, and even death, from such common childhood infections as diarrheal disease and measles. Not only is VAD the leading cause of childhood blindness across developing countries, it also affects children's immune systems and is directly responsible for around 10.8 million deaths each year. Eliminating vitamin A deficiency would cut child deaths due to measles alone by 50 percent.

Women and vitamin-A deficiency

Women, whether pregnant or not, should be asked about nightblindness during their previous pregnancy in the last 3 years, and that should have been a pregnancy carried

to full term. However, pregnant women are particularly vulnerable to VAD, particularly during the last trimester of pregnancy when demand by both the fetus and the mother is highest. Among pregnant women in high-risk areas (where food containing vitamin A is rare), the prevalence of night blindness often increases during the last trimester. Night blindness during pregnancy is highly associated with malnutrition, anaemia and increased morbidity in women and their infants. To assess the prevalence of night blindness among pregnant women, you ask them about their night blindness history for their most previous pregnancy.

Clinical assessment of VAD:

night blindness

Night blindness is the inability to see after dusk or at night and is the most common vision problem resulting from severe vitamin-A deficiency. In many regions, a local term is used to define night blindness. To assess night blindness, ask the individual if he or she has any problem seeing in the dark, at night or in a darkened room compared to their eyesight during the day or in a lighted room. For children, you may need to obtain the information from the child's mother or caregiver. Whenever possible, use the local term for night blindness.

Table 1.5 Cutoffs for vitamin A deficiency (VAD) using retinol concentration

Serum retinol (micrograms/dL)	Serum retinol (micromols/L)	WHO definition of deficiency*	IVACG definition of deficiency**
< 10	< 0.35	Severe	Deficient
10 - 19.9	0.35 - 0.69	Moderate	
20 or above	0.7 or above	None	None

* WHO. Indicators of vitamin A deficiency and their application in monitoring and evaluating intervention program. WHO/NUT/96.10. World Health Organization, 1996. Geneva, Switzerland.

** Sommer A, Davidson FR. "Assessment of vitamin A deficiency: the Anecy Accords". Journal of Nutrition 2002;132:2845S-2850S.

WHO has created a scheme for classifying night blindness by interview, using four questions:

1. Does your child have any problem seeing in the daytime?
2. Does your child have any problem seeing at nighttime?
3. If (2) is yes, is this problem different from other children in your community? (this question is particularly appropriate where VAD is not very prevalent)
4. Does your child have night blindness (use the local term that describes the symptom)?

Biochemical assessment of VAD: serum retinol concentrations

At the individual level, retinol does not reflect liver stores of vitamin A and may be affected by other factors, such as infection and protein-energy malnutrition. However, it does allow for the detection of subclinical vitamin-A deficiency at a level that does not lead to vision problems, but does lower immune response and hence increases the risk of morbidity and mortality.

At the population level, you measure the serum or plasma retinol concentration to determine vitamin A status. The proportion of individuals with low retinol levels reflects the prevalence of VAD in children and adults. The prevalence in pregnant women may be a bit higher than the overall adult prevalence.

For assessment of vitamin A status, the high-performance liquid chromatography (HPLC) method currently is used, but it is expensive and time-consuming. This method requires the handling and transportation of blood specimens, with skilled technicians needed to operate the equipment. Further, it requires freezing of samples, and transportation can be difficult.

A surrogate for plasma retinol is plasma retinol-binding protein (RBP). It can be

measured by radical immunodiffusion, a technique that is much simpler and less expensive than HPLC. RBP can also be measured in a rapid field test using dried blood spots. One alternative is to measure retinol levels by using filter paper blood spot samples. Retinol can be measured in a small sample of serum obtained from a finger pricked by sterile lancet.

At this time there is no field-based method for testing for Vitamin A content in oil.

Iodine Deficiency Disorders (IDD)

Iodine is a mineral that is part of the hormones produced by the thyroid gland located in the front of the neck. When iodine intake falls below recommended levels, the thyroid may no longer be able to synthesize sufficient amounts of thyroid hormone. The resulting low level of thyroid hormones in the blood is responsible for the damage done to the developing brain and the other harmful effects known collectively as the iodine deficiency disorders.

Iodine deficiency can cause a goiter - a swelling of the thyroid gland in the neck. Iodine deficiency is also associated with severe mental disabilities due to permanent brain damage in the fetus and infant and retarded psychomotor development in the child. Such disorders can be prevented by iodising all edible salt.

Clinical signs of IDD: goiter

Palpation of the thyroid is performed as an indicator of iodine deficiency. However, this technique is less reliable when there are few goiters and/or when the goiters are relatively small. The thyroid size is slow to respond to changes in iodine nutrition. Therefore assessment of thyroid size through palpation may not be representative of the current iodine nutrition status. Consequently, palpation is not preferred by WFP; nonetheless, it often is still used in the absence of other tests.

Biochemical assessment of IDD: urinary iodine

The measurement of the iodine concentration in urine is the recommended way to assess the current iodine status of a population⁵. Urinary iodine (UI) concentration is a good indicator of iodine intake because most of the ingested iodine is excreted in the urine.

At the individual level, iodine excretion varies throughout the day due to hydration and iodine intake. At the population level, the median UI concentration of casual specimens will be representative of the population's recent iodine intake. For assessing the iodine status of a population, urine specimens from individu-

als do not need to be collected over a 24-hour period. The goal is to have a median urinary iodine concentration between 100-300 µg/L (WHO/UNICEF/International Council for Control of Iodine Deficiency Disorders [ICCIDD]). The urinary iodine survey should be used to help determine the level of iodine needed in the salt to achieve median urinary iodine values between 100-300 µg/L.

Blood samples or blood filter paper specimens for assessing thyroid function (such as thyroid stimulating hormone [TSH], thyroglobulin, or T4) in children or adults are not recommended for survey settings.

Table 1.6 Epidemiologic criteria for assessing iodine nutrition based on median urinary iodine concentrations in school-age children

Median urinary iodine (µg/L)	Iodine intake	Iodine nutrition
< 20	Insufficient	Severe iodine deficiency
20-49	Insufficient	Moderate iodine deficiency
50-99	Insufficient	Mild iodine deficiency
100-199	Adequate	Optimal
200-299	More than adequate iodine intake	Risk of iodine-induced hyperthyroidism within 5 or 10 years following introduction of iodised salt in susceptible groups
>300	Excessive iodine intake	Risk of adverse health consequences (Iodine-induced hyperthyroidism, autoimmune thyroid disease)

Source: WHO/NHD/01.1, 2001

⁵ The current recommendations by WHO/UNICEF/ICCIDD on urinary iodine and goiter are specific to school-age children, those within the range of 6-12 years, although a narrower age range is acceptable, e.g., 8-10 years.

⁶ Testing kits are available to test for either iodite or iodate. Attention should be paid to this detail when determining which one to order and use in the field.

Materials and procedures for urine collection

You will need the following materials for collecting urine samples:

- Disposable cups for collecting urine specimens
- Screw-capped tubes for urine storage and transportation
- Disposable pipette for transferring urine from cup to tube
- Tube labels
- Tube racks
- Cardboard with styrofoam-insert boxes
- Mailing/shipping labels
- Coolant
- Disposable gloves (for handling of urine which may pose an infectious disease risk to handlers)
- Permanent ink pens for labels
- Sealable plastic bags
- Waste disposal bags

Follow these guidelines when collecting urine samples:

- Always wear gloves while handling urine specimens to reduce the risk of infections from the urine.
- Provide each participant with a disposable paper cup for urine collection.
- Ask the individual to urinate directly into the cup. It should be filled approximately halfway with urine.
- Transfer approximately 3-5 mL of the urine specimen to the screw-capped tube using a disposable pipette. (Note that urinary iodine analysis generally requires 1 mL or less; however, the provision of extra urine allows for repeat analysis if necessary.) Dispose of used cups and pipettes properly. The urine specimen should be labeled appropriately and placed into a tube rack.

At the end of the collection of survey information, urine specimens should be packed in batches into sealed plastic bags and then into a shipping box or padded bag. Refrigeration during the shipping process is preferable, but not required.

Various techniques are used to measure urinary iodine. A detailed description of the

various methods can be found in a document produced by WHO entitled Assessment of Iodine Deficiency Disorders and Monitoring their Elimination. A guide can also be found online at URL: http://www.who.int/nut/documents/assessment_idd_monitoring_elimination.pdf

Field methods to test for iodine in salt

Iodised salt is often a first-line defence against iodine deficiencies, and there are circumstances in which it is useful to test salt in order to determine coverage of iodised salt. When iodine deficiency prevalence is estimated to be high, or when the region of interest is landlocked, coverage of iodised salt can act as a proxy indicator for iodine deficiency. An easy-to-use field-based method for testing salt has been developed.

Method:

- Place a small amount of the salt to be tested on a saucer and moisten with two drops of test reagent (a dilute acid, potassium iodide and starch solution).

- If iodate (or iodite)⁶ is present, the salt should immediately turn blue-purple and remain blue for several minutes before fading.

Disadvantages:

- If the result is not interpreted immediately, colour fading may occur over time and lead to incorrect results.

- These kits are specific to the form of iodine, either potassium iodate (KIO₃) or potassium iodide (KI) salt.

Testing kits:

ICCIDD

c/o Centre for Community Medicine
All India Institute of Medical Sciences
New Delhi-29, India

Email: cpandav@iqplusin.org

WYD Iodine Checker

Salt Research Institute

China National Salt Industry Corporation

http://www.chinasalt.com.cn/SALT-3/Product1%20-%20ChinaSalt_com.htm

REFERENCES

- I World Food Programme. Food and Nutrition Handbook. Rome: World Food Programme; 2000.
- II Prudhon C. Assessment and treatment of malnutrition in emergency situations. Paris: Action Contre la Faim; 2002.
- III Habicht JP, Martorell R, Yarbrough C, Malina RM, Klein RE. "Height and weight standards for preschool children: How relevant are ethnic differences in growth potential?" *Lancet* 1974;i:611-5.
- IV Centers for Disease Control and Prevention. What is Epi Info™? Atlanta: US Department of Health and Human Services. Available at URL: <http://www.cdc.gov/epiinfo/>.
- V Erhardt J, Gross R. Nutrition survey software. Available at URL: <http://www.nutrisurvey.de/>.
- VI McIntire D et al. "Birth weight in relation to morbidity and mortality among newborn infants". *N Engl J Med* 1999;340:1234-1238.
- VII World Health Organization. The World Health Report 2002. Geneva: World Health Organization; 2002.
- VII International Zinc Nutrition Consultative Group (IZiNCG). "Assessment of the Risk of Zinc Deficiency in Populations and Options for Its Control, 2004". Available at URL: <http://www.izincg.ucdavis.edu/publications/FNBv25n1supp2zinc.pdf>
- IX World Health Organization. Micronutrient deficiencies: battling iron deficiency anaemia. Geneva: World Health Organization; 2003. Available at URL: <http://www.who.int/nut/ida.htm>.
- X Sanchez-Carrillo CI. "Bias due to conjunctiva hue and the clinical assessment of anaemia". *J Clin Epidemiol* 1989;42:751-4.
- XI Sharmanov A. Anaemia testing manual for population-based surveys. Calverton, Maryland: Macro International Inc.; 2000.
- XII HemoCue AB. Corporate Web site. URL: <http://www.hemocue.com/>.
- XIII International Nutritional Anaemia Consultative Group (INACG), 2002. "Adjusting Hemoglobin Values in Program Surveys". <http://inacg.ilsa.org/file/HemoglobinValues2004.pdf>
- XIV Tanumihardjo SA, Blaner WS, Jiang T. MOST Technical Report. Dried blood spot retinol and retinol-binding protein concentrations using enzyme immunoassay as surrogates of serum retinol concentrations. Arlington: The MOST Project; 2002 Jun. Available at URL: <http://www.mostproject.org/Assesmt%20Methods.PDF>.
- XV World Health Organization. "Vitamin A". Available at URL: <http://www.who.int/vaccines-diseases/en/vitamina/science/sci05.shtml>.
- XVI Sullivan KM, May S, Maberly G. Urinary iodine assessment: a manual on survey and laboratory methods. 2nd ed. Atlanta: Emory University and UNICEF; 2000. Available at URL: <http://www.sph.emory.edu/PAMM/lab/UIAssessment2.pdf>.

Defining and Measuring Mortality

Key messages

- Description of the different types of mortality rates, with formulas used
 - Crude mortality rate/crude death rate (CMR)
 - Age-specific mortality rate (ASMR)
 - Age-specific mortality rate for children under 5 years (ASMR-U5)
 - Under-5 mortality rate (U5MR)
 - Cause-specific mortality rate
 - Infant mortality rate (IMR)
 - Maternal mortality rate (MMR)
- Retrospective cross-sectional mortality surveys
- The use of a “recall period” in mortality surveys
- Determining the causes of mortality

Deaths, and counting deaths, is a crucial public health indicator for many reasons. Death is the final and most definitive health outcome of many important public health problems. And most important causes of poor health in a population, when common and severe enough, produce an elevation in the mortality rate. Death is easily defined, making it a health outcome for which a standardized case definition is easily applied. Because death results from so many health problems - from chronic diseases, infectious diseases and injuries - the mortality rate can provide an overall indicator of general health status of a population. Mortality rates can also provide information on nutritional status because widespread malnutrition among children or adults almost always results in an elevation of the mortality rate, especially if the level of communicable diseases is high. Nonetheless, the mortality rate is a relatively insensitive measure of population health status because conditions often must be quite poor before it is markedly elevated. The mortality rate is also relatively non-specific; there are many causes of elevated mortality, any one of which might lead to an

increase in the mortality rate. As a result, an elevated mortality rate can indicate that there is indeed a health problem in a population, but it cannot indicate the cause.

Mortality rates have been measured in many countries for hundreds of years. Deaths are often counted by various authorities, including religious leaders, civil authorities and public health professionals. In stable populations, mortality rates are usually monitored by registering deaths using a vital statistics system, and reporting deaths is mandatory in most countries. However, in many countries in the developing world, vital statistics systems are far from complete. Even if functioning, such systems usually are disrupted early in situations of civil conflict or displacement. As a result, cross-sectional surveys are often necessary to determine accurate mortality rates.

Often, especially in emergency situations, initial surveys will combine the assessment of many different health and nutrition outcomes. Recently, nutrition assessment surveys have begun routinely including mortality measurement. When combin-

ing nutrition and mortality assessment in the same survey, it is important to consider the sampling strategy so as not to choose a sample which is biased for either outcome

(See Chapter 3 for more details). For example, you cannot include only households with children 6-59 months in the survey sample; the mortality rate in such households may not reflect the mortality rate in all households in the population.

COUNTING DEATHS

Just counting the number of deaths in a population is not sufficient. For example, if you hear that there have been 139 deaths in a certain population, this tells you nothing about the rate of death if neither the size of the population from which these deaths were reported nor the time period during which these deaths occurred were known. If you subsequently learn that the deaths came from a population of 5,000 persons, you still have insufficient information: If these deaths occurred over 10 years, the rate of death in this population is quite low; on the other hand, if these deaths occurred in the same month, the rate of death is extremely high. This example illustrates that every mortality rate must have:

- The number of deaths (the numerator of the mortality rate);
- The size of the population from which the deaths came (the population denominator of the mortality rate); and
- The time period during which the deaths occurred.

If 127 deaths occurred in a population of 19,546 over 9 months time, the death rate would be 127 deaths per 19,546 people per 9 months. However, this rate cannot be compared to the mortality rate in

other populations of different sizes or to numbers of deaths counted over different time periods. To determine if the death rate is high, low or normal as compared with rates in the same population in previous time periods or compared to rates in other populations, the mortality rate in a given population must be converted to a rate using a standard population denominator and time period.

The first step in such a conversion is to decide how the final rate should be expressed. There are three different ways to express the same mortality rate.

- a) # deaths/1,000/year: For many vital statistics systems, which record deaths for longer time periods for an entire nation or province, mortality rates are often expressed as the number of deaths per 1,000 population per year.
- b) # deaths/1,000/month: In some displaced populations, when the acute emergency is over and the health situation stabilized somewhat, mortality rates are sometimes expressed as the number of deaths per 1,000 population per month.
- c) # deaths/10,000/day: During acute humanitarian emergencies, when the number of deaths is totalled each day or every few days, the mortality rate is often expressed as the number of deaths per 10,000 population per day.

These are three different ways to express the same mortality rate; the conversion among them is merely an exercise in mathematics. For example, to convert from 34 deaths per 1,000 per year to deaths per 1,000 per month, just divide the numerator by 12 (1/12th the number of deaths will occur in one month as in one year): $34 / 12 = 2.8$ deaths per 1,000 per month.

Example 2.1 Expression of mortality rates

Even though they may appear to be very different, mortality rates expressed using different population constants or time periods indicate the same rate of death in a population. For example:

- Take a mortality rate of 9.6/1,000 population/year.
- This could be expressed as 0.8/1,000 population/month.
- This could also be expressed as 0.26/10,000 population/day.

The equivalency of these rates can be seen if we calculate from one rate to the other. For example, if the rate of 0.26 deaths per 10,000 per day remained constant for an entire year, we would expect that about 95 people would die (0.26×365 days in a year) out of each 10,000 people in the population.

Because the actual number calculated varies depending on the population constant and the time period, a mortality rate should never be stated without these parameters. For example, you cannot say that the mortality rate is 1.86; you must say that the mortality rate is 1.86 per 10,000 per day. The number 1.86 would mean very different things if the population constant and time period were 10,000 per day, 1,000 per year or 1,000 per month.

SOURCES OF DATA TO CALCULATE MORTALITY RATES

In stable populations, it is better to collect information of death prospectively where, as each death occurs, it is reported to public health or government authorities. Such systems allow the calculation of recent death rates as frequently as is required, and this data can be collected easily. In vital statistics systems, death reporting is often mandatory for persons charged with burying bodies. If deaths occur predominantly in clinics or hospitals, medical personnel may be responsible for death reporting. In many societies, reli-

gious leaders record deaths. In humanitarian emergencies, someone may be hired to count deaths and monitor the area designated as the graveyard or cremation site.

All of these systems of counting deaths require separate information on the size of the population from which the deaths occurred in order to calculate mortality rates. Such information for the population denominator may come from census counts; census projections; population registration; or the monitoring of births, deaths, immigration and emigration.. In humanitarian emergencies and other situations in which data on population size is poor, techniques have been developed to estimate population size.

But which population size is used as the denominator if deaths are counted for a time period during which the population size fluctuates? One approach would be to calculate the average population during the time period (add the population at the beginning of the time period to the population at the end of the time period and divide by 2, producing the arithmetic mean population).

A second approach would be to determine the population at the mid-point of the time period and use that (this is called the “mid-interval population” and is the method used most commonly in vital statistics systems).

However, in many situations, the population denominator for a mortality rate itself is only a rough population estimate and no accounting can be made for changes in the population during the time period of interest. This is often true in humanitarian emergencies which have the additional complication of high rates of in-migration and out-migration.

TYPES OF MORTALITY RATES

Many different rates are used to measure mortality:

- Crude mortality rate/crude death rate (CMR)
- Age-specific mortality rate (ASMR)
- Age-specific mortality rate for children under 5 years (ASMR-U5)
- Under-5 mortality rate (U5MR)
- Cause-specific mortality rate
- Infant mortality rate (IMR)
- Maternal mortality rate (MMR)

Crude Mortality Rate (CMR)

The crude mortality rate (CMR), also called the crude death rate or CDR, is

defined as the number of people of all ages and both sexes who die in a given time interval divided by the total population at the mid-point of that time interval. The CMR always includes the length of the time interval and a standard population size, called the population constant. For example, a CMR may be 8.5 deaths per 1,000 persons per year.

It is calculated by the following formula where:

- the numerator of the fraction in parentheses is the number of deaths which occurred in a specific population during a certain time period. Only deaths which occurred during this time period should be included in the numerator of the mortality rate.
- the denominator of the fraction is the number of people in the population in which these deaths occurred. This population should be well defined, and only persons fitting this definition should be included in the denominator. For example, if you are calculating the mortality rate for a certain province, only people who lived in that province during the time period of interest should be included in the population denominator.

$$\text{CMR} = \left(\frac{\text{Number of deaths}}{\text{Mid-interval population}} \right) \times \text{Population constant} \div [\text{Number of time units}]$$

Example 2.2 Calculation of CMR with standard time unit

In a specific population, 377 deaths occurred during a period of 8 months in a population with a mid-interval size of 58,975.

Using the information in the formula you get:

$$\frac{377}{58,975} = 0.006393 \text{ or } 0.6393\%$$

This means that each person has an average likelihood of 0.006393 (or 0.6393% chance) of dying during the 8-month period.

Stating that the CMR is 377 deaths per 58,975 per 8 months has little meaning; it cannot be directly and meaningfully compared to other CMRs from previous periods or from other populations. However, if this rate is converted to deaths per 1,000 per year, as follows, it can be compared to other rates expressed in the same way:

1. To convert this likelihood to a likelihood for a standard population size, we multiply this rate by 1,000 to obtain 6.4. This means that during the period of 8 months, 6.4 people died for each 1,000 people in the population.

2. To convert this likelihood to a likelihood for 1 year: 6.4 is divided by 8/12ths (8 months divided by the 12 months in 1 year) = 9.6 deaths per 1,000 population per year. This rate means that, if the death rate for the 8-month period continued for an entire year, for every 1,000 people in the population, there would be 9.6 deaths.

Using the formula above, the rate of deaths per 1,000 per year would be calculated as follows:

$$\left(\frac{377}{58,975} \right) \times 1000 \div \left[\frac{8}{12} \right] = 9.6 \text{ deaths per } 1,000 \text{ per year}$$

Vital statistics systems which calculate mortality on an annual basis use the size of the population on July 1 to indicate the average population between January 1 and December 31. Such systems count the number of deaths during a year's time, divide it by the mid-interval population, then multiply by 1,000 (the population constant) to get the number of deaths per 1,000 population per year.

Since the CMR reflects the overall risk of death in the population among all ages and both sexes, it is the least specific indicator of mortality. Mortality reflected in the CMR may result from causes as varied as those from violent deaths from massacres to those from neonatal tetanus. If only one indicator

of mortality can be calculated, CMR is usually the one chosen. Ideally, a newly calculated CMR should be compared with a previous CMR from the same population to determine whether the mortality rate is rising or falling. Such trend information can be used as an overall evaluation of health, nutrition and other interventions. However, when prior mortality data are unavailable, a rough rule-of-thumb can be used:

- a CMR of less than 1 death per 10,000/day indicates a reasonable health situation;
- a CMR of more than 1 death per 10,000/day reflects elevated mortality; and
- a CMR of more than 2 deaths per 10,000/day indicates a health emergency.

Calculating CMR using person-time units

The denominator of a mortality rate is the number of people in the population; however, the denominator can also be seen as being based on person-time instead of the number of persons. That is, a rate of 10 deaths per 10,000 per day may be seen as the risk of death in 10,000 people during a period of one day, or the risk in 5,000 people during 2 days, or the risk in 1,000 people during 10 days. In all three examples, the denominator is 10,000 person-days (the number of people in the population multiplied by the number of days in the time period). This will be important later when discussing the measurement of mortality in cross-sectional surveys. The sample size required to achieve a certain precision around the estimate of the CMR is the number of person-time units required in the denominator of the rate.

In general, if births and deaths are distributed evenly throughout the time period, then each person who was born or who died during the time period contributes, on average, $\frac{1}{2}$ a person-time period to the denominator. For example, vital statistics systems

assume that births and deaths occur evenly throughout the year. Therefore, each person who was born or who died during the year contributed about $\frac{1}{2}$ a year to the denominator. Use of the mid-interval population, as described above, captures half of deaths and half of births and is one way of adjusting the population denominator for the incomplete contribution of births and deaths.

Age-Specific Mortality Rates (ASMR)

Age-specific mortality rates (ASMR) restrict both the numerator and denominator to persons of a certain age. For example, a mortality rate for persons 15-49 years of age is the number of deaths of persons 15-49 years of age divided by the mid-interval population of persons 15-49 years of age (adjusted for the length of the time period).

ASMR is often used to determine if the rate of death is substantially different from that expected in any specific age group. For example, in a survey in Kosovo, the death rate among young men was much higher than expected, indicating that some factor disproportionately increased the risk of death in this age group.

$$\text{ASMR (15-49)} = \left(\frac{\text{Number of deaths age 15-49}}{\text{Mid-interval popul. age 15-49}} \right) \times \text{Population constant} \div [\text{Number of time units}]$$

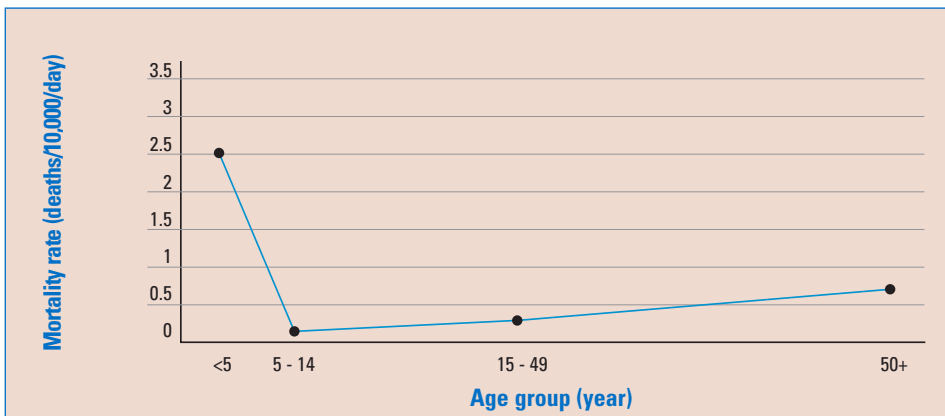


Figure 2.1 Age-specific mortality rates, Badghis Province, March 2001 - April 2002.

Age-Specific Mortality Rate for children under 5 (ASMR-U5)

The age-specific mortality rate for children under five (ASMR-U5) is calculated by dividing the number of deaths of children under age 5 during a specific time period by the number of children under age 5. This is often called the “under-5 mortality rate”; however, as described below, this term is also used for a completely different measure of mortality in children under 5 years of age. For this reason, the term “ASMR-U5” is used here to maintain a distinction between these two different measures.

The ASMR-U5 often is used as a more sensitive indicator of the affect of emergency conditions on mortality. When health and nutritional status in a population deteriorates, the ASMR-U5 often changes earlier and to a greater extent in a crisis situation than the crude mortality rate because young children are more susceptible to health and nutrition insults than older children and adults.

Cause-specific mortality rate

The cause-specific mortality rate measures the rate of death due to a specific cause (i.e., malnutrition-related deaths, violence related deaths, etc.), and it includes only those deaths attributed to the cause of interest in the numerator. The population denominator may include the entire population, or if the cause of death occurs predominantly in a subgroup of the population, it may include only that subgroup. For example, if 28 people in a population of 78,904 die from tuberculosis during the course of a year, the cause-specific death rate for tuberculosis during this time period

would be 35.5 deaths from tuberculosis per 100,000 population per year.

If data on the causes of deaths in a population are available, cause-specific mortality rates provide information about the most important causes of death. Such information can be used to design intervention programs addressing these causes. However, in many populations, such information is lacking and the causes of death must be obtained from other sources (see below).

Because the number of deaths from a single cause is usually far lower than the number of deaths from all causes (measured by the crude mortality rate), the denominator of cause-specific death rates is often expressed as per 100,000 population. This allows the actual rate to be a number greater than one. In the example above, the cause-specific death rate for tuberculosis could also be expressed as 0.355 deaths from tuberculosis per 1,000 per year, but that rate is less easily understood than the larger number of 35.5 deaths per 100,000 per year.

As mentioned above, the denominator of mortality rates for causes of death which occur predominantly or only in a certain population group may include only those most susceptible to death from that cause. For example, death rates for uterine or ovarian cancer are almost always expressed as the number of deaths per 100,000 adult women because deaths from these causes are confined to women. Similarly, death rates for prostate cancer are calculated using a denominator consisting of the number of adult men in the population.

$$\text{ASMR-U5} = \left(\frac{\text{Number of deaths in children <5}}{\text{Mid-interval popul. of children <5}} \right) \times \text{Population constant} + [\text{Number of time units}]$$

MORTALITY “RATIOS”

Some mortality rates are not truly rates, even though they may be called a mortality “rate.” These include rates which use live births as a denominator, such as the UNICEF under-five mortality rate, the infant mortality rate and the maternal mortality rate.

The under-five mortality rate, or U5MR as the term is most commonly used, is the probability of dying before the age of five, usually expressed per 1,000 live births. The U5MR cannot be calculated

directly from data on births and deaths by age in a single year because the deaths, for example, of four-year-olds occur to children born four to five years before the occurrence. U5MR can be calculated using life table methods, from birth history data (the recording of the date of each birth and the age of death for those that have died), or using indirect methods that are beyond the scope of this manual. This measure of childhood mortality is used most frequently by UNICEF and others who conduct large health assessment surveys.

Comparison of the two measures of under-5 mortality rates

Both U5MR and ASMR-U5 measure the mortality risk for children under 5 years of age, but the two indicators express the risk differently.

- In the case of U5MR, the risk is expressed as the cumulative probability of dying before age 5 years in a hypothetical group of 1,000 births.
- In the case of ASMR-U5, the risk is expressed relative to the mid-interval population as with the crude and other age-specific mortality rates.

Because U5MR expresses risk over 5 years, whereas ASMR-U5 expresses risk per year, U5MR is often almost five times as large as ASMR-U5.

As each measure (U5MR and ASMR-U5) has its uses and its advocates, there is no overwhelming reason to recommend one over the other; they are two different ways of expressing much the same data. Since relief agencies tend to be more familiar with age-specific mortality rates, which are derived in the same way as the CMR (counting deaths during a period of time and dividing by a population denominator), that method will usually be the one used in emergency assessments. Moreover, the usual nutrition and mortality assessment survey done in emergency situations does not gather the data necessary to calculate the U5MR; only the ASMR-U5 can be calculated.

On the other hand, U5MR is used by UNICEF and others when measuring child mortality in stable populations. It is presented as the measure of child mortality in many summary publications, such as the State of the World’s Children. To avoid confusion, any reporting on under-five mortality should specifically note whether it is calculated as an age-specific mortality rate or as the probability of dying by the age of 5 years. For WFP purposes, the ASMR-U5 should be used.

Infant Mortality Rate (IMR)*

The infant mortality rate (IMR) is the number of deaths in children under 1 year of age in a given period divided by the number of live births in the same time period. The infant mortality rate allows assessment of the rate of death in the most vulnerable age group - children less than 1 year of age. It often rises earlier and faster in the face of poor health and nutrition than other mortality rates.

The infant mortality rate also is described as a ratio since many of the children who die and are recorded in the numerator were born before the beginning of the time period, and thus their birth is not recorded in the denominator. If the time period is 1996, for example, then a six-month-old child dying in March 1996 would have been born in 1995; her death would add to the numerator but her birth would not be added to the denominator. Likewise, a child born late in the year would still be at risk of dying under the age of one for much of the following year.

The difference between a ratio such as the infant mortality rate and the usual mortality rate can also be seen another way. The infant mortality rate calculates the chances that a live-born infant will die before his first birthday - it is a cumulative incidence. The denominator is the population at the beginning of the time interval of interest. A normal mortality

rate gives the average risk of dying during the time interval for a person in a population and represents a true rate. It uses as the denominator the average population during the time interval, or mid-interval population.

Maternal Mortality Rate (MMR)**

The maternal mortality rate (MMR) uses as the numerator all deaths of pregnant women or pregnancy-related deaths within 42 days of the end of pregnancy. The denominator is live births. Maternal deaths are often a relatively rare cause of death and, as such, the rates should be calculated only for relatively large populations (more than 1,000,000). Random variation in the maternal death rate calculated in small populations with few births may be misinterpreted as significant trends, when they are not actually so.

The maternal mortality rate is critical to determine the need for antenatal and obstetric services. Although the actual proportion of all deaths in a population resulting from pregnancy-related causes is often small, the effects of a woman of childbearing age dying are often much greater for her family and the society than the deaths of others in the population. Therefore, in a certain country, if there were 34,459 births in 2004 and 78 maternal deaths, the maternal mortality rate would be 226.4 deaths per 100,000 live births.

$$* \quad \text{IMR} = \left(\frac{\text{Number of deaths in children < 1 in time period}}{\text{Number of live births in time period}} \right) \times 1000$$

$$** \quad \text{MMR} = \left(\frac{\text{Number of deaths from pregnancy-related causes in time period}}{\text{Number of live births in time period}} \right) \times 100,000$$

CROSS-SECTIONAL SURVEYS FOR RETROSPECTIVE MORTALITY RATES

As mentioned above, it is better to count deaths prospectively so that the mortality rates calculated represent recent events. However, sometimes the system to count deaths does not exist or did not exist during an earlier time period in which you want to measure mortality. In such cases, mortality can be measured using surveys. Just as with nutritional status or other health outcomes, mortality information can be collected from the randomly selected households. The people living in these households report the number of deaths which have occurred in that household during a specified time period. During data analysis, the information on deaths for all the households included in the survey sample is put together. The total number of deaths in all the households is counted and becomes the numerator of the mortality rate. The denominator of the mortality rate is the total number of people in all the households included in the survey sample. The time period is the period in the recent past during which deaths are asked about. Hence, you do not need to know the size of the entire population surveyed or a count of the total number of deaths in that population in order to measure the mortality rate.

Determining the recall period

In order to calculate a mortality rate from data obtained by a survey, only deaths which occurred in a defined period in the past, called the recall period, should be included. To improve the accuracy of mortality estimates in cross-sectional surveys, the beginning of the recall period should be a memorable date known to everyone in the population. For example, the start of the

recall period may be a major holiday or festival (Christmas, beginning of Ramadan, etc.), an election, an episode of catastrophic weather or other remarkable event. The end of the recall period is usually the date the interview takes place. You can then calculate the length of the recall period by counting the days between the holiday or other event marking the start of the recall period and the date of data collection. Of course, this is rarely a nice round number of days, like 90 or 180 days.

To detect such deaths, survey workers ask respondents living in randomly selected households to tell them about deaths which occurred during this recall period. The denominator of the mortality rate, being the total number of people living in selected households, can also be seen as the number of person-time units (i.e., the number of persons in the selected households times the number of time units in the recall period). For example, if a survey selected 569 households in which 3,243 people lived and the recall period was 7.3 months, the denominator would be 23,674 person-months. The same number of person-time units could be obtained from a recall period of 3.65 months and a survey sample of 6,846 people. The denominator of the mortality rate can therefore be increased either by increasing the number of persons in the survey sample or by increasing the number of time units (that is, the length of the recall period).

Advantages of a longer recall period

- A smaller sample size (i.e., number of households) is needed for the same precision, potentially saving resources and time.
- If deaths are recorded for specific parts of the recall period, it is possible to look at sub-intervals of time (e.g., before and after displacement) or to examine monthly trends (depending on sample size).

Disadvantages of a longer recall period

- Mortality rate may be less relevant to current needs than a mortality rate calculated for a more recent time period.
- Additional information, such as cause of death, becomes increasingly unreliable as the recall period lengthens.

Lengthening the recall period is one way to minimize the sample size. However, as you lengthen the recall period, you are asking survey respondents to report deaths which occurred in the more distant past; naturally, an individual's memory may become less reliable over time. This is especially true if, along with recalling the death, you also ask respondents about the circumstances or causes of the death. Moreover, by lengthening the recall period, you will produce an estimate of the mortality rate for a longer period in the past, which may be less relevant to current needs than a more recent mortality rate.

Thus the sample size for a mortality rate is the number of person-time units needed to obtain the desired precision around the estimate of the mortality rate. In acute emergencies, the person-time unit is usually person-days to express the mortality rate in terms of the number of deaths per 10,000 population per day. In stable populations, the mortality rate may be expressed as the number of deaths per 1,000 population per month or per year. The procedure for calculating the minimum sample size to achieve a

certain precision for the mortality rate is described in the chapter on surveys.

If the mortality rate calculated from survey data includes all reported deaths during the recall period, that rate is an average for the entire recall period. It also may also be possible to record deaths as having occurred in specific parts of the recall period. For example, if the recall period is 9.5 months, one could record the death as occurring in one of three intervals: 1-3 months, 4-6 months, or 7-9.5 months prior to the interview date. Because this increases the complexity of the mortality survey, it should only be included if the additional information is useful and if the persons interviewed can reliably place deaths into these shorter intervals. Most people tend to recall important or traumatic events as having occurred more recently than actual fact, so care must be taken to be sure responses are accurate. In practice, in populations where calendar time is not closely followed and dates are not well remembered, recalling exactly when deaths occurred can be very difficult. Nonetheless, if a traumatic or important date can be identified within the recall

period, separate mortality rates can be calculated for both the period before and the period after such a date. For example, some surveys done in displaced populations have asked if a specific

death in the household occurred before or after the household left its home village. Separate mortality rates could then be calculated for the pre-displacement and post-displacement periods.

How long should the recall period be?

There is no absolutely “correct” length for a recall period for surveys measuring mortality rates. The recall period should be based on the objectives of the survey and the following factors:

- **Accuracy:** the recall period should be short enough to allow accurate recall of information about the death. For most purposes, a recall period greater than one year probably will result in less accuracy.
- **Statistical precision:** the recall period should be sufficiently long to provide enough person-time units to obtain the desired precision around the estimate of the mortality rate. For sample sizes used in many surveys, such as 1,000 households, a recall period substantially less than 90 days produces relatively poor precision.
- **Recent changes in mortality rates:** if mortality rates are changing rapidly, you may not be interested in the average rate over the last year, but rather the average rate over the prior few months. The population should also have a relatively constant mortality rate during the recall period. This may have to be assumed if no information is available.
- **Seasonality in mortality:** if you are trying to measure the impacts on mortality of factors not determined by season, the recall period should be chosen to cover several seasons so these effects can be mitigated.
- **Logistic considerations:** longer recall periods reduce the number of households which need to be included in the survey sample and therefore the time needed to complete the survey.

During the acute phase of an emergency, it may be advisable to use a short recall period, such as 1-3 months, because you may be most interested in the mortality rate for a very recent time period. When measuring mortality in stable populations with less fluctuation in the mortality rate, much longer recall periods (such as one or more years) can be used.

Mortality interview

To estimate a mortality rate from a survey we need to know (a) the number of people at risk, and (b) the length of time over which they were at risk. However, the composition of some of the households will have changed during the recall period (death, birth, migration into and out of the household). As a result, the number of people within each of the households may not have been constant during the recall period.

Figure 2.2 demonstrates this concept graphically. Time moves from left to right, with the vertical line on the left being the beginning of the recall period and the vertical line on the right being the end of the recall period - usually the date of data collection at each household. The assessment of mortality will count only those deaths which occurred during the recall period (those deaths occurring between the vertical lines). Each horizontal line illustrates a household member. The top line shows a household member who lived in the household at the beginning of the recall period and still lived there when the survey team visited the household. The other horizontal lines represent other household members who entered or left the household during the

recall period by various means, including birth and death. The dotted horizontal lines represent household members who died during the recall period; these persons would be counted in the numerator of the mortality rate. The household shown in Figure 2.2 had three members at the beginning of the recall period and also had three members at the end of the recall period; however, only one person was in the household during the entire interval. At one time in the middle of the recall period, the household had six members.

Two main methods have been used to count the number of people in a household in order to calculate a denominator for mortality rates: the past household census method and the current household census method. For both methods, a household census is taken, whereby a list is made of all the people living in the household. In the past household method, the census is done as of the beginning of the recall period. Interviewers might pose a question such as, “At the time of {name of holiday or event}, who lived in this household?” In the current household census method, the census is done as of the time of the interview; the question often posed is, “Who lives in this household now?”

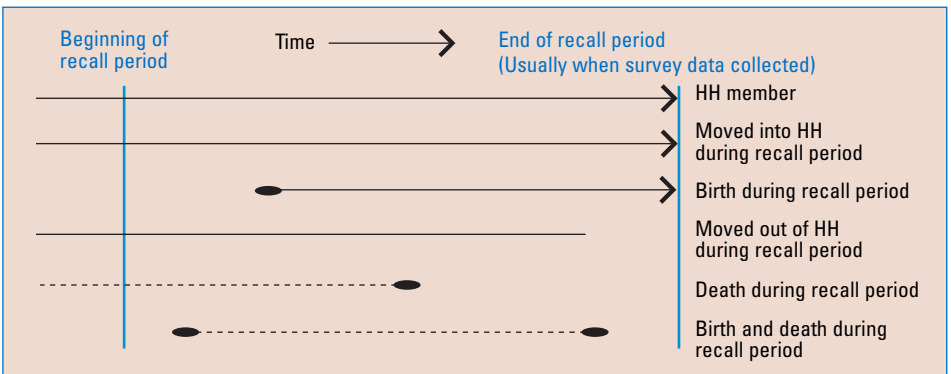


Figure 2.2. Household members' experience during the recall period

In this manual we recommend a modification of the current household census method. Essentially, a census is done at both the end and the beginning of the recall period. In order to calculate the denominator you need to:

1. Ask the household respondent to list all the household members at the time of the survey (the end of the recall period).
2. Ask the household respondent if each of these household members were present at the start of the recall period.
3. Add to the household list all the members of the household who were present at the start of the recall period but are not currently present in the household.
4. Ask the household respondent the current status of each of the members who were in the household at the beginning of the recall period but are no longer in the household. Status may include alive but living elsewhere, dead or unknown.
5. Ask the household respondent if each person on the household list is younger or older than 5 years of age. This allows calculation of an age-specific mortality rate for children under 5 years of age.

6. Ask the household respondent if any babies were born during the recall period and where these newborns are now.

The interviewer also can ask for additional information if other indices of mortality are to be calculated:

1. The age of each member. These data confirm whether an individual is above or below 5 years of age and allow a demographic pyramid of the population to be constructed. In addition, other age-specific mortality rates could be calculated, such as those shown above for Badghis Province.
2. The sex of each member. These data allow calculation of separate mortality rates for males and females.
3. The date of each death if mortality rates are to be calculated for sub-periods within the recall period.
4. The cause of death if cause-specific mortality rates or proportional causes of death are to be calculated.

These data are collected on a form, using a separate sheet for each household. Figure 2.3 shows an example of the form.

Figure 2.3 Example of household mortality data collection form

Survey district: Ambo		Village: Limbo		Cluster number: 4	
HH number: 23		Date: 12- Aug - 04		Team number: 2	
1 ID	2 Sex	3 Current age (in years)	4 Present now	5 Present at beginning of recall period	6 Current status (1 = Alive; 2 = Dead; 3 = Unknown)
1	F	23	Yes	Yes	1
2	M	26	Yes	Yes	1
3	M	54	Yes	Yes	1
4	F	48	Yes	Yes	1
5	F	18	Yes	NO	1
6	F	12	Yes	Yes	1
7	M	8	Yes	Yes	1
8	M	2 mos	Yes	NO	1
9	F	4	Yes	Yes	1
10	M	1	Yes	Yes	1
11	M	3	Yes	NO	1
12	F	29	NO	Yes	2
13	M	33	NO	Yes	1
14	M	8	NO	Yes	1
15	M	31	NO	Yes	3

Tally (if data on household members will not entered into the computer)

	Number above	Data come from:
a. Number of HH members at end of recall period	11	Column 4
b. Number of children < 5 years at end of recall period	4	Columns 3 & 4
c. Number of HH members at beginning of recall period	12	Column 5
d. Number of children < 5 years at beginning of recall period	2	Columns 3 & 5
e. Total number of deaths	1	Column 6

Sometimes survey managers may be tempted to ask each household respondent only the number of people in the household rather than listing each household member. Although this may be faster, it is far less accurate than asking the respondent to list all the household members. We therefore strongly recommend that the household members are listed on a form such as that above.

The numerator of the crude mortality rate in the survey sample is simply the total number of all deaths counted in the survey sample during the recall period - that is, the sum of all the numbers in row “e” for all the households selected for the survey sample. The population denominator of the mortality rate is the average of the total population in selected households at the beginning of the recall period (the sum of row “c” for all households) and the total population in selected households at the end of the recall period (the sum of row

“a” for all households). This average population is then multiplied by the number of time units in the recall period to derive the person-time denominator for the mortality rate. The time and population constants are then applied to convert the mortality rate to a standard form which can be compared to other mortality rates.

For under-five mortality, a comparable process is followed. The numerator of the under-five mortality rate is the number of deaths in children under 5 years of age which occurred in selected households, or the total of row “f” for all households. The denominator for this mortality rate is the average of the number of children under 5 years of age at the beginning and end of the recall period - that is, the average of rows “d” and “b.” This mid-interval population of children under 5 years of age is multiplied by the number of time units in the recall period, as described above.

What to do with people whose status in the household is reported as unknown?

If such persons represent relatively few people who are no longer in the households, they can be excluded from both the numerator and denominator.

If they represent a large proportion of household members who are no longer in the household, two mortality rates can be calculated: one assuming that the unknown members are alive and one assuming that the unknown members are dead. Some probing with members of the community may also give you an idea whether those whose status is unknown are more likely to be dead or alive but living elsewhere. For example, in a population where many young men fled the household to join a fighting group which has not lost many members in battle, heads of households may report their status as unknown, but they may be likely to be alive. In other situations where attackers take household members away and there have been mass executions, such household members may be more likely to be dead.

In any situation where the number of persons with unknown status is larger than 10 percent of the number of deaths, calculate two mortality rates (one rate excluding unknown persons from the numerator, and therefore assuming that they are still alive, and the second rate including unknown persons in the numerator and therefore assuming that they are dead).

CAUSE OF MORTALITY

One of the survey objectives may be to determine the major causes of death during the recall period. During a cross-sectional survey, this is done by asking questions of a surviving household member who was present just before and during the death of their relative. The questions are meant to elicit a description of the signs and symptoms experienced by the person who died in order to determine what illness caused the death. This process is notoriously difficult even with an extended interview of a closely related person very soon after death. Lists of validated questions exist; however, the interview is much too long for most emergency assessments and requires highly skilled interviewers. More abbreviated lists of questions have been used in some surveys, but such lists have not been properly validated.

Nonetheless, some causes of death may be distinct enough to diagnose with fewer questions. For example, malnutrition may be suspected as a cause of death if the population being surveyed has experienced famine and food insecurity, if the surviving relative reports lack of food in the household and if the deceased person had rapid weight loss in the few weeks before death. In addition, some diseases are well known by mothers and others in the society. Many cultures and languages have specific terms for measles, neonatal tetanus and other common illnesses with relatively unique appearances.

In many situations of conflict, it may be of interest to determine if deaths have been caused by war-related violence. Because such violence is easily identified by lay people, a short series of questions, such as those below, can often accurately identify deaths due to this cause.

Questions to detect war-related violence:

- 1) “Did (the person) die from some sort of injury such as being assaulted, shot or stabbed, a car accident, a fall, drowning, poisoning, burn, bite or sting?”
If YES, go to next question.
If NO, record death as not related to injury or violence.
- 2) “Was this injury caused by someone fighting the war such as from a bullet, bomb, mine, machete or assault?”
If NO, record non-war-related injury or violence as cause of death.
If YES, record war-related injury or violence as cause of death.

War-related violence normally affects only particular areas within the whole survey area. As a result, if war-related violence was a major cause of death during the recall period, the sample size may have to be substantially larger to measure mortality rates with any precision (see chapter on surveys for more detailed explanation). Nevertheless, determining the contribution of war-related violence to overall mortality may be important in many situations.

In general, because of the complexity of determining the causes of deaths in cross-sectional surveys through interviews, alternate sources of data should be used to determine the causes of death. Such sources could be disease surveillance, death registration, clinic or hospital log books, or others. If other sources of data on causes of deaths do not exist, such information could be collected during surveys if the following conditions exist:

- If local terms exist for causes of interest, and respondents can reliably identify them.
- If the causes of interest consist only of violence.

Example 2.3 Calculation of mortality rates from a cross-sectional survey

The data for a cluster sample survey were gathered between June 11 and 17. The sample contained 387 households. At the end of Ramadan, the November 14, before the survey, 2,818 people lived in the households selected for the survey sample, of which 535 were children under 5 years of age. At the end of the recall period (i.e., at the time of survey data collection), the population of these selected households was 2,827, of whom 578 were children under 5 years of age. During the recall period, 44 people died; 31 of these deaths were children under 5 years of age. Seventeen adults had left the household during the recall period and were living elsewhere; 4 adults were no longer in the household, and their current status was unknown.

The first step in calculating any mortality rate is to determine the length of the recall period. The mid-point of data collection fell on June 14; this date can be used as the end of the recall period. There are 213 days between November 14 and June 14. These 213 days are equivalent to 7 months (November 14 - June 14).

Crude mortality rate (in deaths per 10,000 population per day)

The denominator equals the average population size:

$$\frac{(2,818 + 2,827)}{2} = 2,822.5$$

multiplied by the length of the recall period:

$$2,822.5 \text{ persons} \times 213 \text{ days} = 601,192.5 \text{ person-days}$$

The numerator equals the 44 deaths reported in all ages during the recall period. Therefore, the mortality rate equals:

$$\frac{44 \text{ deaths}}{601,192.5 \text{ person-days}} \times 10,000 = 0.73 \text{ deaths per 10,000 population per day}$$

Crude mortality rate (in deaths per 1,000 population per month)

If the CMR is to be expressed as deaths per 1,000 per month, the recall period would be 7 months. Therefore, the denominator would be:

$$2,822.5 \text{ persons} \times 7 \text{ months} = 19,757.5 \text{ person-months}$$

and the mortality rate would be:

$$\frac{44 \text{ deaths}}{19,757.5 \text{ person-months}} \times 1,000 = 2.22 \text{ deaths per 1,000 population per month}$$

Age-specific mortality rate for children under 5 years of age (in deaths per 10,000 population per day)

The denominator equals the average size of the population of children under 5 years of age:

$$\frac{(535 + 578)}{2} = 556.5$$

multiplied by the length of the recall period:

$$556.5 \text{ persons} \times 213 \text{ days} = 118,534.5 \text{ person-days}$$

The numerator equals the 31 deaths reported in children under 5 years of age during the recall period. Therefore, the mortality rate equals:

$$\frac{31 \text{ deaths}}{118,534.5 \text{ person-days}} \times 10,000 = 2.62 \text{ deaths per 10,000 population per day}$$

Age-specific mortality rate for children under 5 years of age (in deaths per 1,000 population per month)

If the age-specific mortality rate for children under 5 years of age is to be expressed as deaths per 1,000 per month, the recall period would be 7 months. Therefore, the denominator would be:

$$556.5 \text{ persons} \times 7 \text{ months} = 3895.5 \text{ person-months}$$

and the mortality rate would be:

$$\frac{31 \text{ deaths}}{3895.5 \text{ person-months}} \times 1,000 = 7.96 \text{ deaths per 1,000 population per month}$$

REFERENCES

Measuring Mortality, Nutritional Status and Food Security in Crisis Situations: Smart Methodology, Version 1, June 2005. UNICEF and USAID, New York and Washington, D.C. 2005. Available at: <http://www.smartindicators.org/>.

Spiegel PB, Sheik M, Woodruff BA, Burnham G. “The accuracy of mortality reporting in displaced persons camps during the post-emergency phase”. *Disasters* 2001;25:172-180.

Myatt M, Taylor A, Robinson WC. “A method for measuring mortality rates using previous birth history”. *Field Exchange* 2002;14:13-15.
Available at: <http://www.enonline.net/fex/17/index.html>

Woodruff BA. “A method for measuring mortality rates using previous birth history: a commentary”. *Field Exchange* 2002;14:16.
Available at: <http://www.enonline.net/fex/17/index.html>

Designing a Survey

Key messages

- How to determine whether a survey is necessary
- What information is needed to prepare for a survey
- How to choose appropriate sampling methodology and calculate sample size
- How to select the survey sample
- How to train the survey team and develop survey materials
- How to collect survey data and assess its quality
- Presenting the results

Carrying out a survey requires many skills, much patience and a substantial investment of time but, when well conducted, the value to WFP will far outweigh the costs. This section summarizes some of the many steps involved and provides guidance on how each of these steps may be completed. It also highlights, for many of the steps described, some of the more common mistakes and how to avoid them. Additional guidance, and more thorough discussions of the theoretical aspects of surveys, can be obtained from the references listed elsewhere in this document.

Key steps in carrying out a survey include the following:

1. Decide whether a survey is necessary. If a survey is deemed necessary, then the following steps would apply.
2. Define survey objectives and define the geographic target area to be included in the survey.
3. Determine what information to collect and from which population subgroup it will be collected.
4. Gather background information necessary for carrying out the survey and meet with community leaders, local authorities and organizations that may be concerned with nutrition.

5. Determine the appropriate sampling method.
6. Calculate sample size.
7. Select the sample.
8. Determine the schedule for the survey, and obtain and prepare supplies and equipment.
9. Design the data collection form and surveyor's manual.
10. Select and train survey workers.
11. Field test data collection forms and data collection procedures.
12. Collect the data.
13. Enter the data and assess its quality.
14. Analyse the data and present the results.
15. Disseminate findings in presentations and reports.

Although listed roughly in order of their execution, some of the tasks will have to be done simultaneously or out of order in some circumstances and may need frequent revisiting. No manual or set of instructions can possibly instruct a novice survey manager in all the potential technical and logistic complications. For this reason, the advice of an experienced person should be sought at many points in the process of planning and carrying out a survey.

1. DECIDE WHETHER A SURVEY IS NECESSARY

The decision to undertake a nutrition survey usually will be made with local or national government authorities and other partner agencies. The actual decision-making process will depend on local circumstances and relationships. It is, however, always important to share information about when and where you plan to undertake a nutrition survey to prevent unnecessary duplication and overlap of surveys.

Conducting a nutrition survey is expensive and time-consuming. Before starting a survey, you should answer the following questions:

- **Are the results crucial for decision-making?**

If a population's needs are obvious, immediate programme implementation is the first priority. 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 may not be necessary to undertake a nutrition survey before distributing food. Similarly, if another agency has recently⁷ carried out a nutrition survey in the same area, and the context has not changed considerably, then it should not be necessary to repeat the process. However, if current population needs must be determined or if WFP requires outcome or baseline data for a specific project, then it may be necessary to carry out a survey. Thus, the implementation of WFP programmes may be sufficient justification for carrying out a nutrition survey if data are unavailable from other sources.

- **Are the survey results going to be used to take action?**

There is no point in undertaking a nutrition survey if you know that a response will not be possible. If there is no capacity to implement an intervention to address the identified needs, or if the survey objectives do not address WFP Strategic Priorities, further thought should be given to the usefulness of initiating a survey.

- **Is the affected population accessible?**

Insecurity or geographical constraints may limit access to the population of interest. If this is extreme, a survey cannot be conducted.

Unless these three prerequisites are fulfilled, there is probably insufficient reason to undertake a survey; other data collection techniques may be more appropriate and efficient. Such data collection techniques may include nutrition and disease surveillance, food market monitoring, qualitative assessment of food supplies and household food economy, screening of all persons in the vulnerable population and other techniques. In general, because surveys gather data at a single point in time, a single survey has a very limited ability to explore causality. To more completely understand nutritional problems in a population, additional information about the causes of malnutrition, which cannot be collected in a survey, must be obtained by other means, such as qualitative assessment techniques.

Surveillance data are often especially useful to answer public health or nutrition questions. In many populations,

⁷ The time involved in “recently” varies with the context and the use of the survey results. In general, survey results from the last year are useful; however, attention must be paid to changes in the target area.

information on the number of cases of communicable diseases is collected routinely from health care providers, such as clinic and hospital personnel, both public and private. Nutrition surveillance is also often carried out by reporting anthropometry from clinics where growth monitoring is done to central public health authorities. Of course, because most surveillance data are collected from health facilities, they are relevant to people who come to clinics for curative or preventive care. Often such people are quite different from those who do not come to health care workers for services. As a result, surveillance data rarely are truly representative of the entire population. As will be described in this chapter, surveys can provide just such representative information if carried out correctly.

Because surveillance systems gather data continuously over time, such data are especially well suited for following trends in the incidence or prevalence of the disease reported in the system. For example, if the surveillance system has not undergone major changes in a period of five years, it can show whether the number of cases of a specific disease has increased, decreased or remained the same during this time period. In general, because surveys gather data at a single point in time, data from a single survey cannot be used to follow trends. Moreover, because surveys collect data on possible contributing factors at the same time they collect data on the disease of interest, you often cannot tell which came first, the risk factor or the disease. For this reason, surveys usually are not the best way to explore causality. To more completely understand nutritional problems in a population, additional information about the causes of malnutrition should be obtained by other means, such as qualitative assessment techniques.

2. DEFINE SURVEY OBJECTIVES AND DEFINE THE GEOGRAPHIC TARGET AREA TO BE INCLUDED IN THE SURVEY

You must be clear about your objectives before starting a nutrition survey. Precise and clear objectives will make it much easier for your team, collaborating organizations, the survey population and donors to understand what you are trying to achieve. Clear objectives will also make the analysis of survey data much easier by guiding which analyses will answer the basic questions that prompted the survey. Often, a nutrition survey is undertaken to fulfil the following types of objectives:

- To measure the proportion of individuals in specific groups, often children 6-59 months of age or women of child-bearing age, with malnutrition or anaemia. Such data can be used to determine the need for specific nutrition interventions.
- To measure the coverage of feeding programs - that is, the proportion of individuals in specific groups who are beneficiaries of a nutrition program - for example, the proportion of moderately malnourished children who receive food from a supplementary feeding program or the proportion of families who have received food from the general ration distribution. These results can measure whether a program is reaching the intended beneficiaries.
- To establish a baseline against which changes in nutritional status over time can be compared by carrying out a follow-up survey. Although such data are sometimes used to measure the effectiveness of a program, there may be many factors that can influence change over time in addition to the implementation of a specific nutrition program.

Serial surveys meant to demonstrate changes in nutritional status should be planned carefully. For example, baselines and follow-up surveys meant to detect changes over time could be done in the same population and at the same time of year in order to minimize the differences between populations and the effect of seasonal changes in nutritional status. In addition, an apparent difference between surveys may be the result only of sampling error, described later in this manual. You should not conclude that a statistically significant difference exists between the results of two surveys without the use of a statistical test. In addition, surveys over time in an intervention population (that which receives a programme) and a non-intervention population (that which does not receive a programme) may provide evidence that a particular program has caused a change in nutritional status. The intervention population is the population that receives a program, and the nonintervention group is similar population that does not receive the program.

Undertaking a nutrition survey provides an ideal opportunity for agencies to learn more about the population they are assisting or planning to assist. When undertaking a nutrition assessment, it may be useful to collect additional information on the population, such as mortality, immunization and nutrition programme coverage data. Objectives related to these health outcomes should be included in the list of survey objectives. Such objectives could include

- Estimating the coverage of feeding programs;
- Estimating mortality rates (crude and under-5 years); and
- Estimating the coverage of measles vaccination and vitamin A supplementation.

You must decide in which area the survey should be conducted, and you must define this area carefully. Remember that the area from which the survey sample is selected is the only area to which your survey results can be generalized. You will not be able to say anything about an area or population that was not eligible to be selected for the survey sample.

In most cases, the area chosen will correspond to an administrative or government area, such as a district or province. For WFP purposes, sometimes the area chosen for a survey will correspond to areas where WFP is implementing a programme or is investigating the need to implement a programme. The survey ideally should be conducted in an area where the whole population has a similar nutritional situation because the final estimate of the prevalence of malnutrition can be applied only to the entire population from which the sample was selected. It cannot be applied with any statistical precision to any subgroup or sub-area within the survey population or area. If you conduct a survey in an area in which different groups have very different nutritional statuses, the results will be an average of these different nutritional statuses. For example, if some provinces in a particular nation have suffered drought and crop failure while others have not, it would not be very useful to do a nationwide survey to determine which provinces are in greatest need of assistance. The result of such a survey would produce only an average measure for the entire nation.

**COMMON MISTAKE #1:**

Selecting the area to be assessed on the basis of accessibility or the presence of aid organizations, not on the need for a survey.

Explanation: Nutrition surveys should be done to answer specific programmatic questions, such as “Does this population need feeding programmes?” or “What type of feeding programmes are needed by this population?” or “When we measure nutritional status in one year’s time, will there be an improvement in comparison to this baseline?” Therefore, the selection of the area to assess by carrying out a survey should contain a population about which someone needs answers to specific questions. A population should not be chosen because they are easier to reach than other populations (e.g., closer to the capital city or on a better road). Surveys done in more easily accessible populations may be biased because populations which are easier to reach may be substantially better off than populations in more remote or less secure locations. As a result of choosing the easier population, important resources of food, money and personnel may be directed to a population in which the need for interventions is not as great as in other populations.



Solution: Be sure the area you select for a survey truly needs a survey; that is, be sure that the area has a potential need and that the capacity exists to take action on the basis of the survey results.

**COMMON MISTAKE #2:**

Always selecting the area to be assessed on the basis of administrative delineations, not on environmental or other characteristics more likely to determine risk of malnutrition.

Explanation: The decision regarding which geographic area to include in a survey should be based on (1) who needs the survey results, and (2) what decisions need to be made. For example, if knowledge of the prevalence of malnutrition in a province is required to decide whether to request food assistance, the selection of survey sites should be made from all communities in the province, regardless of the province's geologic or ecologic boundaries. On the other hand, if there is strong suspicion that, for example, the people living in the mountains have a greater shortage of food, then it may be best to target the mountainous districts for the survey and exclude districts in the lowlands. Of course, if the survey is done to measure the outcomes of an intervention, the population to be included in the survey should be potential recipients of that intervention. In general, decisions regarding all aspects of survey design should be determined by the questions the survey is meant to answer and the use to which the results will be put.



Solution: Define the area to be included in the survey according to who needs the information and what will be done with the information.

3. DETERMINE WHAT INFORMATION TO COLLECT AND FROM WHICH POPULATION SUBGROUP IT WILL BE COLLECTED

In large part, what information you will collect in the survey will be decided when formulating the survey objectives. However, additional information may be included in the list of major objectives. When making the list of data to collect, remember that data collection requires time and money. Survey workers should not be overburdened by collecting information which will not be analysed or used to improve the health of the population. Also, remember to collect all the data necessary to meet the survey objectives. Some types of information may be necessary only during data analysis. For example, if you are assessing the nutritional status of adult women by using body mass index (BMI), remember to determine pregnancy status for each woman included in the survey sample because pregnant women will have to be excluded during the analysis of BMI. If cluster sampling is done, you will also need to know how to identify which cluster each household or individual belongs to in order to calculate appropriate confidence intervals. Therefore, you must record in each data set the cluster number for each household, child, woman and any other unit of analysis.

At this point you will also need to decide what age group to measure. For many nutrition and health outcomes, the subgroups selected to measure are the groups at greatest risk of the nutritional deficiency. For example, anthropometric surveys of acute and chronic malnutrition usually target children aged 6-59 months. Young infants may be included if you suspect that there is an acute nutritional problem in this group. Young children and women of childbearing age may be included because

these groups are at greatest risk for anaemia, and adolescents, especially adolescent girls, may also be included if there is suspicion that this age group is at particular risk for anaemia or other nutrition conditions. If you are in doubt about which group to include in measurement of some health or nutrition outcome, consult an expert in that disease or condition.

In order to organize the data, you could make a complete list of all the data you wish to collect during the survey. The partial list below details the data needed to assess some health and nutrition outcomes in children 6-59 months of age:

For children 6-59 months of age currently in household:

- A. Village name, cluster number, household number
- B. Date of birth, age in months, or both
- C. Sex
- D. Vaccination status
 1. Tuberculosis (BCG) vaccine-by scar, mother's history or vaccination card
 2. Measles- by mother's history or vaccination card
- E. Recent morbidity
 1. Diarrheal disease
 2. Acute respiratory infection
- F. Nutritional status
 1. Malnutrition
 - a. Weight
 - b. Height or length
 - c. Presence of bilateral oedema
 2. Anaemia
 - a. Hemoglobin
 3. Vitamin A
 - a. Presence of night blindness
 - b. Serum vitamin A level
 - c. Coverage of Vitamin A capsules
 4. Enrolled in Supplementary/Therapeutic Feeding Program, currently or recently

Such a list should be made for each target subgroup of the population. Creating such a list:

- Helps to ensure that nothing essential is forgotten;
- Identifies the specific equipment and supplies which will be needed for the survey;
- Allows others to review what data will be collected in the survey; and
- Organizes the data in the order it may be included on the data collection form.



COMMON MISTAKE #3:

Using mid-upper arm circumference (MUAC) as the only anthropometric index of acute malnutrition.

Explanation: Some survey managers feel that measuring weight and height in the field using scales and height boards is too complex, while measuring MUAC requires only a MUAC tape. However, MUAC is not the best index for use in nutrition assessment surveys for the following reasons:

- The size of a child's upper arm increases as the child gets older. Therefore, if the same cut-off point (often < 12.5 cm) is used to define malnutrition for all ages of children 12-59 months of age, a younger child is more likely to be defined as malnourished than an older child, regardless of their actual nutritional status.
- Taking a MUAC measurement is difficult to do accurately. If the measurer pulls the tape too tightly, the measurement will be spuriously low. If the measurer does not pull the tape tightly enough, the measurement is spuriously high. Several studies demonstrate that inter-observer and intra-observer error are both quite high with MUAC measurements. Moreover, if all measurers pull too tightly, then the survey will overestimate the prevalence of acute malnutrition. Likewise, if the tape is consistently not pulled tightly enough, the survey will underestimate the prevalence of acute malnutrition.
- MUAC measures only acute malnutrition. As a result, MUAC cannot tell you if children are chronically malnourished. In some populations, chronic malnutrition may be more important than acute malnutrition.

MUAC may be used to screen large numbers of children to determine who needs admission to supplemental or therapeutic feeding. However, such data should not be used to estimate the prevalence of malnutrition in the population.



Solution: Use weight-for-height instead of MUAC to measure acute malnutrition.

**COMMON MISTAKE #4:**

Always excluding infants under 6 months of age.

Explanation: Infants under 6 months of age often are not included in nutrition surveys for various reasons.

First, in most populations, infants under 6 months of age are considered less vulnerable to acute malnutrition. Such children are relatively protected from food shortages because typically most of their diet consists of breast milk. Unless the mother is very ill or very malnourished, the supply of breast milk is usually sufficient for young infants; therefore, food shortage is less common in breastfeeding infants. Nonetheless, there may be situations where maternal health or nutritional status is so poor that some women may not be able to adequately breast feed their young infants, or young infants may have substantial exposure to communicable diseases which lead to malnutrition. There may be other situations where the survey is meant to evaluate specific programs targeting young infants.. In such cases, it may be desirable to include children under 6 months of age in the survey sample. However, it should be kept in mind that the number of infants under 6 months of age included in most population-based household surveys will be relatively small. As a result, a separate estimate of the prevalence of malnutrition for just this group will have very little precision.

Second, many survey workers are less comfortable handling such small children. Survey workers should be reassured that weighing and measuring young infants is not difficult, especially if using the UniScale or another scale which allows weighing of children in the mother's arms. The decision to include infants under 6 months of age should be based upon the need to assess their nutritional status, not on perceived difficulties with their inclusion in the survey sample.



Solution: Include infants under 6 months of age in the survey target population if there is reason to believe that they are unusually vulnerable to malnutrition.

GATHER BACKGROUND INFORMATION NECESSARY FOR CARRYING OUT THE SURVEY AND MEET WITH COMMUNITY LEADERS, LOCAL AUTHORITIES AND ORGANIZATIONS THAT MAY BE CONCERNED WITH NUTRITION

Many types of information are necessary to plan a nutrition survey, and a good variety of it can be garnered from discussions with community leaders and health care workers, from reports of prior assessments, or from other sources. The logistics of planning a survey often can be a more time-consuming process than it would appear. It is very important that this planning phase is comprehensive and well developed: the positive effects will be apparent once the survey is underway. To begin designing the survey, it is advisable to gather the following information:

- 1) To calculate the sample size, it is necessary to obtain either data on the most current estimate of the prevalence of malnutrition or information that can be used to estimate this prevalence.
- 2) To determine which sampling method to use, it is necessary to obtain information about what data are available at the local, regional and national levels.
- 3) To carry out the first stage of multi-stage cluster sampling, it is often necessary to identify local geographic units with corresponding population size.
- 4) To calculate the number of households to be selected in order to obtain data on the required number of children and women, the average number of women and children per household is necessary.
- 5) To construct a local calendar used to estimate children's ages in populations where date of birth is frequently not known, it may be necessary to obtain information on seasonal and historical events.
- 6) To establish referral systems for severe malnutrition, information on nutrition programs and health infrastructure will be needed.
- 7) And to aid in planning everything from the survey teams' work to the time schedule to the geographic areas selected for the survey sample, maps are of course necessary.

It is absolutely essential to meet with community leaders and local authorities during the survey planning process and data collection. During your visit you should:

- 1) Make sure the community fully understands the objectives of the survey. If the population does not understand why you are doing a survey, they may not cooperate with data collection.
- 2) Agree on the dates of the actual survey with the community and local authorities to avoid conflict with other community activities, such as major holidays, market days or food distribution days.
- 3) Obtain information on security and access in the survey area.
- 4) Obtain letters of permission from the local authorities, addressed to the district or village leaders, stating that you will be visiting. The letters should explain why you are conducting a survey and ask for the population's cooperation.

Of course, national and local government officials should be consulted regarding the necessary permits and clearances. Ethical review by an institutional review board may be required for survey procedures. Some countries require permits for research and may define any survey data

collection as research. In addition, specific export permits may be required to remove biologic specimens from the country if laboratory testing is to be done elsewhere (such as in the case of testing for some micronutrient deficiencies).

5. DETERMINE THE APPROPRIATE SAMPLING METHOD

Although there are many ways to choose samples, the methods broadly fall into one of two categories: non-random sampling and random sampling. Non-random sampling does not guarantee a sample representative of the larger populations and is rarely used in epidemiologic studies or surveys. For these reasons, it will not be further described in this manual. In contrast, random sampling very frequently is used to select samples for surveys. Random sampling is defined as sampling where (1) the selection of each unit is done at random, and (2) the likelihood that any one unit is selected is finite and calculable. This means that, if you are selecting a random sample of households from a population, you could calculate the probability that any specific household in that population will be chosen for the sample.

Definitions

To discuss the various sampling methods, some terminology must be defined:

- **Sampling universe** - the entire group of sampling units (commonly households or persons) who are eligible to be included in the survey sample. This population should match the population for which you are trying to estimate the outcomes measured in the survey. For example, if a survey is to be done in a province in order to estimate what proportion of households have a safe water supply, the sampling universe would be every household residing in that province on the day sampling is done.
- **Sampling frame** - the list of all the sampling units from which you will choose your sample. The sampling frame should match the sampling universe as closely as possible; however, in some surveys, it does not match completely. For example, if a telephone survey wants to determine what proportion of adults have arthritis, the sample may be selected from persons listed in directory assistance. As a result, an adult who does not have a telephone cannot be included in the sample, even though the sampling universe includes all adults in the population.
- **Sampling unit** - the unit that is selected during the process of sampling. If you select households from a list of all households in the population, the sampling unit is the household. If you are selecting districts in the first stage of cluster sampling, the sampling unit at the first sampling stage is district.
- **Basic sampling unit or elementary unit** - the sampling unit at the last stage of sampling. In a multi-stage cluster survey, if you select first villages, then select households within selected villages, the basic sampling unit would be household.
- **Sampling fraction** - the proportion of all sampling units in the sampling frame which were selected or will be selected for the sample. If you want a sample of 100 households from a list of 10,000 households, the sampling fraction is. $100 \div 10,000 = 0.01$ Thus, one of every 100 households in the sampling frame is selected for the survey sample.

- **Sampling interval** - the inverse of the sampling fraction. This is used when carrying out systematic random sampling. For example, in the example above, the sampling interval would be 100. If you are selecting households by walking down the street and selecting every 100th household, you would count households until 100 is reached and include that household in the sample. Then you would continue counting until the 200th household is reached and include that household in the sample, etc.
 - **Respondent** - the person who answers the questions during an interview.
 - **Survey subject** - the person about whom data are collected in the survey.
- If the survey is collecting dietary information on young children, the children are the survey subjects, but the respondent is probably the child's mother or other adult caretaker who answers the questions during the interview.
- **Unit of analysis** - that unit for which the data are analysed. In the example above where dietary data are obtained for young children, the unit of analysis would be children. However, if you calculated the proportion of mothers providing adequate complementary feeding to their children, the unit of analysis would be mothers. If you calculated the proportion of households in which children were provided with adequate complementary feeding, the unit of analysis would be the household.

Example 3.1 Application of terminology to a hypothetical survey

As an example, a hypothetical two-stage survey is conducted in a province. The sample size for the survey is 500 households out of 100,000 households in the province. Villages are selected using the PPS methodology (described later) from a list of all possible villages in the province. Households are then randomly selected from a list of all the households in each selected village. In each selected household, the head of the household reports on how frequently meat is served to the mother of any young children in the household, and each child 6-59 months of age is weighed and measured. The elements of this survey are as follows:

- The **sampling universe** for the whole survey is all households in the province at the time of the survey.
- The **sampling frame** for the first stage of sampling is the list of all villages in the province from which the sample of villages is chosen. The sampling frame in the second stage of sampling consists of the list of households in each selected village.
- The **sampling unit** is the village.
- The **basic sampling unit** is the household.
- The **sampling fraction** for the whole survey is 0.005 ($500 \div 100,000$).
- The **sampling interval**, if systematic random sampling was used to choose households directly from a list of all 10,000 households, would be 200.
- The **respondent** for the question about meat is the head of the household.
- The **survey subject** for the question about meat is the mother of a young child.
- The **unit of analysis** when calculating the proportion of mothers who get meat at least once a week is mothers.
- The **survey subject** for the anthropometric measurements is the child 6-59 months of age.

SELECTING A SAMPLING METHOD

The decision about which to make the basic sampling unit (children or households) depends on what information is available before beginning the sampling. For example, some villages or refugee camps may have lists of children under 5 years of age. In such cases, it may be easier to directly select children to assess. However, in most places, the basic sampling unit will be the household because households may be listed in registration databases or because households are easier to identify and select after arrival in a village or camp.

Systematic or Simple Random Sampling (SRS)

Different sampling techniques are more appropriate in different situations. If a complete list of sampling units (households or children) is available for the

entire population, you can choose a sample by systematic or simple random sampling. In SRS, individual basic sampling units are chosen directly from a list of all eligible basic sampling units. These techniques will be described further.

Systematic random sampling can also be done on the ground without having a list of all basic sampling units. If the actual shelters are arranged in some order and the total number of households in the sampling universe is known, then a sampling interval (n) can be calculated to obtain a certain sample size and every n th household can be selected by walking or driving through the population and counting houses. Figure 3.1 shows a photograph of a refugee camp in which this technique was used to select a sample, even though there was no paper or computer list of all households.



Figure 3.1 Cegrane Refugee Camp in Macedonia, May 1999.

Cluster sampling

Cluster sampling is a sampling method in which the first sampling step involves selecting collections of persons or households instead of sampling households or persons directly. If there is no list of all the sampling units in the population and the houses are not placed in a regular order, you may have to do cluster sampling.

For example, you may choose a sample of villages in a province as the first stage of sampling because there is no sampling frame for the entire sampling universe; that is, there is no list of households for the entire province. Once you arrive at each selected village, you then select a sample of households within that village.

Cluster sampling is done very frequently. It allows random sampling in situations where simple or systematic random sampling of households either is not possible or is inefficient. However, as described later, cluster surveys often need larger sample sizes because they are inherently less precise than surveys of the same sample size done with simple or systematic random sampling.

Another distinct advantage of cluster sampling occurs when sampling a widely dispersed population such as rural households. In cluster sampling, all the basic sampling units, such as households, are grouped together into clusters, so that the distance between basic sampling units within a cluster can be small. The only long-distance travel of the survey teams is between clusters. If simple or systematic random sampling were used, each basic sampling unit might be quite far apart, resulting in substantial travel to visit each one.

6. CALCULATE SAMPLE SIZE

Sampling error, confidence intervals, precision and P values

To discuss sample size calculations, one must understand some additional concepts. Most surveys which measure the prevalence of malnutrition or mortality rates actually measure the nutritional status of a sample of children and mortality in randomly selected households chosen from the population of concern. There will always be some difference between the survey results and the population from which the sample was selected. For example, if many samples are selected of 6 persons from a room which contains 10 men and 10 women, samples will sometimes contain 3 men and 3 women, but might also contain 4 men and 2 women, 2 men and 4 women and sometimes even 1 man and 5 women or 5 men and 1 woman. Samples which are very different from the entire population are much less likely to be randomly selected than samples which are similar to the entire population. The difference between the result calculated from a sample and the true value for that outcome in the entire population is called sampling error. Of course, we are usually doing a survey because we don't know the results for the entire population, so we usually cannot compare the survey results to the population results.

The size of the **sampling error** can be measured and expressed in many ways. The standard error is one such measure of sampling error; however, the most common method used when presenting survey results is confidence intervals (sometimes called confidence limits). If a survey were repeated many times with the same sampling methods and the same sample size, 95 percent of the **confidence intervals** around mortality rates or malnutrition prevalence calculated from these surveys

would include the true population value. Thus, the 95 percent confidence interval is an expression of how certain we are that the actual result in the population is similar to that obtained from a survey.

For example, a survey estimates a prevalence of wasting of 8.7 percent among young children, with a 95 percent confidence interval of 7.1 percent - 9.5 percent. We are then 95 percent sure that the true prevalence of wasting in the population in which the survey was done is between 7.1 percent and 9.5 percent. There is a small probability that the prevalence is less than 7.1 percent or greater than 9.5 percent. The confidence interval is often presented as an interval, but it can also be written as $\pm X$ percent. This type of expression is often seen in newspaper accounts of the results of a public opinion survey. For example, a report may say that 68 percent ± 3 percent of people favor a certain policy. This means that the confidence interval for the estimate of 68 percent is 65-71 (68 - 3 through 68 + 3). Note that one must be very careful to determine if \pm component is the confidence interval, a standard error or a standard deviation.

Precision, that is, how similar the results would be if a survey were repeated over and over, is measured by the sampling error. If the confidence interval is wide, sampling error may be responsible for a substantial difference between the result obtained by a survey and the actual value in the population. In contrast, if the confidence interval is narrow, we know that if the same methods were used in repeated surveys, the results would be quite similar. In general, in the absence of bias, the larger the sample, the closer the survey estimate of malnutrition prevalence or mortality will be to the actual value in the population. Precision is increased, and

the confidence interval narrowed, with larger sample sizes. This means that, all other factors being equal, the larger the sample size, the narrower the confidence interval and the more certain we are that the survey result is close to the actual population value. Therefore, statistically speaking, the larger the sample size, the more certain we are that the survey result is close to the actual population value. However, it takes more time, money, personnel and other resources to measure more children or ask more households about mortality. As with most things in life, there are trade-offs. In this case, the trade-off is between more certainty in the result and spending more money and time doing the survey. However, we can decide how much certainty we want, or conversely, how much uncertainty we will be comfortable with. On that basis, we can then calculate how many children or households will be included in the survey to obtain the desired level of precision, thus saving resources. Statistical equations and computer software can calculate the precise sample size needed to achieve a given degree of sampling error in the results of the survey, therefore saving survey managers from having to include too many people in the survey.

When one is interested in knowing whether there is a statistically significant difference between two survey estimates, frequently a statistical test is applied and a P value calculated. The **P value** is the probability that the two estimates differ by chance or sampling error. As a general convention, if the P value is < 0.05 , we would state that the two estimates are statistically significantly different from one another. If the P value is > 0.05 , then we would state that there is no statistically significant difference between the two estimates. The P value is calculated assuming that there is no bias in the estimates.

For example, suppose that a baseline survey found a 50 percent prevalence of anaemia among young children before an intervention, and a follow-up survey found 40 percent prevalence in this same group after the intervention. It may be possible that this difference is due only to the random selection of different children for the two samples from a population in which there had been no change in the prevalence of anaemia. In this case the intervention probably had no effect. However, if we know that the P value for this difference is <0.01 , then we know that there was less than a 1-in-100 chance that this difference was due only to sampling error. Therefore, we could conclude with some certainty that, in the absence of bias, the difference between the two survey results is real and that the prevalence in young children in the entire population has declined between the two surveys. In general, if the precision of the two surveys is high (that is, the sample size is sufficiently large), the likelihood of the difference being due only to sampling error is decreased. The selection below describes how to calculate the sample sizes for two surveys when the intention is to demonstrate some level of difference between them.

Bias

Sampling error is not the only source of difference between a survey's result and the actual population value. As described above, sampling error is due to the random selection of children or households from the population. Sampling error cannot be eliminated entirely, but it can be minimized by selecting a larger sample and its extent can be calculated based on statistical theory. Unfortunately, bias cannot be calculated. Bias is anything other than sampling error that causes the survey result to differ from the actual population prevalence or rate. Examples of bias might include:

- 1) The survey workers systematically measured the height of each child as 2 cm taller than they really are. As a result, each child's weight-for-height Z-score would be underestimated by a small amount, thereby causing an overestimate of the prevalence of wasting.
- 2) Survey respondents misunderstand questions about mortality in their households. They tell survey interviewers, for example, that persons who left the household are dead, when in fact the respondent does not really know whether or not they are dead. This would result in an overestimate of the mortality rate, thus increasing the difference between the mortality rates calculated from the survey results and the actual population mortality rate.

Unlike sampling error, bias cannot be calculated by the computer after data collection is finished. Therefore, it is very important to avoid or minimize bias during sampling and data collection. You do this by standardizing measurement techniques, training survey workers well, writing clear questions to be asked of survey respondents and through other techniques. Although a full description of the many sources of bias is beyond this manual, survey workers must be very diligent to avoid bias.

SAMPLE SIZE FORMULAS

The sample size is the number of units of analysis (for example, children 6-59 months of age or women of childbearing age) or the number of basic sampling units (for example, households) required for the survey. Calculating the required sample size will allow you to include only the necessary number of children, women or households in the survey.

Sample size for simple or systematic sampling

If simple or systematic sampling is done, sample size calculation depends largely on two factors:

- 1) The estimated prevalence of the outcome being measured (p in the formula below)
- 2) The precision you desire for your estimated prevalence (d in the formula below)

The formula used to calculate sample size for simple or systematic sampling is:

$$1.96^2 \times \frac{p \times (1-p)}{d^2}$$

The values for p and d must be expressed as decimals. For example, if you expect to find that 10 percent of children have malnutrition, then $p = 0.10$. If the precision desired equals ± 5 percentage points, then $d = 0.05$. In this example, the sample size would be:

$$1.96^2 \times \frac{0.10 \times [1 - 0.10]}{0.05^2} = 138.2 = 139$$

Sample size for mortality estimates

Calculating sample size for mortality measurement is essentially the same process. The actual calculation of sample size can be done using computer programs specifically written to calculate sample size for mortality rates (SampleRate is one example of such a program; it is available at <http://www.brixtonhealth.com/index.html>). Alternately, the sample size can be calculated as if the mortality rate were a proportion or percentage. That is, you make an assumption regarding the mortality rate in the population on interest, just as you would make an assumption regarding the

prevalence of malnutrition. Then you calculate what proportion of the population would have died during the recall period to obtain this rate.

For example, you assume that the crude mortality is 2 deaths per 10,000 persons per day. This is equivalent to 2 persons dying each day in a population of 10,000, or 0.02 percent of the population dying each day. If, for example, you wish to start the recall period with a well-known holiday which produces a recall period of 107 days, then 2.14 percent of the population would die in 107 days (0.02 percent \times 107). This is the “prevalence” of death in the population. Therefore, in the formula for sample size calculation, “ p ” equals 0.0214 and “ $1-p$ ” = 0.9786. Next, you must convert the desired precision, that is, the confidence intervals, into “prevalence.” In the example above, if you want a 95 percent confidence interval of ± 0.5 death per 10,000 per day, you convert 0.5 death per 10,000 per day into a “prevalence.”

Using the method described above, 0.5 death per 10,000 per day would mean that 0.005 percent of the population would die each day. During the 107-day recall period, 0.535 percent of the population would die (0.005 percent \times 107). Therefore, the “ d ” in the sample size equation equals 0.00535. The sample size for simple or systematic random sampling would then be:

$$1.96^2 \times \frac{0.0214 \times (1 - 0.0214)}{0.00535^2} = 2811 \text{ Person}$$

If households will be sampled for the survey, then this number is divided by the average number of persons per household. For example, if the average household size is 5.5 persons, then the survey sample should contain at least 511 households (2811 / 5.5).

Sample size for cluster sampling

For cluster sampling, another factor must be taken into account when calculating sample size. A measure called the “design effect” must be included because, for a given sample size, cluster sampling usually results in less precision than simple or systematic random sampling. Essentially, the design effect tells you how much larger the sample size must be with cluster sampling to get the same precision as simple or systematic random sampling. Therefore, once the sample size is calculated as above for simple or systematic random sampling, it must be multiplied by the assumed design effect to get the sample size appropriate for cluster sampling.

$$1.96^2 \times \frac{p \times (1-p)}{d^2} \times \text{DEFF}$$

If we use the example above, with an assumed malnutrition prevalence of 10 percent ($p = 0.10$), precision of 5 percent ($d = 0.05$) and a design effect of 1.5 (DEFF = 1.5), the equation must be multiplied by 1.5:

$$\left[1.96^2 \times \frac{0.10 \times (1-0.10)}{0.05^2} \right] \times 1.5 = 207.4 = 208$$

HOW TO MAKE ASSUMPTIONS NEEDED FOR SAMPLE SIZE CALCULATION

One of the most difficult aspects of determining a sample size is deciding what values to include in the formula for precision, the prevalence of the outcome and the design effect. Below is some guidance for making these assumptions.

Precision. If survey workers want greater precision, the sample size must be larger, as described above. To determine just how much precision you need, you must consider what question the survey is designed to answer. If a survey is meant to determine whether there is a

large problem with malnutrition, then you may not need much precision. On the other hand, if you will compare this survey to a baseline or a follow-up survey, you may want much more precision to ensure that a difference detected between the two surveys has statistical significance. Also, if precise subgroup estimates are needed, such as males vs. females, or by age, then a larger sample size would be required. In fact, desired precision and expected prevalence are interconnected. Therefore, if you expect a high level of malnutrition or mortality in the population to be surveyed, you will have to use a larger sample size to achieve a given precision.

However, you often will not need such high precision for common outcomes or indicators. For example, if the prevalence of stunting is 50 percent, there may be no programmatic decision which would change if the prevalence were 45 percent or 55 percent, so very narrow confidence intervals may not be necessary; ± 10 percentage points may be sufficient. On the other hand, rarer outcomes may need greater precision. If the prevalence of wasting is estimated to be 10 percent, confidence intervals of ± 10 percentage points would not be very useful. This would mean that the true prevalence of wasting is somewhere between 0 percent and 20 percent. The difference here is significant: 0 percent is excellent and no additional feeding programs are needed, while 20 percent is a catastrophe, requiring widespread food aid and supplementary and therapeutic feeding programmes. To distinguish between these possibilities and make programmatic decisions, you will need much greater precision, such as ± 3 or ± 4 percentage points so that the confidence interval is 7 percent - 13 percent or 6 percent - 14 percent.

The important point is that there is no standard precision to be used, nor any way to calculate the desired precision. You must consider why the survey is being conducted and what questions need to be answered. Then think about possible results and whether wide confidence intervals will be acceptable when making program decisions.

Expected malnutrition prevalence or mortality rate

You can use various techniques to obtain a gross estimate of the prevalence of malnutrition or the rate of mortality before you conduct a survey. Surveillance data, for example, may include counts of the number of children presenting to clinics with malnutrition or the number of deaths. A prior survey may have estimated these outcomes, and persons who have worked in this population since that survey may be able to give you a general idea if malnutrition or mortality have changed since that survey. An overall impression of the extent of malnutrition or mortality also can be obtained by more qualitative means. You can ask health workers if they see many thin children, or you can ask religious leaders if they recently have been called upon to conduct more than the usual number of funerals.

In general, a prevalence of wasting of 20 percent is very high. In such a situation, you will have already received many reports of serious malnutrition while organizing the survey. The traditional 30 x 30 survey assumes a prevalence of 50 percent, a level of wasting seen only very rarely in the worst emergency situations. However, if you have only the most imprecise estimate of the prevalence of malnutrition, use an estimate closer to 50 percent than you think is the true prevalence. This will overestimate the sample size required, ensuring that you have a

large enough sample size to get the needed precision.

Design effect is a measure of how evenly or unevenly the outcome (for example, wasting, stunting, anaemia, or mortality) is distributed in the population being sampled. For example, if you think that malnutrition is about the same in all parts of the population, then the design effect is probably low. In many populations, the design effect for malnutrition is usually in the range of 1.5-2.0. On the other hand, if you think an outcome such as mortality is quite different in different parts of the population, then the design effect may be quite high. For example, in emergencies where violence causes a large proportion of deaths and the violence is not evenly distributed, the design effect can be in the range of 4-10.

Probably the best source for estimates of design effect are prior surveys done in the same or similar populations. However, because the design effect changes with the number of units of analysis in each cluster, design effects from prior surveys should not be used in the calculation of sample size for a survey which will have a very different cluster size. In general, the greater the number of units of analysis in each cluster, the larger the DEFF. There are some published papers which can give some indication of the range of possible design effects for various outcomes other than the prevalence of wasting and mortality rates.

Sample size calculation accounting for non-response

Sample size calculations should also account for non-response. If we assume that, at most, 10 percent of households will be gone or will refuse participation, then we must select enough households for the initial sample so that, if we lose 10 percent of selected households to

$$\frac{\text{Number of households with data}}{(1 - \text{Nonresponse rate})} = \text{Number of selected households}$$

non-response, we will still have enough to obtain our desired precision. This can be calculated using the following formula:

is shown in the table below and the largest sample size is used in order to ensure that all outcomes have an adequate sample size.

Thus, if the non-response rate is 10 percent (or 0.10 in decimal format), then the number of households to be selected in the example above is:

This table shows that in order to obtain at least 305 children and 415 women for the survey, data must be collected from at least 415 households.

$$\frac{415}{(1 - 0.1)} = 461$$

Sample size calculation for detecting the difference between two surveys (before commencing the first survey)

Assuming a 10 percent non-response, if 461 households are invited to participate in a survey, 415 would agree to participate.

If a survey is designed with the specific intention of comparing it to another survey which will follow it (i.e., baseline and follow-up surveys), the calculation to determine the necessary sample sizes in order to detect a statistically significant difference between two surveys is different than the regular sample size calculation.

Sample size for multiple outcomes

Most surveys measure more than one outcome. In such cases, the sample size for each outcome should be calculated. An example

Table 3.1 Sample size calculations based on varying outcomes

Target group and type of malnutrition	Estimate from prior surveys (%)	Assumed current value (%)	Precision desired (%)	Design effect assumed	Sample size needed
Children 6-59 months					
Wasting (< -2 SD)	3.7	5	± 3	1.5	305
Stunting (< -2 SD)	39.2	50	± 10	2	193
Anaemia (<11.0 g/dL)	48.5	50	± 10	2	193
Women of childbearing age					
Malnutrition (BMI <18.5)	Not available	10	± 5	3	415
Anaemia (<11 g/dL)	53.5	50	± 10	2	193

SD = standard deviation; BMI = body mass index

The two surveys may be done to compare the current situation in two different populations or they may be done to detect change over time in the same population. Note that this process produces a sample size sufficient only to make an overall estimate for the entire survey sample. If separate estimates are needed for subgroups within the sample, such as estimates for urban and rural dwellers or males and females, the calculated sample sizes apply to only one such group. The entire survey sample must be a combination of the sample sizes calculated for each group.

This table shows that at least 305 children 6-59 months are needed and at least 415 adult women are needed. However, because in most surveys you will be sampling households, you must now calculate how many households must be included in the survey to obtain the required number of children and women as shown in Table 3.2.

This table shows that in order to obtain at least 305 children and 415 women for the survey, data must be collected from at least 415 households.

Sample size calculation for detecting the difference between two surveys (before commencing the first survey)

If a survey is designed with the specific intention of comparing it to another survey which will follow it (i.e., baseline and follow-up surveys), the calculation to determine the necessary sample sizes in order to detect a statistically significant difference between two surveys is different than the regular sample size calculation. The two surveys may be done to compare the current situation in two different populations or they may be done to detect change over time in the same population. Note that this process produces a sample size sufficient only to make an overall estimate for the entire survey sample.

If separate estimates are needed for subgroups within the sample, such as estimates for urban and rural dwellers or males and females, the calculated sample sizes apply to only one such group. The entire survey sample must be a combination of the sample sizes calculated for each group.

Table 3.2 Sample size household calculations

Target group and type of malnutrition	Sample size needed	Number of persons in target group per household	Number of households needed
Children 6-59 months		1.1	
Wasting (< -2 SD)	305		277
Stunting (< -2 SD)	193		175
Anaemia (<11.0 g/dL)	193		175
Women of childbearing age		1.0	
Malnutrition (BMI <18.5)	415		415
Anaemia (<11 g/dL)	193		193

SD = standard deviation; BMI = body mass index

The assumptions you need to make before calculating the sample sizes include:

- 1) The estimated prevalence of the outcome being measured in one survey (p_1 in the formula below)
- 2) The estimated prevalence of the outcome being measured in the other survey (p_2 in the formula below)
- 3) The design effect for the two surveys (DEFF in the formula below)

$$n = DEFF \times \frac{6.175 \times [p_1(1-p_1) + p_2(1-p_2)]}{(d)^2}$$

The formula is:

In this equation, 6.175 is the z value assuming that the P value of significance is 0.05 and the power required is 0.8. This equation also assumes that you will have equal sample sizes for both surveys and that you are calculating these sample sizes before performing the first survey. Remember that the difference between the two surveys' results ($P_1 - P_2$) is the minimum difference which can be detected with statistical significance. Any difference greater than this found after the two surveys have been done will, of course, be statistically significant.

For example, you assume that a baseline survey done before an iron supplementation program is begun will find that 50 percent of non-pregnant women of childbearing age will be anaemic. You wish to detect a statistically significant difference of 7 percent or more in the prevalence of anaemia in this group when you do a follow-up survey three years later. How big should the sample size be for the two surveys? The prevalence in the first survey (P_1) equals 0.5, the prevalence in the second survey (P_2)

equals 0.43, the design effect is assumed to be 1.5, and the difference between the two prevalence rates is 0.07.

$$n = 1.5 \times \frac{6.175 \times [0.5(1-0.5) + 0.43(1-0.43)]}{(0.07)^2} = 467$$

Therefore, each survey sample must include at least 463 women of childbearing age to be able to detect a statistically significant difference of 7 percent or more in the prevalence of anaemia with statistical significance.

Because many statistical analysis programs for computers can calculate sample sizes for both single surveys and the comparison of two surveys, it is rarely necessary to calculate sample sizes by hand. It is recommended that survey managers identify such a program which they can learn thoroughly and use for each sample size calculation.

Sample size calculation for detecting the difference between two surveys (after an initial survey has already been completed)

If a survey is designed with the specific intention of comparing it to another survey which has already been completed (i.e., a follow-up survey), the calculation to determine the necessary sample sizes in order to detect a statistically significant difference between two surveys is different than the regular sample size calculation. This calculation is substantially more complex, and a survey statistician should be consulted for assistance. A computer program may be available soon to perform this type of calculation. When completed, it will be made available from the Nutrition Service at WFP headquarters.



COMMON MISTAKE #5:

Always using cluster sampling, even if simple or systematic random sampling is possible.

Explanation: Some people tend to use cluster sampling in all situations because that is what they are accustomed to or that is what their organization recommends. However, cluster sampling usually requires a larger sample size to get the same precision, which in turn requires more survey workers, more time and more resources to complete the survey. Therefore, it is much more efficient to use systematic random sampling when conditions permit, such as when there is a list of all the sampling units or the arrangement of dwellings in neat rows.



Solution: Choose the most efficient sampling method on the basis of the data available on the population of interest.

7. SELECT THE SAMPLE

Once the type of sampling is selected and the desired sample size is determined, the children or households to include in the survey can be selected. These sampling methods are covered in more detail in many books listed in the reference section. A summary description is presented below:

Simple random sampling

Simple random sampling is the process in which each sampled unit (child or household) is selected one at a time from a list of all eligible sampling units. Simple random sampling can be done many ways, but it requires a complete list of all the basic sampling units in the population.

a) The prototypical method for simple random sampling is to write the name of each household or child on a piece of paper, then put all the pieces of paper in a bowl and randomly select as many pieces of paper as the number of households or children needed for the survey. Of course, if there are 10,000 households in the population, it would take a very long time to write the names of the households on 10,000 pieces of paper.

b) Another way would be to number the households. Then random numbers between 1 and the total number of basic sampling units could be selected from a random number table or generated on a calculator or computer. The household with the same number as the random number would be included in the sample. The quantity of random numbers selected equals the desired number of sampling units, as determined by the sample size calculation.

Systematic random sampling

Systematic random sampling is an alternate way to select a random sample. It may be much easier when the population is large. Systematic random sampling selects one household at random, then selects every n th household thereafter, where “ n ” equals the sampling interval. The sampling interval is the total number of sampling units in the population divided by the desired sample size. The first household is selected by choosing a random number between 1 and the sampling interval. Then the sampling interval is added to that number to select the next sampling unit.

For all subsequent selections, the sampling interval is added until the end of the list of sampling units is reached. For example, if there are 10,000 households in the population and a sample of 1,000 households is needed, the sampling interval is 10 (10,000 divided by 1,000). A random number between 1 and 10, the sampling interval in this example, is chosen to select the first household. Let us say that 3 was the random number. The second household is selected by adding the sampling interval of 10 to the random start of 3 to choose household number 13. Then 10 is added to this number to select household number 23, and so on.

Systematic random sampling can be done with a list of all sampling units either on paper or on a computer. You can also arrange the sampling units, such as households, in a pattern so that they can be easily counted on the ground. For example, in Cegrane Camp in Figure 3.1, the desired sample size was 350 households. The camp contained 5,263 households; therefore, the survey team needed to include in the survey sample every 15th household ($5,263 \div 350 = 15$). The team chose a random number between 1 and 15 inclusive to select the first tent, then beginning in one corner of the camp, counted tents along the first row until that number was reached. This was the first tent selected for the survey. Then proceeding down that row and subsequent rows of tents, the survey team counted each tent and selected every 15th tent to include in the survey. The team did not have a list of all households in Cegrane Camp, but because the tents were in rows that were easily counted, a systematic random sample could be selected easily.

However, as mentioned above, in many populations, no list of all children or all households exists, and the dwellings are not arranged in neat rows.

In such populations, survey workers may need to do cluster sampling. Many organizations, especially those working in emergency situations, are very familiar with cluster sampling.

Cluster sampling

Cluster sampling is used in large geographically disperse populations, where no accurate list of households is available for the entire population and households cannot be visited systematically. This is the most common situation in most populations. Cluster sampling is often more convenient and uses fewer resources for transport than simple random sampling because a cluster design reduces the distance the survey team has to travel between households. However, the sample size is usually larger than simple random sampling so that more households need to be visited.

With cluster sampling, the sampling is split into multiple stages. In most cluster surveys, there are two stages of sampling:

- 1) The first stage of sampling selects collections of persons or households, such as geographic areas within the population to be surveyed. These geographic areas may consist of political subdivisions, such as districts, subdistricts, census blocks or other defined areas. Alternately, in rural regions, the areas to be selected may be discrete concentrations of population, such as villages.
- 2) The second stage of sampling chooses, within each selected area, the households to be included in the survey.

Stage one: selecting the primary sampling unit

Cluster sampling requires the division of the population into smaller geographical units, such as city blocks, subdistricts or villages.

These geographic units may be referred to as enumeration areas, enumeration units, or other terms, and are usually available from the organization within the country responsible for the census. A sample of these geographic units, called primary sampling units (PSUs), is then selected in the first sampling stage. Although many texts and people use the word “cluster” to mean the same thing as PSU, they are not the same. The PSU is the geographic unit selected during the first stage of sampling. A cluster is the group of basic sampling units, usually households, chosen within a selected PSU. Therefore, when carrying out the first stage of sampling, you are selecting those PSUs in which a cluster will be selected; you are not directly selecting clusters.

Probability Proportional to Size (PPS)

When determining what to use as PSUs, the selection of smaller PSUs rather than larger PSUs will facilitate second stage sampling (see below). However, in order to use a geographic unit as PSUs, some measure of the relative size of each unit, most commonly the population or the number of households, must be known. For example, if a survey is done in a city, it would be better to use city blocks rather than larger neighborhoods as PSUs. In addition, each geographic unit should have at least the number of households required to form a complete cluster. Moreover, the geographic unit chosen to be PSUs must be mutually exclusive; that is, all households in the population being surveyed must be contained in one PSU and only one PSU.

The first stage selection of PSUs is done so that the chance of any specific PSU being selected is proportional to the size of that PSU relative to the entire population. This type of selection is called “probability proportional to size” or PPS. Thus, if one PSU has a population of 5,000 and another 1,000, then the former PSU has five times the chance of being chosen to contain a cluster as the latter PSU. This is the main reason why some measure of the size of each PSU is required.

PPS sampling is demonstrated schematically in Figure 3.2. Each row of boxes represents 6 PSUs from which we must select one randomly. Each PSU, A through F, is assigned to a box, and the population of that PSU is written inside that box. In the first row, the size of the box allocated to each PSU is equal. As a result, if we throw a dart randomly at the first row of boxes, the chance that PSU A will be hit is the same as the chance that PSUs B through F will be hit. As a result, each PSU has the same chance of selection as any other PSU. This is called selecting PSUs with equal probability. On the other hand, if we make the size of the box for each PSU proportional to the population of that PSU, as is done in the second row of boxes, the chances that a randomly thrown dart will hit PSU A is much smaller than the chance that it will hit PSU C, which has a much larger population. This results in PPS sampling; that is, the probability of selection for any single PSU is directly proportional to the size of that PSU relative to the sizes of all other PSUs.

	A	B	C	D	E	F
Not PPS	231	912	3,099	376	484	763
	A	B	C	D	E	F
PPS	231	912	3,099	376	484	763

Figure 3.2 Schematic demonstration of (1) equal probability of selection, and (2) probability proportional to size.

In practice, we cannot draw boxes for each of the PSUs from which the selection will be made in a real survey. Moreover, throwing a dart is not really a random way of making a selection. When carrying out sampling for a cluster survey, the following method is usually employed to select PSUs with probability proportional to size:

- 1) Determine the sample size using methods described above as if you were using simple or systematic random sampling.
- 2) Obtain the best available data on subdivisions of the populations which might be used as PSUs. You will need the size of each unit as well as the location of each unit. Census data from the national or local government offices often provide such information. In stable populations with little in- or out-migration, a census that is several years old may still be acceptable. In emergency situations, data may consist of population estimates or registration data in camps. Alternatively, if no population data are available, you can estimate the relative size of the population living in each PSU using data from key informants such as community leaders or health workers.
- 3) Create a list of PSUs with a column containing the measure of the size of each PSU. The order in which PSUs are listed is not important. [Usually it is recommended to sort on a variable of interest for implicit sampling, such as on rural/urban status, or by geographic areas.] What is important is that all PSUs be included on the list. Figure 3.3 gives a hypothetical example of a list of villages with the number of households in each village.
- 4) Add columns to this list which contain the cumulative population.

Imagine that you are numbering all the households in the entire population. In Figure 3.3, households number 1-600 are located in the village of Utural. Households number 601-1300 are located in the village of Mina, etc.

- 5) Determine the sampling interval. The sampling interval is the number of PSUs you will select divided by the total number of households in the population. For example, if you wanted to select 30 PSUs from the population listed in Figure 3.3, the sampling fraction would be $25,370 / 30 = 845.7$ H 845.
- 6) Select a random number between 1 and the sampling fraction. The village where this number household is located will be the first PSU containing a cluster. For example, if 399 is the random number, household number 399 is located in Utural, and the first cluster will be located in that village.
- 7) Add the sampling fraction to the random number selected above. The village where this number household is located will be the second PSU containing a cluster. For example, $399 + 845 = 1,244$. Household number 1,244 is located in Mina; the second cluster will be in this village.
- 8) Continue adding the sampling fraction to the previous number to determine where the remaining clusters will be located.

Some PSUs may be large enough to be selected more than once to contain a cluster. In such a case, when the survey team arrives at this PSU, they should select as many clusters from this PSU as indicated during the first stage sampling procedure. The selection of each cluster in a PSU with more than one cluster should be completely independent. The procedure for selecting households will be described below.

Figure 3.3 A list of hypothetical villages to be included in a cross-sectional survey

No.	Village name	Number of households	Cumulative number of households-Lower	Cumulative number of households-Upper	Cluster number
1	Utural	600	1	600	1
2	Mina	700	601	1,300	2
3	Bolama	350	1,301	1,650	
4	Talum	680	1,651	2,330	3
5	War-Yali	430	2,331	2,760	
6	Galey	220	2,761	2,980	4
7	Tarum	430	2,981	3,410	
8	Hamtato	150	3,411	3,560	
9	Nayjaff	90	3,561	3,650	
10	Nuviya	300	3,651	3,950	5
11	Cattical	430	3,951	4,380	
12	Paralai	150	4,381	4,530	
13	Egala-Kuru	380	4,531	4,910	6
14	Uwanarpol	310	4,911	5,220	
15	Hilandia	2,000	5,221	7,220	7, 8, 9
16	Assosa	750	7,221	7,970	
17	Dimma	250	7,971	8,220	10
18	Aisha	420	8,221	8,640	
19	Nam Yao	180	8,641	8,820	
20	Mae Jarim	300	8,821	9,120	11
21	Pua	100	9,121	9,220	
22	Gambela	710	9,221	9,930	12
23	Fugnido	190	9,931	10,120	
24	Degeh Bur	150	10,121	10,270	
25	Mezan	450	10,271	10,720	13
26	Ban Vinai	400	10,721	11,120	
27	Puratna	220	11,121	11,340	
28	Kegalani	140	11,341	11,480	14
29	Hamali-Ura	80	11,481	11,560	
30	Kameni	410	11,561	11,970	
31	Kiroya	280	11,971	12,250	15
32	Yamwela	330	12,251	12,580	
33	Bagvi	440	12,581	13,020	
34	Atota	320	13,021	13,340	16
35	Kogouva	120	13,341	13,460	
36	Ahekpa	60	13,461	13,520	
37	Yondot	320	13,521	13,840	
38	Mozop	1780	13,841	15,620	17,18,19
39	Mapazko	390	15,621	16,010	
40	Latozah	1,500	16,011	17,510	20,21
41	Voattigan	960	17,511	18,470	22
42	Plitok	420	18,471	18,890	
43	Dopoltan	270	18,891	19,160	23
44	Cococopa	3,500	19,161	22,660	24,25,26,27
45	Famegzi	400	22,661	23,060	
46	Jigpelay	210	23,061	23,270	28
47	Mewoah	50	23,271	23,320	
48	Odigla	350	23,321	23,670	
49	Sanbati	1,440	23,671	25,110	29,30
50	Andidwa	260	25,111	25,370	

How do you decide how many clusters should be selected? For a given sample size, the more clusters in the survey sample, the lower the design effect and the greater the precision obtained by the survey. However, a larger number of clusters often requires substantial additional logistic and transport costs because travel between clusters may be difficult or involve long distances. Determining the number of clusters to use in a survey therefore requires weighing the advantage of greater precision with the disadvantage of greater cost. Studies have demonstrated that, for a given overall sample size, having fewer than 25-30 clusters may lead to a high design effect and an unacceptable loss of precision. Adding more than 30 clusters often does not increase the precision enough to justify the additional cost. Consequently, many surveys use 30 clusters.

The size of clusters is determined from the number of clusters, as discussed above, and the sample size calculation. The total sample size is divided by the number of clusters to decide how many basic sampling units should be included in each cluster. For example, if sample size calculations determined that 450 households should be selected for a survey and 30 clusters were to be used, then each cluster would contain 15 households.

Stage two: selection of households to form the clusters

There are several methods of choosing the households within the selected PSUs.

1. *Simple or systematic random sampling*

The best way is to select households using simple or systematic random sampling, as described previously. Simple random sampling can be done using a complete list of all the households in the selected PSU. Village leaders sometimes have such a list available to keep track of tax obligations or for some other purpose. If there is no written list, village leaders or elders can often

tell survey workers the names of the heads of all the households in the village while survey workers write them down. When creating such a list, survey workers must be very careful to ensure that the informants have not forgotten any household in the PSU, such as households headed by women, households of poor people, households of ethnic minorities or others. Once a list is located or created, households can be numbered and random numbers used to select individual households for inclusion in the survey. Another method of random sampling within PSUs is to select households from the household list using systematic random sampling. Alternately, survey workers can draw a rough map of all the households within the PSU and then carry out systematic random sampling using the map to ensure that no households are missed by the sampling.

2. *Segmentation*

If the PSU is large enough to make the techniques above too time-consuming, the PSU can be divided into segments of roughly the same size. One of these segments is then chosen at random. In general, the segments should contain fewer than 250 households. These households then are listed and the required number of households is selected.

3. *EPI method*

If it is absolutely not possible to select the households using random or systematic sampling, then the sampling method frequently used by WHO's Expanded Programme on Immunization (EPI) can be used. While this method is simple, widely known and rapid, it may result in a biased sample. See Common Mistake # 7 for a more detailed explanation of this potential bias. To employ this method, the following procedures should be followed after arrival at the selected PSU:

- 1) Go to the center of the selected PSU. Local residents can help you locate the center.

- 2) Randomly choose a direction by spinning a bottle, 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 center to the edge of the village, counting the number of houses on the way.
- 4) Draw a random number between 1 and the number of houses counted on the line. Count the number of houses on the line from the center of the village; the house matching the randomly selected number is the first house to be included in the survey.
- 5) Include all children aged 6-59 months in this household for the nutrition survey and complete the mortality questionnaire.
- 6) Subsequent households are chosen by proximity. In a village where the houses are closely packed together, choose the next house on the right. If the village is less densely inhabited, choose the house with the door closest to the last house surveyed, whether it is on the right or left.
- 7) The original EPI method recommends that sampling continue until the required number of children have been enrolled in the survey.

In general, once a household is selected, all eligible persons in that household should be included in the survey. If there is more than one eligible person and only one is selected, this makes the likelihood of selection different for different persons and thus requires a weighted analysis. Such analysis is substantially more complex than an unweighted analysis and is best avoided by including all eligible persons from each selected household. For a more complete discussion of this issue, see Common mistake # 10 below.

Regardless of the method of selecting households, if there are two clusters located in the same PSU, their selection should be completely independent. For example, if you make a list of all households in a village, you should select one cluster by random

sampling, then select the households for the second cluster. The lists of households for each cluster should be kept separate.

Some potential operational problems

Implementation problems can arise in even the best-planned surveys. Typical among these are inaccessible clusters, non-response and an insufficient number of households in a given PSU to complete an entire cluster.

Inaccessible clusters

At times, it may be impossible to reach a sample cluster due to poor weather, impassable roads, insecurity or other reasons. Usually, the best recourse is to replace the cluster with another randomly chosen cluster with similar characteristics. For example, if the cluster in question is located in the far northern part of the area included in the survey, it should be replaced with another cluster in the same general area, but one that can be reached during the period of survey fieldwork. To minimize the risk of bias, replacement clusters should be chosen from among similar clusters; convenience should not be an issue. As far as possible, supervisory personnel should make decisions on replacement clusters.

Survey non-response

Non-response is an important issue in surveys. When households are selected, there may be non-response at two levels: (1) entire households may be missing or refuse participation, and (2) individuals within consenting households may refuse participation or be absent. The initial calculation of sample size should compensate for the predicted level of both types of non-response. This will help ensure that the final survey sample will have the required precision in spite of some non-response.

When no one is at home in a selected household, the survey team should inquire from neighbors whether the dwelling unit is inha-

bited and if so, where the residents are and when will they return. If they are to return before the survey team must leave the PSU, a message can be left that the survey team will return at a prearranged time. If the house is not occupied, no further action is required. No pressure should ever be applied to an individual within a selected household who refuses interview or biologic specimen collection.

Non-response can bias the survey results because people who participate in a survey may be systematically different than those who do not. These differences may be reflected in the indicators that are being measured. As a result, non-response should be minimized as much as possible by allowing adequate time to reattempt contact with absent hou-

sehold members. Moreover, the reasons for both household and individual non-response should be noted on data collection forms to allow the assessment of potential non-response bias during later data analysis.

Insufficient number of households

If possible, before selecting the sample of PSUs, survey managers should go through the list of PSUs to be sure each is large enough to select a complete cluster. If certain PSUs are not large enough, they can be combined with adjacent PSUs. If this cannot be done before sampling because the list is too long, another procedure can be followed in the field to complete a cluster. Once all available households are selected in a small PSU, selection of households can be continued in a neighboring PSU to complete the cluster.



COMMON MISTAKE #6:

Using 30 x 30 cluster sample size regardless of required precision for the survey.

Explanation: Many survey managers select a sample consisting of 30 clusters with 30 children or households in each cluster. Such a sample is often called “30 x 30” or “30 by 30.” Such sampling has also been recommended by many organizations in order to ensure sufficient precision when the survey is completed. However, in some situations, the 30 x 30 cluster survey provides more precision than is really needed. The 30 x 30 sample size assumes that:

- 1) the prevalence is 50 percent;
- 2) the desired precision is ± 5 percentage points;
- 3) the design effect is 2; and
- 4) 15 percent of households or children will refuse or be unavailable.

However, in most emergency-affected populations, the prevalence of acute malnutrition is much lower than 50 percent, far less than 15 percent of households refuse or are unavailable and the design effect may be less than 2.0. Therefore, for most nutrition surveys where wasting is the primary indicator of interest, the desired precision could be obtained with a sample size substantially less than the 900 included in a 30 x 30 survey. Survey workers could design a more efficient survey by making their own assumptions about the potential prevalence and design effect and by calculating a sample size necessary to achieve the precision they need, even if different from ± 5 percentage points.



Solution: Calculate the sample size which provides the desired statistical precision, but not more.



COMMON MISTAKE #7:

Selecting households using the EPI method for final-stage sampling instead of true probability sampling at this stage.

Explanation: Infants under 6 months of age often are not included in nutrition surveys for various reasons.

Other methods of selecting households may be less biased than the EPI method and should be used if possible. These include the methods described in this chapter about selecting the sample.

Why should the EPI method be avoided? The EPI sampling method uses proximity sampling, which means houses are selected according to their proximity or distance to the previous house. Proximity sampling may introduce bias into the sample. Figure 3.4 (below) represents a village with 30 households. The first house is often selected by spinning a bottle to choose random direction. Lines A and C represent the arc that makes house number 5 eligible to be the first house. Lines B and C represent the arc that would make house number 1 eligible to be the first house in the sample. The likelihood that a randomly chosen line falls into arc AC is much greater than the likelihood that such a line would fall into arc BC. As a result, house 5 is much more likely to be eligible to be the first house than house 1. In general, because houses in the center of the village are closer to the point of origin for the randomly chosen line, they are more likely to fall on this line.



Figure 3.4 Schematic of Village With 10 of 30 Households Selected by EPI

Houses also tend to be closer together in the center of most villages than at the periphery. Selecting the next closest house often moves the survey team toward the center of the village, thus making it more likely that houses in the center are selected for the sample. In Figure 3.4, if house 1 is selected as the first house, choosing the next closest house results in selection of houses 2-10. The circle includes the 15 more central houses in this village. Note that 7 (houses 4-10) of the 10 selected houses fall within the circle. In many places in the world, families living in the center

Continued on the next page

Continued from the previous page

of the village are different from families living at the edge of the village. Those in the center may be richer or of a different ethnic group. Families in the center may also be village leaders or may be merchants, whereas families at the edge may be farmers. If the nutritional status of these groups differs, the nutritional status of the children included in the sample may not be representative of the nutritional status of all children in the population.

In addition, the choice of which house is actually the closest is often unclear, allowing the survey workers to decide which house will end up in the survey sample. Survey workers should never choose households on any basis other than random selection. If two houses look equally distant from the last house in the sample, most workers will choose the house that looks nicer, doesn't have the angry dog in the front garden, or has no children so that data collection can be completed more rapidly. This adds yet another potential source of bias to the overall sample selection.

Finally, the EPI method of selection is not true probability sampling because you cannot calculate the probability that any one house in the village will be selected for the sample. True probability sampling requires that the total number of houses in the village be known so that this probability can be determined.

GO

Solution: Use a method for the final stage of sampling which produces a true probability sample.



COMMON MISTAKE #8:

Ending household selection after reaching target number of children, women or households for that cluster.

Explanation: The sample size should be calculated and adjusted for possible non-response. This sample size is then used to determine how many households should be sampled. The number of households then is divided by the number of clusters to determine how many households will be included in each cluster. You next should select this number of households in each cluster and attempt to gather survey data on all eligible members of these households. Do not stop gathering data in the cluster if you reach the desired number of children or women.

The EPI method recommends that survey teams select households until the desired number of children are recruited for the survey. Most of the time, for the sake of efficiency, survey teams will begin in one part of the village and move in a certain direction until they have completed survey activities in that village. If survey workers stop when the desired number of children is found, they may stop before reaching the remaining eligible households in the last part of the village.

GO

Solution: Determine how many households to select for each cluster by calculating the sample size, and then select and visit the predetermined number of households. Do not stop the survey before visiting all the selected households, even if the required number of eligible children has already been met.

**COMMON MISTAKE #9:**

Selecting only households with a child under 5 years of age if collecting information on other target groups or household-specific information.

Explanation: Since nutrition assessment surveys often include children 6-59 months of age as the main target population, some survey teams may wish to exclude households that do not contain an eligible child. However, some surveys may also measure nutritional status in other age groups, such as adult women, or they may measure mortality rates among persons of all ages or gather other household information, such as receipt of relief food or source of water.

Hence, households with children 6-59 months of age may not be representative of all households. And excluding households without eligible children might therefore bias other indicators being collected, particularly if the survey is measuring crude mortality. Households with young children tend to have young parents and small children; as a result, the mortality in such households may be less than average because the adults tend to be younger or, conversely, the mortality may be higher because young children are more likely to die than are older children and adults. Unfortunately, there is no way to determine which is true in any specific population and there is therefore no way to know in which direction the bias is operating. Thus, you cannot tell the true mortality rate in the population if mortality is measured only in households with young children.



Solution: Include all households selected for the survey sample, regardless of whether there is a child under 5 years of age.

**COMMON MISTAKE #10:**

Selecting only one child from surveyed households that have more than one eligible child.

Explanation: If you include all eligible children from each selected household, each child in the population will have the same chance of being included as the household in which the child lives. This is because once a child's household is selected for the survey, the child will automatically be included in the survey, regardless of whether there are other eligible children in that household. Therefore, because all households in the population have an equal chance of selection, all children in the population have an equal chance of selection.

In contrast, if you include only one child in a household with more than one eligible child, you have now changed the chances that children in that household will be included in the survey. In households with only one child, the child's chance of being included in the survey is the same as that household's chance, as explained above. If a selected household has two children, and you include only one child from that household, you have added another sampling step because you then must choose between the two children in that household. Therefore, each such child's chance of being included in the survey is equal to the chance that their household is selected, divided by 2, since you have to choose between the two children in that household. As a result, the likelihood that any specific child in the population is included in the survey sample is now different for different children in the population.

The ultimate goal of sampling is to obtain a sample of children that is representative of all children in the population being surveyed. If you include only one child in each selected household, the sample no longer will be representative of the population because it will contain a smaller proportion of children from multi-children households than does the population. A similar principle applies to women of reproductive age and other target groups.



Solution: Always select all eligible children in every household chosen for the survey.

8. DETERMINE THE SCHEDULE FOR THE SURVEY, AND OBTAIN AND PREPARE SUPPLIES AND EQUIPMENT

The exact dates of the survey should be chosen to determine when survey workers, supplies and equipment will be needed. You should consult with community leaders to help determine the best times to conduct the survey. That way, you can avoid conflicts between the survey and market days, local celebrations, food distribution days, vaccination campaigns, or other times when people may be absent. 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 testing, community mobilization, data collection, data analysis and report writing.

Moreover, you should take into account the seasonality of acute malnutrition and interpret survey results with this seasonality in mind. If results of a survey will be compared with those of a previous survey, try to conduct both surveys at the same time of the year so as to eliminate potential discrepancies associated with seasonal variation.

Once the sample size has been calculated, you can determine what type of supplies are needed and in what quantity. You should make a complete list of supplies and equipment required during the survey. For some equipment, such as height boards and scales, usually only one item is needed per team. For other supplies, such as lancets, alcohol wipes, HemoCue cuvettes, etc., at least one item will be

needed per survey subject tested. In addition to the equipment needed to actually take the measurements at each selected household, you will need:

- 1) stationery, such as data collection forms, pencils, erasers, clipboards and waterproof folders or pouches to store completed forms;
- 2) material needed for transport, such as fuel and spare parts; and
- 3) items needed for the survey team members, including food, blankets or sleeping bags, cots, water bottles, electric torches, etc.

The process of ordering or obtaining equipment and supplies must be started early; it always takes longer than you think. For material coming from outside the country where the survey will take place, you must take into account delays at customs and you often must pay duty on such imported items. Measuring instruments, such as scales, height boards and portable stadiometers, should be in perfect condition and tested regularly for accuracy. For example, during a survey, scales should be checked each day against a known weight. If the measure does not match the weight, the scales should be recalibrated, discarded, or the springs replaced.

9. DESIGN THE DATA COLLECTION FORM AND SURVEYOR'S MANUAL

The list of data to be collected by survey workers in the field must now be put into a workable format. This includes writing out the specific questions to ask survey respondents and creating specific places on the data collection form to record the data. The data collection form should be organized clearly to facilitate ease of use by survey workers in the field. The questions or

description of the data to be collected begin on the left side of the form and are numbered so that survey workers can easily find their place when interviewing a mother. All the data are written on the right side of the form so that the data entry person can scan down the form quickly while entering the information. It is important to keep data collection forms open and uncluttered so that survey workers can find each question easily during the interview and likewise can determine easily where to record each item of information. The codes to be typed into the computer should also be apparent on the form to ease data entry.

Items on the data collection form should be grouped according to the person from whom (or the source from which) the data will be collected. Questions posed to the caretaker come first, then all the data collected by examination of the child, then the anthropometric and laboratory measurements. For example, by listing all the questions for the mother in one section before listing the anthropometric measurements, the survey workers can complete the mother's interview before setting up the equipment to weigh and measure the child. Although the presence of oedema will be used when analyzing the anthropometry data, this

data need not be included with the anthropometric measurements on the data collection form. In fact, it is much easier to include it in the section on examination.

The data collection form also can be designed to make it easier to enter the data into the computer once field data collection is complete. The computer entry screen can be made to look as much as possible like the paper data collection form. Recording data in a column on the right or left side of the paper form allows the person entering data into the computer to scan down a column instead of searching on the form for each piece of data. An example of such organization is shown in Annex 4.

If possible, create a "surveyor's manual" as a guide for the survey teams while working in the field. Include details on how each item of data, including questions for household members, should be created. Such a manual could describe the sampling procedures to be followed at each cluster to help standardize household selection across clusters. It could also describe the technique for collection of biologic specimens or field laboratory testing methods.

**COMMON MISTAKE #11:**

Not writing questions in the language of respondents.

Explanation: Some information in nutrition assessment surveys is collected by asking questions of the mother or another household member. For example, dietary information, such as how often a child eats meat, is collected by asking the mother or other caretaker about a child's recent diet. To help ensure that all the survey workers ask the same question, these questions must be written down so that the same words are used by all survey workers for all interviews. If the questions are written in a language the survey respondents do not understand, the interviewer must translate each question into the language of the respondent. This mental translation may vary from one interviewer to another, or may even change for the same interviewer between households. As a result, a question may not be posed to all survey respondents in the same way, thus possibly causing different information to be gathered from the respondents.

Survey managers or team supervisors often do not speak the language of the survey respondents. In such cases, the questions can be written in more than one language so that interviewers may read the questions directly to respondents, and supervisors may understand what questions are being asked at which point.



Solution: Write the questions in the language that the survey participants understand.

**COMMON MISTAKE #12:**

Not back-translating questionnaire questions.

Explanation: Survey managers, especially expatriates or outside consultants, often do not speak the language understood by the survey respondents. They will prepare survey questions and data collection forms in their native language. This text then must be translated into the language of the survey workers and respondents. No single translation is perfect. Because the managers may not speak this language, they cannot judge the accuracy of the translation. To make such a judgement, the translated questionnaire then must be translated back to the language of the survey managers to determine the accuracy of the original translation. A different translator, who has never seen the original questions, should make this second translation. The two translators and the survey managers then should discuss any differences between the original version and the back-translation to decide how best to pose each question in the language of the survey respondents.



Solution: Always translate, then back-translate, the data collection form, especially those questions to be posed to survey respondents.

10. SELECT AND TRAIN SURVEY WORKERS

Make a list of all the tasks to be performed by survey teams when they go to the field to collect the survey data. This list may include:

- 1) interviewing household members;
- 2) measuring the weight and height of children;
- 3) measuring the weight and height of women;
- 4) examining children and women for signs of micronutrient deficiency; and
- 5) performing a fingerstick and measuring hemoglobin.

Next, decide what type of worker you will need to perform each of these tasks. When possible, hire someone with experience in taking anthropometric measurements to weigh and measure children. Survey workers with clinical training may be needed to examine children and women. You may wish to hire a laboratory technician to perform the fingersticks and operate the HemoCue and other serologic tests. One survey worker may be able to do more than one task. However, in some cultures, it may be unacceptable for men to weigh, measure and examine adult women; these workers may need to be female. Other cultural factors may also play a role in selecting survey workers.

Team members do not have to be health workers. In fact, health professionals such as physicians are sometimes more difficult to train because they have learned a different method of measuring or examining during their medical education. Persons from many backgrounds can serve as survey workers as long as they can endure the rigors of field work and are literate and able to count.

You will need at least three people per team, sometimes more. Each survey team

needs a supervisor who is responsible for the quality and completeness of data collection. The supervisor should check each completed data collection form at each household to be sure that all data have been collected and recorded correctly because it may be impossible to revisit households to correct errors after the team has left the cluster. The team also needs two individuals to perform anthropometric measurements and record the data on the data collection form. If testing for micronutrient deficiencies, the team may need an additional person who is trained in physical examination and the gathering of laboratory specimens. It may also be useful to have a respected community member on the team. This person can introduce the survey team to the population and help guide the team around the site.

The number of teams should be sufficient to complete data collection in the time allotted in the survey schedule. Having more teams than absolutely needed can be a disadvantage because more teams produce larger inter-observer variation. In addition, it is often difficult to supervise and organize a larger number of teams.

Survey team members should receive comprehensive training in the tasks they will perform as part of survey activities. All members performing a specific task should undergo the same training in that task, regardless of their former experience; this will ensure standardization of methods. The training for a survey usually takes 2 to 5 days and should include:

- 1) A clear explanation of the objectives of the survey.
- 2) An explanation of the sampling method. This should stress the importance of proper household and child selection to ensure a representative sample.
- 3) A demonstration and practice of

weight and height measurements. Each measurer should practice height and weight measurements and assessments of oedema twice on each of 10 children. Standardization of measurements among survey team members during training will help detect and correct errors in measurement technique before the actual data collection. Figure 3.5 shows one example of a spreadsheet with which to compare the measurements of the trainees.

- 4) An explanation and discussion of the questionnaire questions. This will ensure that the questions are phrased

correctly and that each interviewer understands what data the survey managers wish to collect with each question. Role play exercises are useful in practicing interviews.

- 5) A pilot test in the field. A pilot test is an essential component of the training and should test all the components of survey data collection under realistic conditions. Be sure that you visit a location that was not selected for the real survey but is similar to those sites actually selected. Data collected during the pilot test should not be used in the analysis of the survey results.

Figure 3.5 A spreadsheet for comparing height measurements among survey worker trainees

Standardization Exercise													
Data		Measures										Report	Mean
	Child	1	2	3	4	5	6	7	8	9	10		
4	Total measurement	A	87.3	87.1	87.0	87.3	87.1	87.3	87.0	86.6	87.9	87.3	87.35
5		B	81.6	86.1	86.3	86.6	86.5	86.0	86.7	86.3	86.8	86.3	86.30
6		C	77.9	77.1	78.3	78.3	77.8	77.6	77.4	77.8	79.8	78.3	77.80
7		D	80.1	80.5	80.1	80.7	80.6	80.4	80.3	80.3	80.8	80.7	80.60
8		E	83.0	83.1	83.1	83.4	83.1	83.0	83.7	83.8	83.3	83.4	83.30
9		F											
10		G											
11		H											
12		I											
13		J											
14													
15	Total measurement	A	87.1	87.1	87.1	87.5	87.3	87.1	87.3	87.5	88.4	87.35	
16		B	86.9	86.4	86.0	85.9	86.2	86.3	86.1	86.9	86.8	86.31	
17		C	78.0	78.3	77.9	77.5	77.5	77.5	77.5	77.6	77.7	77.64	
18		D	89.1	88.1	88.8	88.7	89.0	88.9	88.4	88.8	88.7	88.80	
19		E	80.3	80.3	80.1	80.3	80.3	80.3	80.4	80.4	80.4	80.30	
20		F											
21		G											
22		H											
23		I											
24		J											

**COMMON MISTAKE #13:**

Not having enough training or not training in enough detail for survey workers

Explanation: Many populations do not have enough people with experience conducting nutrition surveys or taking anthropometric measurements to make up the teams for a nutrition survey. As a result, some survey workers may have no experience in weighing children, measuring height, conducting interviews, or other activities necessary for data collection. Even if your survey team members are experienced, they may have different techniques than you require. For these reasons, the training given to survey workers must be detailed and extensive. For many nutrition surveys, at least 3 days must be devoted to the initial training before data collection begins.

Many of the steps in data collection, such as measuring height, appear to be simple. However, many sources of error can make the measurements inaccurate and thus bias the final results of the survey. Therefore, each of the steps in data collection should be described and practiced during the training. Children can be brought to the training site or the teams can go to a clinic or feeding center to practice weighing and measuring. In addition, survey workers who will be measuring children should participate in some type of formal standardization exercise. This exercise consists of the survey teams measuring at least height on the same children to compare inter- and intra-observer error. Many texts, such as the MSF Nutrition Guidelines, have descriptions of standardization exercises.



Solution: Always do complete training for all survey workers, including practicing the sequence of activities and carrying out a standardization exercise for anthropometric measurements

11. FIELD TEST DATA COLLECTION FORMS AND DATA COLLECTION PROCEDURES

Conduct pilot testing during the training to give survey team members practical experience in all aspects of data collection and survey methodology before they embark on actual data collection. This pilot testing should include the following:

- 1) Pre-testing the survey questions. Comments by both those interviewed and the survey workers who conducted the interviews can greatly improve the questions.
- 2) Sampling households or children. The team should practice selecting the households.
- 3) Taking and recording measurements correctly in the field. Survey workers should practice weighing and measuring as a team in order to determine which worker should perform each specific task.
- 4) Introducing the survey and completing the data collection form. All survey workers should practice using the data collection form and surveyor's manual. It will often be necessary to revise the form and the surveyor's manual after the pilot testing.
- 5) Organizing transport and equipment.

Pilot testing should not take place in a location where the proper survey will take place, but in a similar community. For example, you could take the survey teams to a neighboring village that has not been selected during the sampling. Do not forget to get a permission letter from local authorities, even for field testing.

At the end of the pilot test, the team members, team supervisors and survey managers should discuss together all aspects of the data collection. The pilot test also will provide an estimate of how long the data collection will take for each survey subject and for a household as a whole. This information will help you calculate how many households or children you can expect to measure each day during the data collection. Keep in mind, however, that during the pilot test the survey team members are still practicing. After collecting information from the first few households in the actual survey, teams will become much more efficient and accurate.

12. COLLECT THE DATA

Data collection will differ for each survey. In small, compact populations, all survey teams may be able to reconvene each evening to discuss questions or difficulties. Surveys over wider areas may require teams to operate independently

for days or weeks. Ideally, there should be some means of communication among teams and between teams and the survey manager so that questions and difficulties can be answered and corrected in a standard way for all teams. If communications are unavailable, the survey manager should provide answers to anticipated questions during the survey worker training and in the survey manual.

Additional ways to improve the quality of the data collected during a nutrition survey include the following:

- 1) Provide rigorous training, even to survey workers who have prior experience or who may think they already have all the skills necessary for the survey.
- 2) Use good quality equipment that is calibrated regularly.
- 3) Provide good supervision of survey teams. For example, the team supervisor should double check each case of oedema. Improperly trained survey workers may mistake a “fat” child for one with oedema (particularly in younger children). In addition, team supervisors should check data collection forms for blank entries or erroneous entries at the end of each household before the team leaves that household.
- 4) Do not overwork your teams; people make mistakes when they are tired.

**COMMON MISTAKE #14:**

Replacement of missing households during data collection.

Explanation: Survey teams will always encounter households where everyone in the household is missing, or a member of a target population, such as a young child or woman of childbearing age, is missing. In order to include enough households in the survey, some survey teams will be tempted to substitute missing households or children with others chosen from the village. This should be avoided. Children may be unavailable for many reasons which may bias the result of a survey. For example, an ill child may be unavailable for survey assessment because he was taken to the hospital. Of course, ill children tend to have more malnutrition than well children. If the survey team fails to include an absent ill child, the estimate of the prevalence of malnutrition may be somewhat underestimated. If that child is then replaced by an available child, that available child may be less likely to have malnutrition. As a result, the estimated prevalence of malnutrition will be further underestimated because the sample now contains a child who is less likely than average to have malnutrition. Although having a sample size too small to achieve the desired precision is not a good thing, it is much worse to inject bias into the estimated prevalence of malnutrition. Substitution therefore should be avoided.

One way to avoid the need to replace missing children is by attempting to predict what the non-response will be among children in the sample. The sample size is then increased by this proportion. For example, if you need a sample size of 400 children and you predict that you will not be able to collect data on 10 percent of children, the sample size could be increased to 444 ($90\% \text{ of } 444 = 400$).



Solution: Do not substitute selected households which are absent or refuse participation with a neighbor or other household not selected in the original sample. Calculate the sample size to account for non-response and achieve adequate precision.



COMMON MISTAKE #15:

Misidentifying the presence or absence of oedema.

Explanation: Some persons who become acutely malnourished develop an accumulation of fluid in the tissues which is called oedema. This abnormal fluid adds to the child's weight. As a result, a child may have normal weight-for-height even though children with oedema have a substantially higher death rate than children with malnutrition without oedema. For this reason, all children with malnutrition and oedema should be judged as severely malnourished.

Survey workers who examine children must be taught the correct way of detecting oedema, as follows: Moderate pressure is applied to the back of the foot or to the shin just above the ankle for a full 3 seconds (the survey workers should count slowly, 1... 2... 3, while applying pressure). Oedema is present if, when the pressure is removed, an indentation remains in the skin.

Frequent mistakes made by survey workers include:

- 1) applying momentary pressure, which is insufficient to make an indentation if oedema is present;
- 2) pushing too hard and causing the child pain;
- 3) recording oedema because the examiner's finger which is applying the pressure produces an indentation while the pressure is applied.

Many children have fat on the back of the foot or lower leg which can be indented with pressure, but the indentation disappears immediately when the pressure is stopped. An indentation from oedema will last many seconds after cessation of the pressure.

When calculating the prevalence of severe and moderate acute malnutrition, persons with oedema should automatically be included in the "severe" category regardless of their weight-for-height Z-score or percent of median. In a population in which a high proportion of malnourished children have oedema, failure to properly classify oedematous children will lead to a serious underestimate of the prevalence of severe acute malnutrition. Because weight-for-height and height-for-age Z-scores are invalid if oedema is present, children with oedema should not be included when plotting the distribution of these Z-scores or calculating the average Z-score.



Solution: Each child who is weighed and measured should be examined for the presence of bilateral pitting oedema. All survey members should be trained to detect bilateral pitting oedema. If oedema is detected, the team supervisor should verify the accuracy of the diagnosis before it is recorded on the data collection form.

**COMMON MISTAKE #16:**

Not providing enough supervision of survey teams.

Explanation: Each survey team must have a supervisor who is responsible for all the activities of that team. Supervisors must observe closely all data collection procedures, including interviews and weighing, measuring and examining selected children. Although the survey workers should have learned correct procedures during the training period, the hard work and long hours that surveys entail may cause some survey workers to cut corners or use sloppy technique. Supervisors should continuously remind them of the proper method.

Data collection forms are often not completely filled out, especially early on when survey workers have not yet established a strong routine. Team supervisors should review each data collection form before departure from the household because a future revisit to a household is often impossible.



Solution: Close supervision of survey teams, especially early on during data collection, is essential for the collection of good quality data. Supervision should include careful monitoring of data collection along with a review of each data collection form before leaving the household.

13. ENTER THE DATA AND ASSESS ITS QUALITY

In order to analyse survey data on a computer, the data from the paper data collection forms must be typed into a database program. The software most commonly used in nutrition data analysis is EpiInfo, with the accompanying EpiNut. Specifically designed to analyse nutrition and public health information, this program can be downloaded free from the Centers for Disease Control website, www.cdc.gov/epiinfo. Other software, such as NutriSurvey and SPSS, can also be used for analysis.

Computer software that allows range and logic checking should be used for data entry. That is, the computer program can be set so that only entries within a specified range can be entered into specific fields. For example, you might wish to

set the acceptable range of 6 - 59 for the field recording the ages of young children who were weighed and measured.

If the data entry person tries to enter a number less than 6 or greater than 59, the computer makes a warning sound that indicates an unacceptable value. Logic checking allows comparison of the values entered into two or more fields to ensure that the data entered makes sense.

For example, suppose you are collecting information in a survey on infant feeding. You first type into the computer that the age at which a child stopped exclusive breastfeeding was 5 months. Then you type in the age at which the child first received cow's milk was 3 months.

The computer will compare these values and show a message that indicates that these two values are contradictory.

Such checking may eliminate some data entry errors, but additional procedures are needed to be sure that the computer data are correct.

This data entry must be done carefully in order to minimize mistakes. Data entry is not an easy job; personnel entering data need proper training and supervision. If possible, employ people who are familiar with computers, a variety of basic software programs, and even data entry. Those who are training the data entry personnel should have experience in the specific data entry software program being used. Trial exercises should be conducted using sample questionnaires in order to check accuracy and possible systematic errors.

After the data has been entered, there are two common quality check methods:

- 1) (This is the standard and is recommended by WFP.) Enter data twice into two different databases and compare the two resulting databases. If discrepancies are found between the databases, the paper data collection forms should be consulted to determine the correct value.
- 2) Alternatively, the data can be entered into the computer only once, and then each record in the database compared to the paper data collection form to check for errors. This is often faster than entering the data twice.

Once the data are entered and checked, preliminary analysis should be done to assess the quality of the data. Some of the techniques used are described below. These analyses can be included in the final report to demonstrate to readers the precision and accuracy of the survey results.

Analysing the distribution of children's ages

Z-scores or percentage of median for height-for-age or weight-for-age require accurate ages to within 2 weeks. In many cultures, mothers may not know the exact dates of birth of their children. Mothers will often round their children's ages to the nearest year, leading to a disproportionate number of children with ages reported as 12, 24, 36 or 48 months of age. As can be seen in Figure 3.6, the mothers of most children included in this survey rounded their children's age to a full year. Even young infants were reported as 12 months of age. In such situations, the age data may be so inaccurate as to make analysis of height-for-age and weight-for-age indices unreliable.

In contrast, during a survey in Macedonia of Kosovar refugees, mothers could report precise dates of birth for their children. The distribution of the calculated ages for these children is shown in Figure 3.7. Although the number of children in each 1-month age group is not identical, there does not seem to be a preference for the ages 12, 24, 36 and 48 months, as shown in the black bars. The differences in the number of children in each age group is probably due to random selection of the survey sample. These figures demonstrate that a simple graph of age distribution of the children in the survey sample can demonstrate whether ages are biased toward whole years. Such a graph probably should be displayed in the final report of any nutrition survey in which height-for-age or weight-for-age are important outcomes.

Figure 3.6 Distribution of Children Under 5 Years of Age, by Their Mothers' Report of Their Age, Bardera, Somalia, January 1993

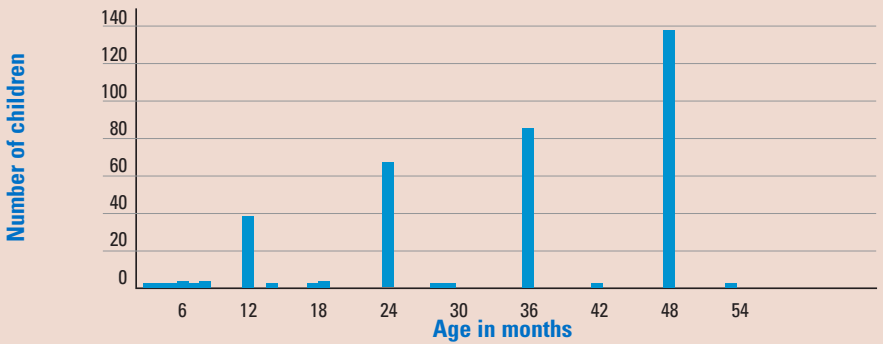
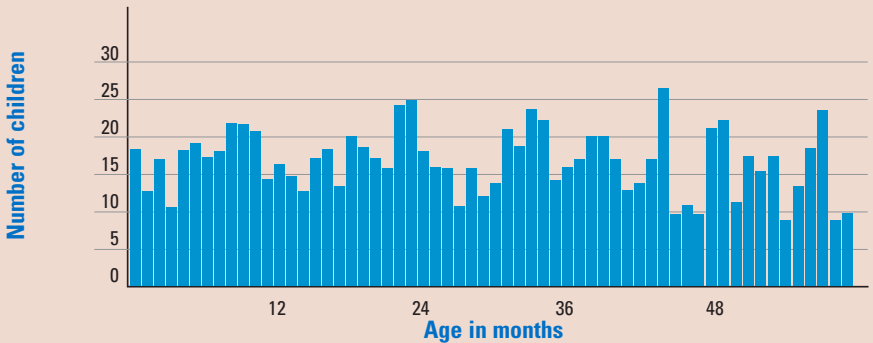


Figure 3.7 Distribution of Children Under 5 Years of Age, by Calculation From Mothers' Reported Date of Birth, Kosovar Refugees, Macedonia, May-June 1999



CALCULATING THE STANDARD DEVIATION FOR Z-SCORES

Sloppy measurements lead to random error. Random error means that for any particular bit of data, the error may be in either direction; some measurements will be larger than the real number, and some will be smaller. If the survey workers rounded each height measurement to the nearest 5 cm, some heights would be recorded as lower than they truly are and others would be recorded as higher than they truly are. A child who is actually 72 cm long would be recorded as 70 cm. Another child who is 73 cm would be recorded as 75 cm. On the other hand, systematic error means that measurements, on average, are biased in one direction or the other. For example, if

the measuring tape were affixed to the height board so that its lower end with the “0” mark was 5 cm above the footboard, every child would be measured as 5 cm longer or taller than they actually were. This would produce a systematic error with every measurement biased upwards.

Random error does not affect the average value, but does lead to a greater width in the distribution of the measurements, which is reflected in a larger standard deviation. Therefore, if survey workers are not careful with measurements of height or age (i.e., if they introduce random error), the standard deviation of the height-for-age Z-score will be greater than it should be, which reduces the precision of estimates (i.e., the confidence interval gets wider).

The standard deviations of weight-for-height, height-for-age and weight-for-age Z-scores in the reference population are, by definition, 1.0. If the measurements used to calculate the height-for-age Z-score (i.e., height or age), have substantial random error, the standard deviation of the height-for-age Z-scores for the survey sample will be substantially greater than 1.0. Many nutrition computer programs, such as EpiNut from Epi Info, calculate Z-scores based on the measurements of children. Once these are calculated and added to the data file, any statistical computer program can calculate the standard deviation of the Z-scores. This standard deviation should be included in the nutrition survey report so that readers can judge the amount of random error in the measurements made during the survey.

For example, in the Somalia survey shown in Figure 3.6, the standard deviation for the height-for-age Z-scores was 1.63. Inaccurate age information leads to random errors in the measurement of age and therefore in the height-for-age Z-scores. On the other hand, the standard deviation of height-for-age in the Macedonia survey was 1.28. In this survey, the age of each child was much more accurate, leading to less random error and a lower standard deviation for the height-for-age Z-score. A stan-

dard deviation for height-for-age or weight-for-height greater than about 1.4 probably indicates that measurement of either age, weight or height was not very accurate.

ANALYSE DISTRIBUTION OF DECIMAL OF HEIGHT

Even though survey workers should always be trained to measure and record height to the nearest millimeter, many tend to round height to the nearest full centimeter or one-half centimeter. As a result, a disproportionate number of height measurements will end in .0 and/or .5, sometimes referred to as digit preference. An analysis of the decimal for the height measurements can tell survey managers if this error is common in the survey data. The distribution of the decimal for the Somalia survey is shown in Figure 3.8. Note the disproportionate number of children whose height measurement ended in 0 or 5. Figure 3.9 shows a similar distribution for a survey done in Mongolia. There is also a preference for rounding the height measurement to the nearest centimeter in this survey, but it is not so pronounced as in the Somalia data. Moreover, there seems to be no rounding to the nearest 0.5 cm. Such an analysis should be presented in the survey report in order to inform readers about the precision of the height measurements.

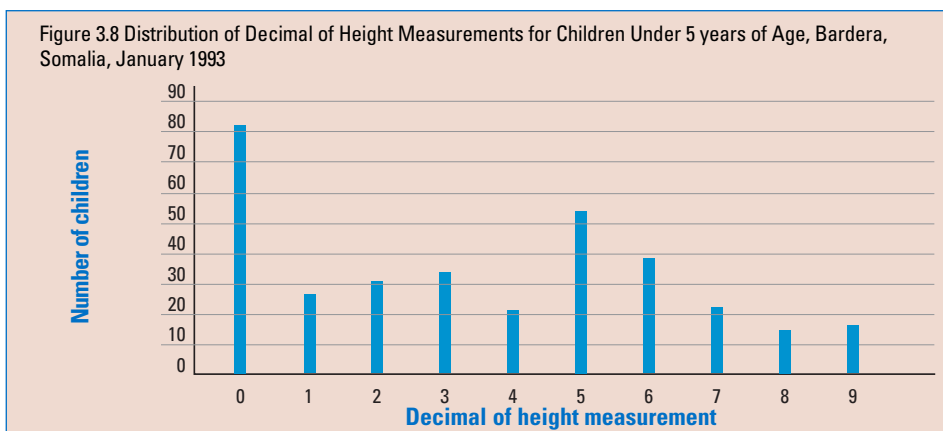
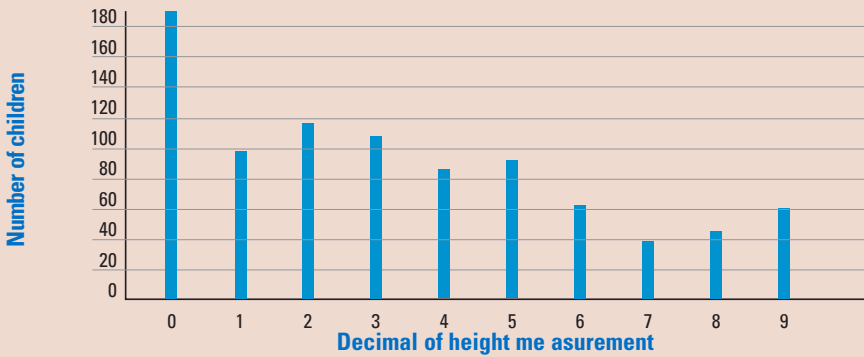


Figure 3.9 Distribution of Decimal of Height Measurements for Children 6-59 Months of Age, Mongolia Nationwide Nutrition Survey, 2001



Calculate the proportion of records with extreme Z-scores

Inevitably, mistakes will be made in either measuring children, transcribing the results to data collection forms or entering the data into a computer. Certain values for anthropometric indices are highly improbable or incompatible with life and should not be included in the analysis of Z-scores. For example, it is extremely unlikely that a child would have a weight-for-height Z-score of -6.0. Many computer programs which calculate anthropometric Z-scores or percents of median from anthropometric measurements will somehow “flag” those children whose Z-scores fall outside certain boundaries, indicating that the calculated index is probably the result of a mistake in the data and is not real. Epi Info™ creates a new field in the data set when calculating the Z-scores from measurements. This field is called

“flag,” and it contains a code number depending on which anthropometric index is out of bounds. For Epi Info, the “flag” variable is based on an older definition of extreme values and should be used with caution.

A more acceptable method of flagging is to create acceptable boundaries for the Z-scores depending on the data set. For areas with a very high prevalence, an alternative approach to defining Z-scores is any Z-score more than 4 standard deviations below or above the mean Z-score for that index. For example, if in a particular survey, the average weight-for-height Z-score is -2.0, then those children with Z-scores less than -6.0 and greater than +2.0 should be excluded from the analysis. Alternately, fixed boundaries can be used to flag records; Table 3.3 details boundaries as recommended by WHO.

Table 3.3 Boundaries for flagging outlying data

Index	Lower boundary	Upper boundary
Weight-for-height	< -4.0	> +5.0
Height-for-age	< -5.0	> +3.0
Weight-for-age	< -5.0	> +5.0

Source: Physical Status: The Use and Interpretation of Anthropometry - Report of a WHO Expert Committee. WHO, Geneva. 1995

Of course, each flagged record with an extreme Z-score should be investigated to correct errors in data recording or data entry, and obvious errors should be corrected in the computer data file. Those children whose flags are not the result of obvious errors must be excluded from the analysis of the Z-scores. The final survey report should present the proportion of children with extreme Z-scores.

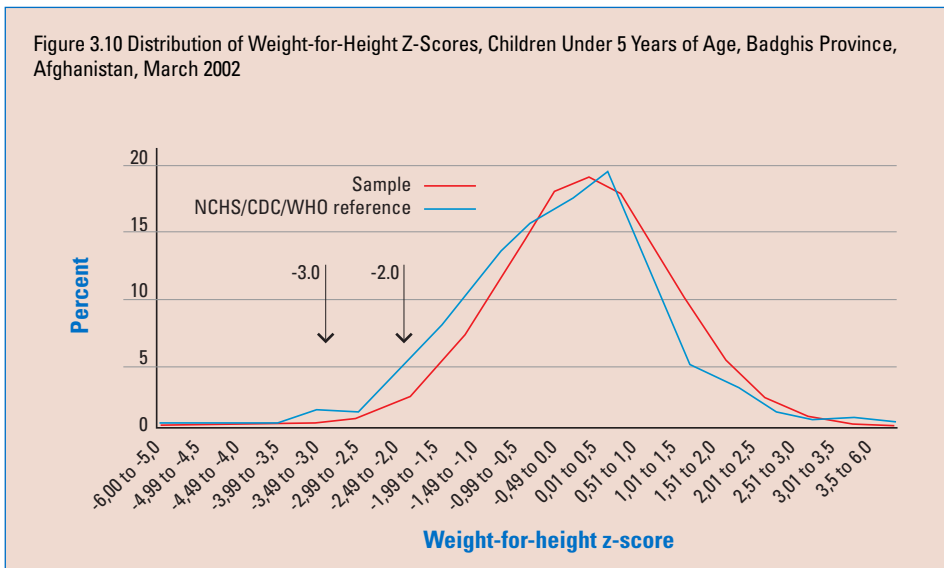
14. ANALYSE THE DATA AND PRESENT THE RESULTS

Once the survey data are entered into a computer program, checked, and the accuracy of measurements confirmed, the data can be analysed to describe children's nutritional status. In the final report, it is customary to present results in certain standardized ways.

- Primary results often will be the prevalence of wasting, stunting and underweight, both < -2 SDs and < -3 SDs. These prevalences are merely the number of children with any mal-

nutrition and the number of children with severe malnutrition, respectively, divided by the number of children with a valid anthropometry index. For example, consider a survey in which 397 children have valid weight-for-height Z-scores, 24 have a Z-score between -3.0 and -2.0 , and 7 have a weight-for-height Z-score < -3.0 . The prevalence of wasting would be 7.8 percent $[(24 + 7) / 397]$. The prevalence of severe wasting would be 1.8 percent $(7 / 397)$.

- In addition, you should present the mean anthropometric Z-scores and their standard deviations for all children without oedema. This number gives an overall summary of the degree of acute malnutrition among children in the survey population.
- You also should present a graph showing the distribution of anthropometry Z-scores among children without oedema. Figure 3.10 shows one example of such a graph.



- The prevalence, mean Z-score and graph of the distribution of height-for-age Z-scores also can be presented for chronic malnutrition.
- If hemoglobin or serum retinol are measured on survey subjects, the comparable results for these values can be presented (the prevalence of abnormally low values, the mean value, and a graph showing the distribution of all the values).
- It is very important to calculate confidence intervals for the major outcomes measured in a survey and to present them in the verbal presentations and the final report. This will give the reader or listener an idea of the precision of the estimates. Most computer programs used to analyse data will give confidence intervals around prevalence rates; however, many such programs assume that your data come from a sample chosen by simple or systematic random sampling. If you have done cluster sampling, the confidence intervals calculated by these programs are not correct. For cluster samples, you must use a computer program which takes into account the cluster sample and calculates the appropriate confidence intervals. Such computer programs will ask you the name of the variable which identifies the cluster to which each unit of analysis belongs. For example, the Analysis module of Epi Info will calculate confidence intervals, but they will not be correct for a cluster survey. In Epi Info for DOS (version 6), you must use the CSample module to calculate confidence intervals for cluster surveys. One of the boxes in CSample asks for the PSU, or prima-

ry sampling unit. You should indicate in this window what variable contains the cluster number. In Epi Info for Windows, you must use the “Complex Sample Frequencies,” “Complex Sample Tables,” or “Complex Sample Means” commands. SAS and Stata have complex sample commands and SPSS has an option complex sampling module.

Confidence intervals for mortality rates may be more difficult to obtain. If mortality data are collected as recommended in this manual, you should be able to calculate the number of deaths and the population denominator in each household. These numbers are then combined for all the households in the survey sample and analysed as a cluster sample. The total number of deaths divided by the total household population gives an estimate of the proportion of the population which died during the recall period. Computer programs, such as CSample or Epi Info for Windows, should give a correct confidence interval for this proportion that takes into account the cluster sampling. The lower and upper ends of this confidence interval then can be converted to death rates expressed as the number of deaths per standard population size per standard time period, such as the number of deaths per 1,000 per year.



COMMON MISTAKE #17:

Comparing results of different surveys or subgroups within a survey without calculating P values or providing confidence intervals for each estimate.

Explanation: The results of two surveys may look different, but this difference may be due solely to sampling error. The P value tells you the likelihood that the difference observed between two surveys is due only to sampling error. If the P value is 0.05, then the likelihood that the difference is due only to sampling error is 0.05, or 5 percent.

If there is no statistical difference between the results of two surveys done in two different populations, then there may be no real difference between these two populations. If the two surveys are conducted in the same population at two different points in time, then there may have been no real change over time. This is obviously very important when formulating programmatic interventions. Expenditure of time, money and other resources should not be based on differences between surveys that do not reflect a real difference in populations.



Solution: Always judge the statistical significance of any observed difference by either comparing confidence intervals or calculating a P value for the difference.



COMMON MISTAKE #18:

Calculation of confidence intervals or P values without accounting for cluster sampling.

Explanation: Most computer programs, such as Epi Info, that are used to calculate epidemiologic measures will display confidence intervals and P values. However, these programs usually assume that the sample was selected by simple random sampling. This may be inaccurate if the sample was chosen using cluster sampling because cluster sampling usually results in greater statistical variance, and therefore less precision, than simple random sampling. Because the variance is greater, confidence intervals will be wider with cluster sampling. Therefore, if cluster sampling was done and the computer program does not take this into account, the confidence intervals are inaccurate and should not be used.

Nonetheless, many survey managers do not know this and will copy the confidence intervals from the computer screen into the survey report, thus giving the reader the impression that the precision of the prevalence estimate is greater than it actually should be. This may be especially important when comparing the results from two surveys. Using the wrong confidence intervals may lead the reader to decide that the two surveys' results are truly different, when the difference may only be the result of sampling error.



Solution: When calculating confidence intervals and P values for survey results obtained by cluster sampling, be sure you are using formulas or computer software that account for cluster sampling.

**COMMON MISTAKE #19:**

Not reporting the number of children with oedema in the survey report.

Explanation: As mentioned above, malnourished children with oedema have a much worse prognosis than malnourished children without oedema. The report of a nutrition survey should always include the number of children with wasting who have oedema. This is especially important in an emergency situation or where the prevalence of protein-energy malnutrition is relatively high since this information will tell the reader what type of wasting is predominant (marasmus vs. kwashiorkor).



Solution: Be sure to include in the survey report the number, as well as the proportion, of children who had oedema.

15. DISSEMINATE FINDINGS IN PRESENTATIONS AND REPORTS

The final part of a nutrition survey is presenting the findings in oral presentations and in a final report. Often, distribution of a preliminary report of the key findings is recommended as soon as data analysis has been completed because a final report may take a long time to complete. The results of the survey should be presented in a standardized format so as to enable easy comparisons between the results of different surveys. One suggested format is shown in the outline below and can be used for both oral presentations and written reports:

Executive summary

This section of the report should be short (one or two pages), and should include a clearly presented summary of all important information in the report. Be aware that 90 percent of readers probably will look at this section only. Write the summary last, after you have finished the rest of the report, and include the following information: the geographic area covered, the date and the objectives of the survey, the methodology used, the main results and recommendations. One way to quickly and clearly present the major results is to create a table.

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, what has happened to them and why this survey was done.

Objectives of the survey

The objectives of the survey should be stated clearly.

Methodology

A straightforward description of the methods employed, including sampling techniques, is necessary so that readers can judge the validity of the survey's results and have a clear reference for future comparison. Include selection criteria for inclusion in the survey sample and clear definitions of all the health and nutrition outcomes measured in the survey. Describe what measurements were taken, by whom and using what instruments. Details on the training of the survey members should be included, noting whether standardization exercises and a trial/pilot

survey were conducted. Describe how the questionnaires were designed and piloted. Standard definitions of indicators used and cutoff values used to define malnutrition also should be included. The methods should be in such detail as to enable someone to replicate your survey in the future using only the final report as a guide.

Results

This section is mainly graphs and tables illustrating the results of analysis. The results often include:

- 1) A description of the response rate, including the number of subjects or households chosen for the sample, the number from whom data were collected and the reasons for non-response;
- 2) A description of the survey subjects from whom data were collected;
- 3) The overall prevalences of the major outcomes;
- 4) Comparison of subgroups within the survey sample, such as comparison of males and females or different geographic locations, if the sample size permits such comparison with any statistical power; and
- 5) A description of potential causal factors investigated in the survey.

Limitations

This section should discuss the limitations that were faced, such as those encountered during team selection and training, survey design, sampling and analysis. Examples of this could include an incomplete or outdated sampling frame, unexpected population movement, security or staff constraints or other factors affecting access to the sample population.

Discussion

The discussion puts the results back into context. The aim of the discussion is to

explain the results seen (for example, prevalence of malnutrition and mortality rates) in terms of the causes of malnutrition - health, care environment, and food security. Organize your discussion by addressing the following questions (not an exhaustive list):

- 1) Is the level of malnutrition typical (referring back to previous surveys/baseline levels)?
- 2) Is the level of mortality typical?
- 3) What are the major acute causes of malnutrition and mortality (taking into account causes already addressed by other interventions)?
- 4) What are the prospects for the coming months?
- 5) Who is worst affected?
- 6) What are the chronic causes of malnutrition?
- 7) What does the community recommend?

Much of the information for the discussion will come from referring back to the results section and considering the major findings in light of other information gathered from prior surveys, other types of assessments, observation, discussions with community leaders and survey workers, etc.

Conclusions and recommendations

This section should restate the major conclusions and make specific, operational recommendations for what is needed most urgently in the surveyed population.

Reports should be written and submitted in a timely fashion to prevent any delay in the intervention. Reports for emergency nutrition surveys should be available within one month after the survey data collection has been completed. Baseline survey reports may not be needed so rapidly.

REFERENCES

Surveys in general

Boss LP, Toole MJ, Yip R. “Assessments of mortality, morbidity, and nutritional status in Somalia during the 1991-1992 famine”. *JAMA* 1994;272:371-376.

United Nations Department of Economic and Social Affairs, Statistics Division. Household Sample Surveys in Developing and Transition Countries. Studies in Methods Series F, No. 96. United Nations, New York. 2005. Available at: http://unstats.un.org/unsd/hhsurveys/pdf/Household_surveys.pdf

Spiegel PS, Salama P, Maloney S, van der Veen A. “Quality of malnutrition assessment surveys conducted during famine in Ethiopia”. *JAMA* 2004;292:613-618.

Gorstein J, Sullivan K, Parvanta, I, Begin F. Indicators and Methods for Cross-Sectional Surveys of Micronutrients. Micronutrient Initiative and the Centers for Disease Control and Prevention. Ottawa and Atlanta. 2005 (in press).

“Measuring Mortality, Nutritional Status and Food Security in Crisis Situations: Smart Methodology, Version 1, June 2005”. UNICEF and USAID, New York and Washington, D.C. 2005. Available at: <http://www.smartindicators.org/>.

Sampling

Bennett S, Radalowicz A, Vella V, Tomkins A. “A computer simulation of household sampling schemes for health surveys in developing countries”. *International Journal of Epidemiology* 1994;23:1282-1291.

Binkin N, Sullivan K, Staehling N, Nieburg P. “Rapid nutrition surveys: how many clusters are enough?” *Disasters* 1992;16:97-103.

Brogan D, Flagg EW, Deming M, Waldman R. “Increasing the accuracy of the expanded programme on immunization’s cluster survey design”. *Annals of Epidemiology* 1994;4:302-311.

Milligan P, Njie A, Bennett S.

“Comparison of two cluster sampling methods for health surveys in developing countries”. *International Journal of Epidemiology* 2004;33:1-8.

Magnani R. “Sampling Guide. Food and Nutrition Technical Assistance”. Washington, D.C. December 1997. Available at <http://www.fantaproject.org/publications/sampling.shtml>.

Design effects

Katz J, Carey VJ, Zeger SL, Sommer A. “Estimation of design effects and diarrhea clustering within households and villages”. *American Journal of Epidemiology* 1993;138:994-1006

Katz J, Zeger SL. “Estimation of design effects in cluster surveys”. *Annals of Epidemiology* 1994;295-301.

Kaiser R, Woodruff BA, Bilukha O, Spiegel PB, Salama P. “Using design effects from previous cluster surveys to guide sample size calculation in emergency settings”. *Disasters* (in press).

Using and Interpreting Survey Results for Decision-Making

Key messages

- It is important to review the quality of nutrition surveys before using them for decision-making. One should not automatically assume that survey data is useful.
- There are many factors to consider when interpreting survey data, including pre-existing information on the prevalence of malnutrition in a given area, country or region; the magnitude of changes over time; the geographical coverage of a survey; the seasonality of malnutrition and information on the different potential causes of malnutrition in an area.
- When assessing trends of malnutrition or mortality in a given area, a rigorous process of comparison between the multiple surveys done over time is necessary. Some factors to consider include: (1) whether the same population/geographic area was covered by both surveys; (2) whether the sample size was adequate enough to ensure that comparisons are possible; (3) whether any differences in the prevalence observed over time were statistically significant or programmatically meaningful; and (4) whether any factors have changed over time that might be responsible for leading to the change in prevalence.

As an organization working with a results-based management approach, WFP is committed to not only striving to achieve positive outcomes for its beneficiaries, but also to using output and outcome indicators to monitor its performance. Such indicators enable us to understand whether the plans and strategies are being implemented in a way that leads to desired project impact.

One of the first steps of programme design involves formulating objectives and defining the means to achieve those objectives (what is often called putting together a “results chain”). Many of WFP’s programmes (including

most emergency operations and Mother and Child Health/Nutrition programmes) have specific objectives related to either reducing or stabilizing the prevalence of malnutrition or to saving lives in emergencies. As such, the main outcome indicators of interest are malnutrition or mortality rates, which generally are best collected through surveys as outlined in this manual.

This section provides guidance on critical issues related to the collection, interpretation and use of survey results for decision-making in the context of WFP’s operations.

WHAT INFORMATION IS AVAILABLE TO HELP YOU TO DECIDE WHETHER A NEW SURVEY MAY BE NECESSARY?

When designing intervention projects with an objective related to malnutrition or mortality, an essential first step is to gather and review existing information to determine whether a new survey is truly needed. There are a number of places to look to determine what surveys may be available from your country or working area. Consultation with partners including non-governmental organizations (NGOs), governments and other agencies (particularly UNICEF) may reveal that historical data already exist that can be used either to help you to establish a baseline understanding of the situation or to help to interpret your findings should you choose to do a survey.

IS AVAILABLE INFORMATION SUFFICIENT FOR YOUR NEEDS?

Once you have collected available nutrition surveys or other information, it is critical to define the potential uses that you may have for the nutritional or mortality data. Measuring trends in malnutrition or mortality over the course of a project is often the main objective of nutritional surveys, but it is not the only potential need that you may have for such data. Nutritional data also can be useful in making decisions about the relative vulnerability of population groups living in different geogra-

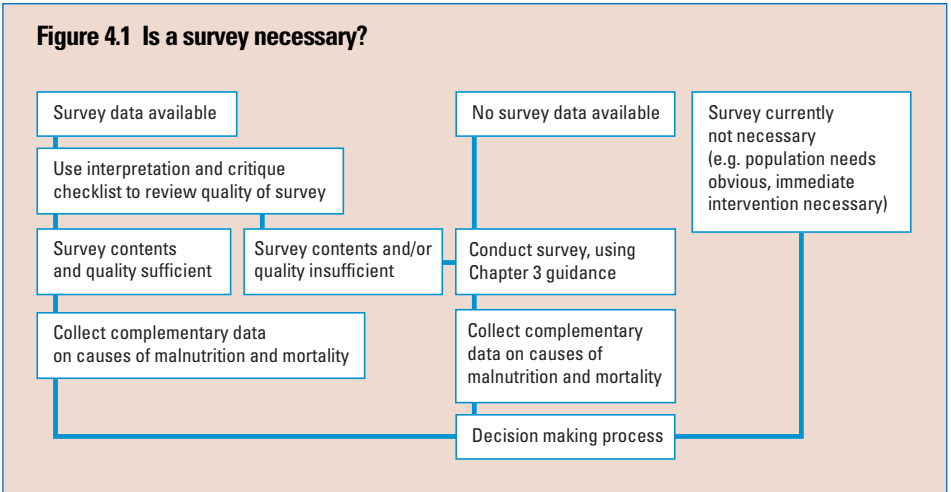
phic areas or for planning beneficiary numbers for supplementary or therapeutic feeding programmes. Therefore, when deciding whether a new survey is necessary, it is important to consider what your real needs are.

Different types of surveys may have different uses for you. Data from national surveys, while useful for giving you an idea of the general situation of the country, generally does not have an adequate sample size on a local level to be much use for baseline/follow-up purposes. Local surveys, such as those done in specific refugee camps, may be very useful for your purposes, although in larger operations they may only give you a relatively small picture of the overall situation.

Clinic surveillance data also may be available; while such data is generally unreliable for getting an accurate idea of the prevalence of malnutrition, it may be quite useful for either persuading decision-makers to undertake a nutrition survey or for understanding seasonal patterns of malnutrition.

Figure 4.1 outlines decision-making steps for three likely scenarios in which you:

- may use existing survey data;
- need to conduct a survey; or
- can make decisions without using survey data.



ASSESSING THE QUALITY OF SURVEYS

Another essential part of the process of determining whether a survey is necessary is to review the quality of any existing surveys. The interpretation and critique checklist (Checklist 4.1) will help you to decide whether the content and quality of a survey are sufficient. For the overall critique of a survey report, it may also be worth answering the following questions:

- Which organizations conducted the survey?
- How much experience do those organizations have in nutrition and health?
- How long have they been in the country and in the specific area of interest?
- Why did they conduct the survey?

Knowing the area and having been able to visit and talk to local people will also help in interpreting a survey report. The report should make sense in the context of what you have seen and recent history. It also should make sense to the people living in the area. The survey should cover the geographic areas and topics about which you need information.

Even if the survey’s quality in terms of methodology may appear to be sufficient, it may be deficient in other ways. It may not include a food security assessment, for example, or it may cover only part of the area where you plan a nutrition program. Therefore, you may decide to do a larger survey with a food security component.

Check list 4.1 Key questions to be considered when interpreting a survey report

Objectives

- ✓ Have the objectives been stated clearly and are they realistic?

Survey Planning & Implementation Issues

- ✓ Have the survey area and target group been specified?
- ✓ Has the questionnaire been translated into local language and back-translated into the original language?
- ✓ Has the questionnaire been piloted in the survey area (but with people who were not part of the sample)?
- ✓ Has the training been long enough (minimum 3-5 days depending on background of personnel)?
- ✓ Were enough qualified supervisors available to assure quality of measurements and interviews?
- ✓ Were all team members trained in the same way?
- ✓ Were the interviewers able to read questions in a standardized way from the questionnaire?

Survey Methodology

- ✓ Has the sampling frame been adjusted for recent population movements?
- ✓ Was the sample representative of the target population, i.e., nobody was left out in the sampling approach?
- ✓ Has the sample size calculation been described in detail, including sample size calculations that are based on different outcomes?
- ✓ Is the sample size large enough for appropriate precision? If the sample size calculation has not been described, did the survey follow international standards, i.e., 30 x 30 cluster sample for nutrition and mortality surveys? *(see section on sample size in Chapter 3)*

Survey Reporting

- ✓ Has the proportion of severely malnourished children with oedema been reported?
- ✓ Are case definitions provided, and do they meet international standards?
- ✓ Was software used for analysis that allows adjusting for cluster survey design?
- ✓ Have weight-for-height Z-scores been used to measure malnutrition?
- ✓ Has oedema been included in the definition of severe acute malnutrition?
- ✓ Has the survey questionnaire been provided in the report?

Results

- ✓ Do the results reflect the objectives of the survey?
- ✓ Does the report contain standard information (i.e., survey area, date of survey, population, survey conducted by, acute malnutrition, acute severe malnutrition, oedema, measles immunization coverage, vitamin A distribution coverage, women's anthropometric status, crude mortality, under-5 mortality)⁸
- ✓ Have 95% confidence intervals been reported with prevalences and rates?
- ✓ Does the report provide detailed information and discussion of causes of malnutrition and mortality?

Discussion

- ✓ Does the report include a discussion of results, including limitations of the survey?
- ✓ If results are compared to a baseline, is the quality of the baseline information discussed (e.g., organization that conducted assessment, methods, one or multiple years, did those years qualify as baseline)?

Conclusions

- ✓ Are conclusions based on results?
- ✓ Are conclusions realistic (e.g., a solid interpretation of what the data can provide and what it cannot)?

Recommendations

- ✓ Are recommendations based on science and best practices and not driven by politics?
- ✓ Are the recommendations useful, i.e., could they have been made without the study?

⁸ Reported regularly in Nutrition Information in Crisis Situations (NICS). Geneva: Standing Committee on Nutrition, United Nations System. Available at URL: <http://www.unsystem.org/scn/Publications/html/mis.html>.

INTERPRETING SURVEY RESULTS

Once you have determined that a given survey (or surveys) are reliable, the next step is interpreting those survey results. This section outlines several major considerations that you may want to use as part of this process, including:

1. Comparing survey findings against existing information;
2. Using the conceptual framework of malnutrition as a tool to help interpret complementary information and to consider the relative importance of different causes of malnutrition; and
3. Interpreting trends over time.

COMPARING SURVEY FINDINGS AGAINST EXISTING INFORMATION

The following tables provide information by region on the average rates of malnutrition (and variation in those rates) that may be useful for interpreting findings of your surveys. It should be noted that many regions

have extreme variation from country to country in the prevalence of malnutrition (or mortality rates), and that it is generally much more useful to use country-specific data than these estimates for comparisons. It is also important to note that while these tables are useful for understanding what a “normal” nutritional situation is in these regions, it is often the case that the “normal” situation may be extremely poor, and therefore not necessarily a good standard to compare against. Tables 4.1-4.4 show regional malnutrition and mortality rates recently published by the United Nations Standing Committee on Nutrition (SCN)⁴ and the United Nation's Children's Fund (UNICEF)⁵. Because of differences in geographical coverage and methods, Tables 4.1-4.4 should never be used as the reference baseline alone, but may help with interpretation when used along with a variety of different information collected.

Table 4.1 Projected prevalence and 95% confidence intervals of acute malnutrition in preschool (0-5 years) children, 2000 and 2005^a

Region	2000		2005	
	Acute malnutrition* (%)	95% confidence interval	Acute malnutrition* (%)	95% confidence interval
Africa	8.3	7.3-9.2	9.5	8.2-10.7
Eastern	7.6	6.3-9.2	8.7	6.8-11.1
Middle	9.1	6.6-12.6	11.9	8.4-16.7
Northern	6.2	3.5-10.6	8.0	4.5-14.0
Southern	4.9	3.3-7.4	6.6	4.4-10.2
Western	10.3	9.0-11.9	10.2	9.0-11.6
Asia	9.2	7.7-10.7	8.9	7.3-10.5
Eastern	2.2	2.1-2.4	1.8	1.6-1.9
South-Central	14.0	11.3-17.2	13.3	10.7-16.5
South-East	8.9	6.5-12.2	5.1	3.7-6.9
Western	4.2	1.9-8.7	3.9	1.4-10.4
Latin America and Caribbean	1.6	1.1-2.1	1.5	0.9-2.1
Caribbean	2.5	0.09	2.4	0.09
Central America	1.7	1.2-2.4	1.6	0.9-2.7
South America	1.4	0.8-2.4	1.4	0.7-2.6
Oceania	NA[†]	NA	NA	NA
All developing countries	8.2	7.2-9.3	8.3	7.2-9.4

* Defined as <-2 standard deviations or Z scores of the weight-for-height median value of the NCHS/WHO international reference data † Not available

Table 4.2 Projected prevalence and 95% confidence intervals of chronic malnutrition in preschool (0-5 years) children, 2000 and 2005⁴

Region	2000		2005	
	Chronic malnutrition* (%)	95% confidence interval	Chronic malnutrition* (%)	95% confidence interval
Africa	35.2	32.5-38.0	34.5	31.7-37.4
Eastern	44.4	37.6-51.4	44.4	37.6-51.4
Middle	37.8	33.7-42.1	35.8	33.0-38.6
Northern	21.7	16.1-28.6	19.1	13.5-26.5
Southern	24.6	21.5-28.1	24.3	20.4-28.6
Western	32.9	30.2-35.7	32.0	28.4-35.7
Asia	30.1	27.1-33.1	25.7	22.5-28.9
Eastern	14.8	13.9-15.8	10.0	9.3-10.7
South-Central	39.7	34.4-45.3	34.5	29.0-40.5
South-East	21.3	17.0-26.0	18.1	14.3-22.5
Western	18.7	10.9-30.1	16.1	7.8-30.3
Latin America and Caribbean	13.7	9.1-18.4	11.8	7.0-16.5
Caribbean	7.4	3.8-14.1	5.7	2.7-11.5
Central America	20.4	12.5-31.5	18.0	10.8-28.4
South America	11.3	6.5-18.9	9.6	4.9-18.2
Oceania	NA†	NA	NA	NA
All developing countries	29.6	27.5-31.7	26.5	24.2-28.7

* Defined as <-2 standard deviations or Z scores of the height-for-age median value of the NCHS/WHO international reference data † Not available

Table 4.3 Projected prevalence and 95% confidence intervals of underweight in preschool (0-5 years) children, 2000 and 2005⁴

Region	2000		2005	
	Underweight* (%)	95% confidence interval	Underweight* (%)	95% confidence interval
Africa	24.2	21.9-26.4	24.5	22.1-26.8
Eastern	29.2	24.6-34.3	30.6	25.7-35.8
Middle	26.1	21.8-30.8	25.3	21.6-29.3
Northern	9.7	4.6-19.4	8.6	3.6-19.5
Southern	13.7	9.7-19.0	13.6	9.6-18.8
Western	27.1	24.2-30.3	26.8	23.6-30.3
Asia	27.9	24.0-31.7	24.8	20.8-28.8
Eastern	9.3	8.8-9.9	6.5	6.1-6.9
South-Central	40.8	33.5-48.5	36.5	29.3-44.4
South-East	27.4	23.4-31.8	23.9	19.9-28.5
Western	11.3	5.0-23.7	10.6	3.3-28.9
Latin America and Caribbean	6.1	4.0-8.1	5.0	3.2-6.8
Caribbean	6.1	3.3-10.8	4.7	2.5-8.7
Central America	9.2	5.2-15.7	7.9	4.3-14.0
South America	4.6	2.9-7.4	3.7	2.3-6.1
Oceania	NA†	NA	NA	NA
All developing countries	24.8	22.2-27.3	22.7	20.1-25.4

*Defined as <-2 standard deviations or Z scores of the height-for-age median value of the NCHS/WHO international reference data † Not available

Table 4.4 Baseline reference mortality data by region⁵

Region	2000		2005	
	CMR (deaths/ 10,000/day)	CMR emergency threshold (2 x crude mortality rate)	U5MR (deaths/ 10,000 children under 5/day)	U5MR emergency threshold (2 x under- 5 mortality rate)
Sub-Saharan Africa	0.44	0.9	1.14	2.3
Middle East and North Africa	0.16	0.3	0.36	0.7
South Asia	0.25	0.5	0.59	1.2
East Asia and Pacific	0.19	0.4	0.24	0.5
Latin America and Caribbean	0.16	0.3	0.19	0.4
Central and Eastern European Region/CIS and Baltic States	0.30	0.6	0.20	0.4
Industrialized countries	0.25	0.5	0.04	0.1
Developing countries	0.25	0.5	0.53	1.1
Least developed countries	0.38	0.8	1.03	2.1
World	0.5	0.5	0.48	1.0

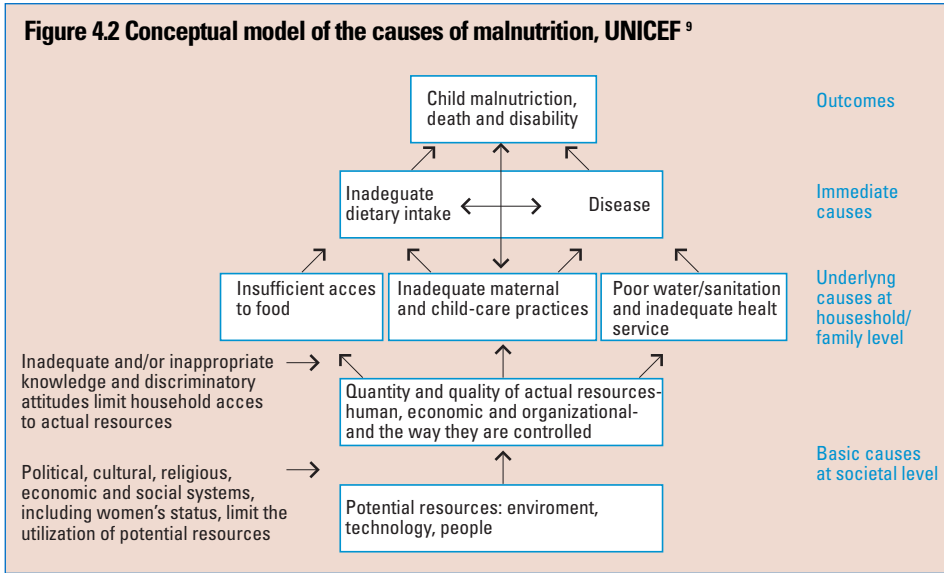
USING A CAUSAL FRAMEWORK TO CONSIDER THE RELATIVE IMPORTANCE OF DIFFERENT CAUSES OF MALNUTRITION

A causal framework (see Conceptual Model of Malnutrition) is necessary to understand long-term causes of malnutrition in the population and decide on the information to be gathered in a survey. Non-food causes of malnutrition and mortality may aggravate the situation rapidly even if rates are not alarming at the moment.

In an individual, malnutrition is the result of inadequate dietary intake, infec-

tion or a combination of both. The widely used UNICEF conceptual model of the causes of malnutrition (Figure 4.2) organizes and explains malnutrition by layers of causes. Malnutrition is caused by more than a simple lack of food; there are other underlying causes that can contribute to adverse nutritional outcomes. The multisectoral causes of malnutrition involve dietary intake, poor health, environmental factors and care practices. For an individual to be adequately nourished, the underlying causes of malnutrition - health, food, care - need to be addressed in tandem.

Figure 4.2 Conceptual model of the causes of malnutrition, UNICEF ⁹



Source: the States of the world's Children 1998 - UNICEF

Underlying causes of malnutrition

The main underlying preconditions to adequate nutrition are food, health and care; the degree of an individual's or household's access to these preconditions affect how well they are nourished.

Food quantity and quality

Food security exists when, at all times, everyone has access to and control over sufficient quantities of good, quality food needed for an active and healthy life. For a household, this means the ability to secure adequate food to meet the dietary requirements of all its members, either through their own food production or through food purchases. Food production depends on a wide range of factors, including access to fertile land, availability of labor, appropriate seeds and tools, and climatic conditions. Factors affecting food purchases include household

income and assets as well as food availability and price in local markets. In emergency situations, other factors - including physical security and mobility, the integrity of markets and access to land - may come into play.

Health and sanitation environment

Access to good, quality health services, safe water supplies, adequate sanitation and good housing are preconditions for adequate nutrition. These preconditions are affected by the existing primary health infrastructure, the types of services offered, their accessibility and affordability to the population, and the quality of these services. Key environmental issues include the degree of access to adequate quantities of safe drinking water, adequate sanitation and adequate shelter. Health and environmental factors influence incidence and

⁹ The State of the World's Children 1998 (URL: <http://www.unicef.org/sowc98/>). New York: UNICEF, 1998.

severity of disease. Health and nutrition are closely linked in a “malnutrition-infection cycle” in which diseases contribute to malnutrition and malnutrition makes an individual more susceptible to disease.

Social and care environment

Malnutrition can occur even when access to food and healthcare is sufficient and the environment is reasonably healthy. The social and care environment within the household and local community also can directly influence malnutrition. Appropriate childcare, which includes infant and child feeding practices, is an essential element of good nutrition and health. Cultural factors and resources, such as income, time and knowledge, influence caring practices. The values of the society dictate the priority given to the care of children, women and the elderly. Attitudes to modern health services, water supplies and sanitation also affect caring practices.

Immediate causes of malnutrition

On an immediate level, malnutrition results from an imbalance between the amount of nutrients needed by the body and the amount of nutrients being introduced or absorbed by the body. Adequacy of food intake relates to:

- a) the quantity of food consumed;
- b) the quality of the overall diet with respect to various macro- and micronutrients;
- c) the form of the food consumed, including palatability and energy density; and
- d) how frequently the food is consumed.

However, malnutrition is not synonymous with a lack of food. In an individual, malnutrition is the result of inadequate dietary intake, disease, or both. Health and nutrition are closely linked. Disease contributes to malnutrition through a loss of appetite, malabsorption of nutrients, loss of nutrients through diarrhea or vomiting, or through altered metabolism. Malnutrition, in turn, makes an individual more susceptible to disease.

While the conceptual framework provides a useful approach for considering the causes of malnutrition, its usefulness depends on the availability of information about those causes. Such complementary information may include quantitative data from sources other than surveys and qualitative information gathered from focus groups, interviews with key persons, and personal observations or observations by national or international colleagues who know the situation well. Sources of such data can vary widely and not all types are equally useful for all types of WFP needs. Even within the scope of WFP needs, uses of data can differ depending on the context of the data collection and objectives for the use of the information. A matrix (Table 4.1) provides rough guidance on suggested use of different sources of information for a variety of WFP purposes. This is by no means exhaustive, nor regulatory.

Table 4.1 Matrix of sources of information for WFP purposes

		Operations/ Program Management	Targeting/ Prioritization	RBM/ Corporate Reporting	Advocacy
Individual level ↑	Facility Based Data	+++	++	+	+
	Sample Survey	+++	++	+++	+++
	ENA Assessment	+	+++	+	+++
↓ Population level	VAM Survey	+	+++	++	+++
	Nutrition Surveillance	+++	+	++	++
	National Survey	+	++	++	+++

Note: +++ optimal use, ++ of some use, + limited use

Complementary data may also include the causal framework or pathway of malnutrition and a seasonal calendar:

A seasonal calendar provides information about harvests and hungry periods, seasonal disease epidemics and other events that may affect food insecurity (e.g., food distributions).

All primary and secondary information should be checked against other sources of information and confirmed with partners.

Interpreting trends over time

In general, when you compare two or more surveys to assess trends in malnutrition and mortality in a given population, these surveys must have used methodologies that meet similar quality and procedural standards. For example, did both samples use representative sampling methods and comparable

measuring techniques? Consider whether the surveys used or collected data for the same:

- definitions of malnutrition (i.e., Z score [preferred] or percent of the median);
- population;
- age groups;
- geographic area; and
- season.

Whenever possible, WFP and partner organizations should conduct a baseline survey in the area where the nutrition program or intervention will later be conducted. In acute emergencies, interventions may have to start immediately, and a survey will be conducted as soon as is possible. Any initial survey should consider sample size requirements for baseline and follow-up surveys (see Chapter 3).

If conducting a baseline survey is not possible, other sources for surveys may be used. Note that national survey

results should not be used as a baseline because national prevalence may not be representative of smaller subsets of the population. If a national survey is conducted with survey methodology that allows for statistical disaggregation into subsets, then this disaggregated data might be useful for these purposes. However, consultation with statisticians or the Nutrition Service in Rome should be undertaken before such a decision is made. National surveys that usually have provincial-level estimates include MEASURE DHS (Demographic and Health Surveys; DHS)¹, UNICEF's Multi Indicator Cluster Surveys (MICS)², or the WHO Global Database on Child Growth and Malnutrition³.

What are some potential differences in geographical coverage and methods?

Comparing current malnutrition prevalence in a district in southern Ethiopia with a baseline estimate for the whole of Ethiopia or eastern Africa has little meaning. A current survey result may be compared to a previous survey that was conducted in a different season, or a baseline survey that has covered several seasons over one or several years.

Differences in measuring mortality are another potential problem when comparing survey results. Child mortality is expressed by UNICEF and WHO as the probability of dying between birth and 5 years of age per 1,000 live births. Conversion to an age-specific mortality rate for children under 5 years, as shown in Table 4.4, requires a mathematical transformation. That transformation is based on certain assumptions that need to be considered as limitations when results are discussed.

If 95 percent confidence intervals are provided, as in Tables 4.1-4.3, overlapping confidence intervals alone are not sufficient to

assume that there is not a statistically significant difference between the baseline and the current survey. However, they at least indicate that the results of the two surveys may not be different. Non-overlapping confidence intervals show that the two surveys are significantly different. Always determine the statistical difference between a baseline and follow-up survey by either comparing confidence intervals or calculating a P value for the difference. Confidence intervals should be presented for all outcomes in your survey, independent of their availability from a previous baseline survey.

How should I interpret changes from baseline to follow-up?

Interpretation of changes between baseline and follow-up(s) depends on the magnitude of the change, trends and the context. A doubling of the baseline often indicates the presence of an acute emergency. However, it is essential to verify that such an increase is actually “real,” as described above.

The causes of malnutrition are complex. Emergency settings and perceptions of what is “typical” or “atypical” in a given country or a given district within a country differ. Such differences make it difficult to develop and make available a standardized, generally agreed upon classification of severity of malnutrition to match to baseline information. However, some internationally agreed upon cut-off values have been developed to provide a guide for classifying malnutrition and mortality rates. Tables 4.5 and 4.6 show malnutrition classifications and mortality benchmarks, as defined by WHO⁶ and Sphere⁷. These classifications are based on acute malnutrition, chronic malnutrition, underweight and mortality. Population benchmarks for other outcomes, such as low birth weight or maternal mortality, are not available.

Table 4.5 Classification of severity of malnutrition in a community by prevalence of acute malnutrition, chronic malnutrition and underweight for children under 5 years of age ⁶

Severity of malnutrition	Acute malnutrition (%) (weight-for-height) < -2 z scores	Chronic malnutrition (%) (height-for-age) < -2 z scores	Underweight (%) (weight-for-age) < -2 z scores
Acceptable	<5	<20	<10
Poor	5-9	20-29	10-19
Serious	10-14	30-39	20-29
Critical	≥ 15	≥ 40	≥ 30

Table 4.6 Mortality benchmarks ⁷

Indicator	Baseline	Benchmark for alert	Benchmark for critical emergency
Crude mortality rate	0.5/10,000/day	1/10,000/day	2/10,000/day
Prevalence of anaemia	1/10,000/day	2/10,000/day	4/10,000/day

Note: Average baseline value based on sub-Saharan Africa.

Table 4.7 Classification of public health significance of anemia based on the prevalence of anemia ⁸

Category of public health significance	Prevalence of anaemia (%)
Normal	≤ 4.9
Mild	5.0-19.9
Moderate	20.0-39.9
Severe	≥ 40.0

Note: The prevalence of iron-deficiency disorder is likely to be 2-2.5 times greater than the prevalence of anaemia

Table 4.8 Classification of public health significance of iodine deficiency disorders based on the prevalence of goiter or urinary iodine⁶

Category of public health significance	Total goiter rate (%)	Median urinary iodine level in school children µg/L (%)
Normal	< 5.0	≥ 100.0
Mild	5.0 - 19.9	50.0 - 99.9
Moderate	20.0 - 29.9	20.0 - 49.9
Severe	≥ 30.0	< 20.0

Table 4.9 Classification of public health significance of vitamin-A deficiency in children (6-71 months) based on the prevalence of night blindness or serum retinol⁹

Category of public health significance	Night blindness (%)	Serum retinol < 0.7 µmol/L (20 µg/dL) (%)
Normal	0	< 2
Mild	0 < 1	≥ 2 < 10
Moderate	≥ 1 < 5	≥ 10 < 20
Severe	≥ 5	≥ 20

At least 95 percent of children 6 months to 15 years of age should be vaccinated against measles and have received an appropriate dose of vitamin A supplementation⁷. All infants vaccinated between 6-9 months of age receive another dose of vitamin A upon reaching 9 months. Routine vaccination programs ensure the maintenance of 95 percent coverage.

INTERPRETING MORTALITY IN LIGHT OF MALNUTRITION RATES

Many nutrition surveys collect both malnutrition and mortality rates, and it is desirable to interpret each of these in light of the other. The causal framework of malnutrition and a seasonal calendar are often useful to help do this.

Table 4.10 shows possible combinations of mortality rates and malnutrition prevalence and their likely causes. In most situations, mortality will increase with higher malnutrition and morbidity; however, mortality can rise in the setting of relatively low prevalence of malnutrition and acute malnutrition may rise without substantial increases in mortality.^{10, 11}

There has been a misconception that rising mortality may plateau as malnourished children die at a rate equal to the rate that non-malnourished children are becoming malnourished. Observed plateaus in the prevalence of malnutrition only occur at unusually high levels of both malnutrition and mortality. Therefore, this scenario was not included in Table 4.10.

Malnutrition prevalence and mortality rates should always be interpreted with caution, in the context of the overall situation and under review of causes of malnutrition and mortality.

Causes of malnutrition and mortality include (see causal framework of malnutrition in Chapter 1):

- General poverty: This includes poor infrastructure, housing, clothing, sanitation and lack of schooling/education.
- Loss of entitlements: In an economic theory of the causes of malnutrition, famine and death, four legal “entitlements” are described by which households obtain food. Those include a production-based entitlement, an exchange-based entitlement, an own-labor entitlement, and an inheritance and transfer entitlement (i.e., households have claims on others/institutions to assist them accessing food). If households lose one or more of these entitlements, destitution and death may result. Economic policies, such as an export ban for livestock, may also affect malnutrition and mortality.
- Ecological stress: This includes high population density, recurrent droughts, livestock overgrazing, water shortages (quantity and quality), wood fuel shortages and deforestation. These stresses can degrade land, substantially increase the time needed to collect water and wood, and reduce food production.
- Societal changes: Population movements can alter cultural norms and habits, potentially leading to health risk behavior or increasing the farming and trade of narcotics as cash crops.
- Poor household food availability and accessibility: This includes poor

harvest, poor pasture conditions, loss of livestock, high market prices, food unavailability in the market, insecurity and inadequate general distributions.

- Poor health status of the population: Contributing factors include low levels of measles vaccination and lack of vitamin A supplementation. Other contributing factors include high prevalence of diseases such as diarrhea, acute respiratory infections, tuberculosis, human immunodeficiency virus (HIV), high worm loads in children, and outbreaks of measles, cholera, Shigella dysentery, meningitis, malaria and other communicable diseases. The combination of diseases and malnutrition greatly exacerbates the risk for mortality.
- Poor public health system with barriers to health care access: This causes and is affected by delays in recognizing health problems and deciding to seek care, delays in arriving at appropriate levels of care, and delays in receiving adequate care.
- Inadequate social and child care environment: This often equates to a lack of health and nutrition education. The results can include a lack of exclusive breastfeeding in infants younger than 6 months, lack of timely introduction of complementary infant/weaning food, and lack of continuation to breast feed children during episodes of diarrhea. Families also may not know how to prepare healthy food or know about basic hygiene.
- Dietary habits in the population: This includes the use of herbal medicines, which might interfere with adequate dietary intake, and extensive tea consumption, which may inhibit iron absorption and result in anaemia, even in children.

Table 4.10 Possible combinations of mortality rates and malnutrition prevalence and likely causes¹²

	High rates of mortality	Typical rates of mortality
High prevalence of malnutrition	Likely causes: <ul style="list-style-type: none"> Acute food insecurity and failure to cope High levels of infection arising from displacement or uncontrolled epidemic Major disruption to care environment 	Likely causes: <ul style="list-style-type: none"> Acute food insecurity Disruption to care environment resulting from damaging coping strategies No major disease outbreaks
Typical prevalence of malnutrition	Likely causes: <ul style="list-style-type: none"> High rates of infection not typically associated with malnutrition (e.g., malaria or meningitis epidemic) Mortality directly caused by conflict or acute disaster (e.g., earthquake) Possible outbreaks of micronutrient deficiency 	Likely causes: <ul style="list-style-type: none"> Either no major acute causes of malnutrition or mortality resulting from the emergency Or causes which have yet to have an impact on malnutrition and mortality

MAKING DECISIONS BASED ON A COMPREHENSIVE REVIEW OF THE INFORMATION

Based on the processes described above, decision-making largely depends your judgement of the situation (if possible after traveling to the area, observing the situation and talking to local people), consultation with partners, a review of previously implemented interventions, predicted seasonal changes (from a seasonal calendar and early warning systems), and the security situation.

There is no magic formula to help you with decision-making, but there are some principles for the systematic review of the evidence. The collected information should enable you to decide whether the prevalence of malnutrition and mortality rates are atypical, thereby justifying a nutrition response. Information about the role of food insecurity and other causal factors, vulnerable groups and geographic

distribution of population needs will help you plan a programme or intervention.

The general objective of a nutrition response is to stabilize the situation and reduce malnutrition prevalence and mortality rates to acceptable levels. If baseline levels have been relatively high before the response, the response should attempt to decrease malnutrition and/or mortality levels in line with more acceptable baselines. A comprehensive package of technical information including a detailed discussion of the situation will facilitate both communication with WFP senior management and good decision-making.

When you interpret information, bear in mind:

- Quality of secondary information may be a problem; use the interpretation and critique checklist to ensure the quality.
- The information collected may be from different age groups and periods.

For example, malnutrition prevalence is usually collected for age 6-59 months as a proxy for the whole population, whereas mortality rates may be available for the whole population and for children under 5 years. Mortality rates refer to the recall period of the survey, whereas the prevalence of malnutrition reflects the status at the time of the survey. Information about acute respiratory disease and diarrhea is usually collected for the two weeks preceding the survey.

- In some circumstances, children under 5 years of age may not be a good proxy for the total population. For example, in areas with high HIV/AIDS prevalence, wasting and mortality may be considerably higher in adults than in children. Attention to morbidity and mortality in age and gender groups, for which data may not routinely be available, is essential.
- You may not have information about all potential causes of malnutrition and mortality. It can be difficult to assess the relative importance of each factor and the timing to best affect changes. Review the causal framework to identify information gaps.
- If you are not able to explain inconsistencies, you may decide to either collect additional information or base your decision-making on the data you have.

SYSTEMATIC REVIEW OF THE EVIDENCE FOR DECISION-MAKING

In summary, there is no magic formula to help you with decision making. For example, the WHO classification of severity of malnutrition in a community (Table 4.5) cannot be used alone for decision-making. You must also consider the context, including complementary factors such as economic and ecological conditions, food security, or health. Your goal will be to collect different types of information from different sources

to provide a comprehensive picture, and then systematically review the situation. You need to identify strengths, limitations and uncertainties of the information, and discuss those in your reasoning. The following criteria¹³ should help you with the decision-making process:

- 1) Consistency: Consistently high malnutrition, micronutrient deficiency, morbidity or mortality rates from different surveys in your program area or emergency setting might justify an intervention.
- 2) Strength: If you find acute malnutrition (> 20 percent) or severe acute malnutrition rates (> 5 percent), an immediate intervention may be justified.
- 3) Trend: If trend analysis shows a sharp increase in malnutrition and mortality, an intervention may be justified.
- 4) Temporal relationship: Although it is not possible to prove causality in a cross-sectional survey, the information can be used for decision-making. Observed or (preferably) measured shortcomings in the areas of food, health, nutrition, agriculture, livestock, livelihoods, or water and sanitation most probably have preceded excessive malnutrition, mortality and other outcomes in the population. Showing increasing trends may sufficiently support the evidence.
- 5) Coherence: Your reasoning should be compatible with existing theory and knowledge. Documenting risks (e.g., failing harvest, disease outbreaks) and adverse outcomes (e.g., morbidity and mortality, malnutrition) in different areas also supports the evidence.
- 6) Interventions: Early interventions may have changed the situation if you are dealing with an emergency or implementing a baseline survey after WFP interventions have already begun. You need to take this into account in your evaluation.

REFERENCES

1. MEASURE DHS. Demographic and health surveys. Calverton, Maryland. URL: <http://www.measuredhs.com>.
2. UNICEF. End of decade assessment: multiple indicator cluster survey. New York: UNICEF; 2004. Available at URL: <http://www.childinfo.org/MICS2/Gj99306k.htm>.
3. World Health Organization. Global database on child growth and malnutrition. Geneva: World Health Organization; 2004. Available at URL: <http://www.who.int/nutgrowthdb/>.
4. United Nations Standing Committee on Nutrition. 5th report on the world nutrition situation, nutrition for improved development outcomes. Geneva: United Nations; 2004. Available at URL: <http://www.unsystem.org/scn/Publications/AnnualMeeting/SCN31/SCN5Report.pdf>.
5. UNICEF. The state of the world's children 2003. New York: UNICEF; 2003.
6. World Health Organization. The management of nutrition in major emergencies. Geneva: World Health Organization; 2000.
7. The Sphere Project. Humanitarian charter and minimum standards in disaster response. Geneva: The Sphere Project; 2004.
8. World Health Organization. Iron deficiency anaemia. Assessment, prevention, and control. A guide for programme managers. Geneva: World Health Organization; 2001. Available at URL: http://www.who.int/nut/documents/ida_assessment_prevention_control.pdf.
9. World Health Organization. Indicators for assessing vitamin A deficiency and their application in monitoring and evaluating intervention programmes. Geneva: World Health Organization; 1996.
10. Yip R, Sharp TW. "Acute malnutrition and high childhood mortality related to diarrhea: lessons from the 1991 Kurdish refugee crisis". *JAMA* 1993; 270:587-590.
11. Young H, Jaspars S. "Nutrition, disease and death in times of famine". *Disasters* 1995;19: 94-109.
12. Save the Children UK. Emergency nutrition assessment: guidelines for field workers. Plymouth, England: Save the Children; 2004.
13. Hill AB. "The environment and disease: association or causation". *Proc R Soc Med* 1965;58:295-300.

Ethical Issues

Key messages

- You should not conduct any assessment without considering ethical issues. Consult with ethical experts among all partner organizations and inform local authorities about your plans in order to allow review of methods and conformity with ethical values in the community. In some cases, you will need permission from the local country's health review boards. In others, you will also need to meet with local governmental officials to make sure that they agree to your plans.

Ethical issues have to be considered whenever human subjects are participating in surveys and other assessments. Verbal consent to participate in the assessment must be obtained from all adult participants and consent from legal guardians must be obtained for individuals < 18 years of age. Specific scenarios where WFP personnel have to consider ethical issues may include:

- Assessments that include the collection of bodily fluids such as blood or urine (even if methods are noninvasive, i.e., when the body is not entered by puncture or incision).
- Studies that include one or more comparison groups (e.g., randomized controlled trials) are routinely conducted and ethically accepted if they meet certain criteria, such as the inclusion of a mechanism to stop the study immediately if an intervention shows significantly better results than either other interventions or comparison groups without interventions.
- Referrals for survey participants who show signs or symptoms that require immediate clinical intervention, e.g., persons with severe malnutrition. Team leaders should immediately calculate the weight-for-height classification of the individual and refer participants with severe malnutrition to a therapeutic feeding center.

Participants with moderate malnutrition should be referred to a supplementary feeding program. Referral mechanisms should also be established for micronutrient deficiencies, such as anaemia, scurvy, pellagra, or beriberi as well.

The consideration of ethical issues is essential when planning assessments and reviewing secondary information. You do not want to base your decisions on data that have been collected in an unethical way. Usually, nutrition and mortality surveys are exempt from ethical review if: (1) data are collected for planning of interventions and programmes, and (2) the survey does not qualify as research because results cannot be generalized. Nevertheless, you have to ensure that whoever is commissioned to implement a nutrition survey or other assessment on WFP's behalf is competent to do so. They must also have the consent of the host government and approval from the country's ethical review board before starting the survey. Also, whenever possible, make survey protocols available to local authorities so they can review the methods and verify that these conform with the community's ethical values. An example of a WFP research proposal to the Nepal Health Research Council is presented in Annex 6.

We recommend being familiar with general regulations and ethical guidelines, including those of the World Medical Association Declaration of Helsinki¹ and the international guidelines for ethical review of epidemiological studies². Additionally, the National Institutes of Health ethics course is easily accessible on the Internet, gives clear instructions and provides a certificate after successful participation³.

The guidelines for ethical review of epidemiological studies address, among others, the following ethical issues:

- Although verbal consent usually will be sufficient when WFP and partners conduct nutrition and mortality surveys for programme planning, it may become relevant when organizations are commissioned for an assessment or research study. Consult with ethical experts among all partner organizations in order to determine the steps that should be taken and inform local authorities about your plans. To help guide the process, the Office of Human Research Protections at the U.S. Department of Health and Human Services provides an informed consent checklist for research studies (Table 5.1)⁴.
- One of the main principles inherent in any assessment should be to minimize harm to the community, in the sense of bringing disadvantage, and of doing wrong, in the sense of transgressing cultural values and social mores. Harm may occur, for instance, when scarce health personnel are diverted from their routine duties to serve the needs of a survey. Survey protocols should address perceived risks for participants and include proposals to prevent or mitigate them.
- Investigators should make arrangements for protecting the confidentiality of survey data by, for example, omitting information that might lead to the identification of individual subjects, or limiting access to the data, or by other means. It is customary in epidemiology to aggregate numbers so that individual identities are obscured.
- You should not enter personal identifying information, such as addresses or names, into the data. Survey forms should be stored in a locked cabinet or room.
- You need to think about benefits for the community if you plan a survey. Will the results be used to implement an intervention if the results show the need for a response? Will the results be available shortly after the survey? Are funds and trained personnel available to start the intervention as soon as possible after the survey? The primary objective of the survey should be to improve nutrition and health care for the population and train local personnel in epidemiological and, if applicable, other methods such as blood tests for anaemia. The community needs to be informed about the survey and, in most situations, results should be communicated as soon as they are available.

Table 5.1 Informed consent checklist - basic and additional elements**Basic elements**

A statement that the study involves research.

An explanation of the purposes of the research.

The expected duration of the subject's participation.

A description of the procedures to be followed.

Identification of any procedures which are experimental.

A description of any reasonably foreseeable risks or discomforts to the subject.

A description of any benefits to the subject or to others which may reasonably be expected from the research.

A disclosure of appropriate alternative procedures or courses of treatment, if any, that might be advantageous to the subject.

A statement describing the extent, if any, to which confidentiality of records identifying the subject will be maintained.

For research involving more than minimal risk, an explanation as to whether any compensation will be given, and an explanation as to whether any medical treatments are available if injury occurs and, if so, what they consist of or where further information may be obtained.

An explanation of whom to contact for answers to pertinent questions about the research and research subjects' rights, and whom to contact in the event of a research-related injury to the subject.

A statement that participation is voluntary and that either refusal to participate or the subject's withdrawal from participation at any time will involve no penalty or loss of benefits to which the subject is otherwise entitled.

Additional elements, as appropriate

A statement that the particular treatment or procedure may involve risks to the subject (or to the embryo or fetus, if the subject is or may become pregnant), which are currently unforeseeable.

Anticipated circumstances under which the subject's participation may be terminated by the investigator without regard to the subject's consent.

Any additional costs to the subject that may result from participation in the research.

The consequences of a subject's decision to withdraw from the research and procedures for orderly termination of participation by the subject.

A statement that significant new findings developed during the course of the research, which may relate to the subject's willingness to continue participation, will be provided to the subject.

The approximate number of subjects involved in the study.

REFERENCES

- 1 National Institutes of Health. “Regulations and ethical guidelines”. Available at URL: <http://ohsr.od.nih.gov/guidelines/guidelines.html>
- 2 Council for International Organizations of Medical Sciences. International guidelines for ethical review of epidemiological studies. Geneva; 1991. Available through the Centers for Disease Control and Prevention at URL: <http://www.cdc.gov/od/ads/intlgui3.htm>
- 3 National Institutes of Health. “Researcher computer-based training”. Available at URL:<http://ohsr.od.nih.gov/cbt/cbt.html>

The End Point: Example of a Good Survey Report

This chapter serves to conclude with how important and crucial is to undertake an accurate assessment and present the findings in a comprehensive and standard manner. Accurate assessment is key to effective and appropriate interventions. It is crucial to present your findings in a way that reflects following issues:

- > Have the objectives been clearly stated?
- > Methodology including sampling is appropriate?
- > WFP strategic priority indicators reported (+ other standard indicators)?
- > Causes of malnutrition and mortality included?
- > Are confidence limits reported and derived correctly?

For your easy reference we have included an example of a good survey report in order to provide guidance and reference when writing or reviewing a report.

The checklist mentioned in Chapter 4 has been applied to the report “Nutrition Survey in Saharwi Refugee Camps-Tindouf, Algeria” to highlight the strengths of the survey and the report.

Application of checklist to Tindouf, Algeria survey report

Objectives

- ✓ Have the objectives been stated clearly and are they realistic?

Survey planning & implementation issues

- ✓ Have the survey area and target group been specified?
- X Has the questionnaire been translated into local language and back-translated into the original language?
- ✓ Has the questionnaire been piloted in the survey area (but with people who were not part of the sample)?
- ✓ Has the training been long enough (minimum 3-5 days depending on background of personnel)?
- ✓ Were enough qualified supervisors available to assure quality of measurements and interviews?
- ✓ Were all team members trained in the same way?
- ✓ Were the interviewers able to read questions in a standardized way from the questionnaire?

Survey methodology

- X Has the sampling frame been adjusted for recent population movements?
- ✓ Was the sample representative of the target population, i.e., nobody was left out in the sampling approach?
- ✓ Has the sample size calculation been described in detail, including sample size calculations that are based on different outcomes?
- ✓ Is the sample size large enough for appropriate precision? If the sample size calculation has not been described, did the survey follow international standards, i.e., 30 x 30 cluster sample for nutrition and mortality surveys? (see section on sample size in Chapter 3)

Survey Reporting

- ✓ Has the proportion of severely malnourished children with oedema been reported?
- ✓ Are case definitions provided, and do they meet international standards?
- ✓ Was software used for analysis that allows adjusting for cluster survey design?
- ✓ Have weight-for-height Z-scores been used to measure malnutrition?
- ✓ Has oedema been included in the definition of severe acute malnutrition?
- X Has the survey questionnaire been provided in the report?

Results

- ✓ Do the results reflect the objectives of the survey?
- ✓ Does the report contain standard information (i.e., survey area, date of survey, population, survey conducted by, acute malnutrition, acute severe malnutrition, oedema, measles immunization coverage, vitamin A distribution coverage, women's anthropometric status, crude mortality, under-5 mortality)¹¹
- ✓ Have 95% confidence intervals been reported with prevalences and rates?
- ✓ Does the report provide detailed information and discussion of causes of malnutrition and mortality?

Discussion

- X Does the report include a discussion of results, including limitations of the survey?
- ✓ If results are compared to a baseline, is the quality of the baseline information discussed (e.g., organization that conducted assessment, methods, one or multiple years, did those years qualify as baseline)?

Conclusions

- ✓ Are conclusions based on results?
- ✓ Are conclusions realistic (e.g., a solid interpretation of what the data can provide and what it cannot)?

Recommendations

- ✓ Are recommendations based on science and best practices and not driven by politics?
- ✓ Are the recommendations useful, i.e., could they have been made without the study?

¹¹ Reported regularly in Nutrition Information in Crisis Situations (NICS). Geneva: Standing Committee on Nutrition, United Nations System. Available at URL: <http://www.unsystem.org/scn/Publications/html/rnis.html>

UNHCR/UNFIP Micronutrient Project

*ANTHROPOMETRIC AND
MICRONUTRIENT NUTRITION SURVEY*

Saharawi Refugee Camps

Tindouf, Algeria

September 2002

A Collaborative Survey Conducted by:



UNITED NATIONS HIGH
COMMISSIONER FOR
REFUGEES



WORLD FOOD
PROGRAMME



CENTRE FOR INTERNATIONAL
CHILD HEALTH
INSTITUTE OF CHILD HEALTH

ALGERIA

As of 10 January 2009



Contents	
SUMMARY	6
INTRODUCTION	8
BACKGROUND	8
SURVEY OBJECTIVES	9
METHODS	10
STAFF TRAINING AND TEAM ORGANISATION	10
TARGET POPULATION GROUPS FOR THE SURVEY	10
SAMPLE SIZE CALCULATION	10
SAMPLING	11
DATA COLLECTION	12
Measurement of Haemoglobin	12
Collection of Dried Blood Spots for Biochemical Analysis	12
Collection of Serum for Biochemical Analysis	12
Measurement of Serum Transferrin Receptor (sTFR)	12
Collection of Urine and Analysis of Urine	15
Anthropometric Measurements	15
Collection of Questionnaire Data	14
Assessment of Clinical Signs of Nutritional Deficiencies	14
Qualitative data collection	14
DATA MANAGEMENT	14
ETHICS AND INFORMED CONSENT	13
IMPLEMENTATION SCHEDULE	15
LOGISTICS	11
RESULTS	15
ANTHROPOMETRY IN 6-59 MONTH CHILDREN	16
ANTHROPOMETRY IN INFANTS <6 MONTHS	18
TRENDS IN MALNUTRITION BY AGE	19
DIET AND YOUNG CHILD FEEDING PRACTICES	19
Prevalence of Diarrhoea and Feeding Response	21
Introduction of Different Foods By Age	22
Vaccination Coverage	24
ANAEMIA	24
Risk Factors for Anaemia	26
URINE STATUS	27
CLINICAL SIGNS OF SEVERE AND MODERATE	29
FOOD DISTRIBUTION ANALYSIS	29
DISCUSSION	33
RECOMMENDATIONS	36
ANNEXES	38

Anthropometric and Micro-nutrient Nutrition Survey, Dhaka and Pabna Camps, October, September 2012 Page 3 of 42

Figures and Tables

Figure 1 - Distribution of Weight for Height z-scores in 5-59 Month Children	17
Figure 2 - Distribution of Height for Age z-scores in 5-59 Month Children	18
Figure 3 - Trends in Malnutrition with Age	19
Figure 4 - Time of Initiation of Breastfeeding After Birth	20
Figure 5 - Trend in Use of Infant Formula With Age	21
Figure 6 - Trend in Diarrhoea Prevalence With Age	22
Figure 7 - Milk Consumption in Infants and Young Children	22
Figure 8 - Consumption of Non-milk Fluids in Infants and Young Children	23
Figure 9 - Consumption of Solid and Mashed Complementary Infant Foods	24
Figure 10 - Distribution of Haemoglobin concentrations in 6-59 month children	25
Figure 11 - Distribution of Haemoglobin concentrations in women 15 - 49 years	25
Figure 12 - Relationship between iron Deficiency and Anaemia	27
Figure 13 - Distribution of Urinary Iodine Concentrations in Adolescents	28
Figure 14 - Trends in Commodity Distribution	30
Figure 15 - Trends in Micronutrient Content of Ration	31
Figure 16 - Trends in Micronutrient and Mineral Content of Ration	31
Figure 17 - Comparison of key indicators, 1997 - 2002	32

Table 1 - Target Population Groups and Procedures	40
Table 2 - Cut-off Points for Defining Anaemia	42
Table 3 - Iron Status - Serum Transferrin Receptor (sTfR)	53
Table 4 - Adolescent population Urinary Iodine	40
Table 5 - Characteristics of the population sample groups	55
Table 6 - Age and Sex Distribution of 6 - 59 Month Children	46
Table 7 - Prevalence and Mean Levels of Acute Malnutrition (Wasting) in Children	48
Table 8 - Acute Malnutrition (Wasting) by Age Class	47
Table 9 - Prevalence of Chronic Malnutrition in z-scores (Stunting) in Children	47
Table 10 - Chronic Malnutrition (Stunting) by Age Class	48
Table 11 - Age and Sex Distribution of Infant Sample	48
Table 12 - Prevalence and Mean Levels of Acute Malnutrition (Wasting) in Infants	49
Table 13 - Prevalence and Mean Levels of Chronic Malnutrition (Stunting) in Infants	49
Table 14 - Indicators of Infant and Young Child Feeding Practices	20
Table 15 - Vaccination Coverage from Card Records	24
Table 16 - Haemoglobin levels and the Prevalence (%) of Anaemia	25
Table 17 - Serum Transferrin Receptors (sTfR) in Anaemic and non-Anaemic Children	25
Table 18 - Urinary Iodine Levels in Adolescents	27
Table 19 - Urinary Iodine Levels in Individual Camps	28
Table 20 - Prevalence of Visible Goitre in Adolescents (n=562)	28

Acknowledgements

We gratefully acknowledge the important contributions made by so many that made this survey possible:

Staff of UNHCR and WFP Branch and Sub-Office, Algiers and Tindouf
Special appreciation to UNHCR sub-office Tindouf for the survey organisation effort and logistic input without which the survey would not be possible.

Saharawi School of Nursing
(Chella Hssoula)
Saharawi Red Crescent (CRS)
Saharawi Ministry of Health
Saharawi Ministry of Cooperation
Mayor Administration Unit
Crossroad (Route Acherch) (CIRA)

Survey Team Members

Dr. Mohamed Amad Fat Ess
Mouana Hazin
Hassiba Ahmed
Dr. Maryub Iss
Dagbaya Bala
Amine Elmestouh
Dr. Jali Lakkas
Sanaa Baa
Ammi Hamid
Agila Saama
Myriam Sibouba
Amdia Gaidah
Ahoua Massara
(Dr. Abdalla Kaddi)
Bachir Abdelrahman (Team Organizer)
Yahouba Boulouar (UNHCR Field Coordinator)

Survey Coordination

Eddie Marchand (WFP Consultant)
Andrew Skea (Institute of Child Health, London) (UNHCR implementing partner)

Operational Coordination

Fahia Abdella (Designated UNHCR Algeria Focal point)
Mr. Assi Mohammed Lamer (Saharawi MDH Survey Focal point)
Mr. Mazin Abushinab (UNHCR Head of Sub-office Tindouf)
Tom Tansley (UNHCR Programme Officer, Algiers)
Dania Khadime (WFP finance officer, Algiers)
Mr. Hoang (Programme officer, WFP, Tindouf)

Project Supervision and Technical Support

Zahra Mingers (UNHCR Sr. Technical Advisor, HCR, Geneva)

Report Completion and Laboratory Analysis

Andrew Skea and Paul Green: Institute of Child Health, London

Funding

Funding was provided for this survey by UNHCR, Geneva and WFP. The UNHCR contribution was provided under a UNHCR funded project entitled 'Enhancing the Nutritional Status of Refugee Women, Children and Adolescents in Africa by Addressing Micronutrient Deficiencies' and coordinated by HCRIS, Geneva. UNHCR Sub-office Tindouf met all local costs of the field level.

© International Maternal and Child Survey, Saharawi Refugee Camps, Tindouf, September 2002. | Page 6 of 62

Summary

An anthropometric and micronutrient, two stage cluster survey was performed in Tazara refugee camps from 12th - 22nd September 2002, with the aim of assessing the prevalence of malnutrition and its probable causes. The survey was funded and initiated at the request of UNHCR and WFP and carried out by their implementing partners in collaboration with the Tanzanian Ministry of Health.

Four population groups, children (6-59 months), adolescents (10-19 years), women (15-49 years), and infants (0-6 months) were included in the survey. Anthropometric measurements were taken on children and infants and infant feeding practice was measured using a 24-hour recall questionnaire. Peripheral blood haemoglobin was measured in children and women and iron status was assessed in children by measuring the levels of serum transferrin receptor (sTFR). Urinary excreta levels were determined in adolescents and volatile organic was assessed by clinical examination. In addition, the general ration distribution records were analysed for nutritional content.

Acute global malnutrition (wasting and/or oedema) was found in 10.6% (95% CI 7.1-14.3) of 6-59 month old children when assessed using weight for height z-scores (WHZ <-2), and 0.5% (95% CI 0.14-0.86) when using weight for height % of the median (WHM <80%). No cases of nutritional oedema were detected. Severe wasting was found in 2.2% (95% CI 1.5-3.1) and 0.7% (95% CI 0.2-1.2) when using WHZ and WHM respectively. Chronic malnutrition (stunting, HAZ >+2) was present in 32.6% (95% CI 28.7-36.5). The mean mid upper arm circumference (MUAC) in children 1-5 years was 14.6 cm (95% CI 14.5-14.6).

In infants less than 6 months, (wasting and/or oedema) was found in 1.1% (95% CI 0-2.4) if when assessed using weight for height z-scores (WHZ <-2), and 0.0% when using weight for height % of the median (WHM <80%). No cases of severe acute malnutrition were found. Chronic malnutrition (stunting, HAZ >+2) was present in 2.3% (95% CI 0.9-4.1).

No targeted selective feeding programmes are currently operational so programme coverage was not assessed.

Breastfeeding was widely practiced with 97.3% (95% CI 96.1-98.4) of mothers having fed their infants using breast milk at some point in their lives. However, only 12.7% (95% CI 8.2-16.7) initiated breastfeeding within one hour of birth and the prevalence of exclusive breastfeeding in infants < 6 months was very low at 2.7% (95% CI 0.6-4.6). Timely introduction of complementary infant/feeding food was also low with only 35.1% (95% CI 18.8-51.2) of mothers introducing appropriate foods between 6-10 months. 28.7% (95% CI 17.6-39.7) of mothers fed infant formula to their infants before 6 months of age and there was also widespread feeding of other liquids and foods in the age group. The prevalence of diarrhoea in infants/children as reported by the mother was 22.3% (95% CI 16.2-29.4) with a pronounced age based peaking at 6-12 months. In agreement with international health recommendations, 90.7% (95% CI 85.8-95.6) of 3/4 of mothers continued to feed their children during episodes of diarrhoea.

Vaccination coverage in children of 12-23 months was determined by vaccination card record. 78.8% (95% CI 69.3-88.3) possessed a vaccination card and vaccination coverage was 76.6% (95% CI 66.4-86.7) for BCG, 77.0% (95% CI 66.4-87.6) for DPT3 and only 66.7% (95% CI 56.3-77.0) for measles.

Anemia (Hb<11.0 g/dl) was present in 38.3% (95% CI 31.7-45.0) of children and there were no cases of severe anemia (Hb<7.0 g/dl). In non-pregnant women anemia (Hb<12.0 g/dl) was found in 47.6% (95% CI 35.0-60.3) and severe anemia (Hb<8.0 g/dl) was found in 4.4% (95% CI 1.2-7.6). The mean level of haemoglobin was 11.5 g/dl (SD 1.0) in children and 11.0 g/dl (SD 1.0) in non-pregnant women.

Serum transferrin receptor (sTFR) levels were measured in children and 34.1% (95% CI 27.4-40.7) were found to be iron deficient, based on a cut-off of 43.5 µg/l. Iron deficiency was

strongly associated with anemia ($\text{OR} = 2.87$, 95% CI, 2.1 - 4.2) and is therefore likely to account for a significant proportion of this condition.

There is a wide range of risk factors for anemia and it was not possible to analyse all of these in detail during the current survey. However, observation and key informant interviews confirmed the widespread and frequent consumption of tea for this population. Data collected on infant feeding confirms that this begins at an early age. Due to the established role of tea in reducing the bioavailability of iron, it is likely that this is a major factor in the measured iron deficiency.

Urinary iodine excretion in adolescents was measured using the Sandell-Kotloff reaction and found to have a median of 1200 $\mu\text{g/L}$ with a range of 50 - 3900 $\mu\text{g/L}$. This level is extremely high compared with the upper limit of 900 $\mu\text{g/L}$ for normal excretion. All four camps had high levels ranging from 750 $\mu\text{g/L}$ in Dhakka to 1754 $\mu\text{g/L}$ in El Auri. Visible goitre was also assessed in adolescents and found to have a prevalence of 7.1% (95% CI, 3.4 - 10.9).

Examination for clinical signs of scurvy and rickets was performed on children aged 6-59 months ($n=443$). Two cases showed signs of possible rickets and 1 case showed signs of possible scurvy. It should be noted that this sample size is only large enough to reliably detect serious public health problems for these conditions and significant problems at a lower level of seriousness might remain undetected.

Analysis of the general ration food distribution records for the previous 6 months revealed large variations in the distribution of commodities with serious problems of erratic supply. The micronutrient and mineral content of the ration is variable with good levels of vitamin A, thiamine and riboflavin but low levels of vitamin C, calcium and iodine. These nutrients are seen to remain consistently low with an average of only 36%, 70% and 75% of the minimum requirement being supplied during the last six months.

Recommendations for action based on the findings of this survey are provided following the discussion.

*A more detailed analysis for the 2001 survey is being conducted separately by the National Research Institute for Food and Nutrition (NRI) in Harare and results will be published online by the Institute when a final report is issued.

© International and African Union Nutrition Survey, Sabarwal, Malawi Camps (Tobias, Soteris) 2002. Page 7 of 42

Introduction

A Joint Food Assessment Mission involving donors and implementing partners was conducted within the Saharawi refugee camps in February 2002. The report from this mission recommended that UNHCR and WFP assess the needs of vulnerable groups within the refugee population. Objectives of such an assessment would include:

- Determine the global malnutrition rate
- Assess the prevalence of micronutrient deficiencies
- Evaluate feeding practices of young children
- Recommend actions necessary to address the situation

In line with this recommendation and normal operational procedures UNHCR organised a Nutrition survey in collaboration with WFP and the relevant Saharawi Ministries. UNHCR Geneva contracted the Institute of Child Health (ICH) to implement the survey, which was conducted in collaboration with a WFP nutrition consultant. ICH made a preliminary field visit to the Saharawi refugee camps during June 2002 to discuss the implementation of the nutrition survey. Following meetings with a wide range of stakeholders (including WFP, ECHO, Red Cross/Red Societies, and relevant Saharawi ministries) it was agreed that the survey should be carried out during September 2002.

The preliminary survey report was issued in October 2002. This final report contains additional data from the laboratory analysis of biological samples, infant feeding and food distribution monitoring data collected during the survey.

Background

The Saharawi refugees have been present in camps in Tindouf, Southwest Algeria, since 1975 when they fled Western Sahara. Since that time, the Government of Algeria has supplied relief aid and UNHCR has also been providing a protection and assistance program. WFP has supplied food aid since 1985 and a range of donors and bilateral arrangements currently support the refugee population. The major food donors include donations targeted via WFP and direct donations from ECHO.

The Saharawi refugee camps exist in a harsh desert environment characterized by high temperatures, low rainfall and little productive soil. However, various income generation and diet diversification activities do exist within the camps. These include a poultry farm and olive, livestock and horticultural projects. There is also at least one cooperative unit whose members produce a range of handicraft products although marketing opportunities are in need of strengthening. Refugees commonly undertake foreign visits for education and other purposes. However, the contribution that any of these activities make to food security and diet diversification for the whole population is unclear as no formal food security or household food security assessments have been performed. There is a wide spread assumption of food aid dependence.

As stated above, the food rations that are distributed within the camps are derived from a number of donors including WFP and ECHO. By the standards of most refugee operations in recent times, the planned general ration appears to be fairly well diversified and adequate in energy. However, humanitarian agencies use a population figure of 155,400 for service and ration planning and although there appears to be no independent, real time updating of the figure, it has been estimated to be as high as 165,000¹. In addition, although some food distribution monitoring is undertaken there is no regular reporting of these activities and thereby no weighting of the food based on site distribution monitoring. Without these data it is hard to make any firm collective judgement on the equity or adequacy of the distribution although anecdotal evidence suggests that the distribution is equitable and there have been no reports of distribution problems of the rations. An additional critical problem is the seasonal nature of the food pipeline and unpredictable delays in deliveries.

¹ However, some distribution for Saharawi has increased over a 10-year period (figure 1.1)

A number of previous nutrition surveys¹ have been conducted in Tindouf (no these include those conducted by CISP in 1997 and 2001). Key findings from these surveys included:

- Anaemia was highly prevalent in children and women of childbearing age (six), although it had decreased between 1997 and 2001. It remained a serious problem.
- Global acute malnutrition of children 6-59 months had increased between 1997 and 2001. In 2001 a severe malnutrition rate of 4.5% was found. This finding was of particular and urgent concern given the lack of a therapeutic feeding programme in the camps.
- Infant feeding practices were particularly poor and these may of had a major impact on child malnutrition.
- Obesity in women of fertile age had increased markedly between 1997 and 2001.

As well as conducting two comprehensive surveys, CISP with support from UNHCR, has also initiated various micronutrient interventions including a trial of supplementary feeding and intramuscular treatment of children, and supplementary feeding of pregnant women. They also designed a nutrition surveillance system, but it is not clear what the current coverage and effectiveness of this programme is. There is currently no routine vitamin A supplementation programme, although UNHCR has implemented a one-off distribution as part of a VMC mass polio immunisation campaign during the summer of 2000 and the Saharawi MOH has planned to carry on vitamin A supplementation as a routine activity. Iron tablets are routinely distributed through ANC clinics although no data is available on programme effectiveness. Anecdotal reports indicate that coverage and compliance are likely to be low.

¹Coeliac disease is known to be a problem amongst children in the Saharawi population and a previous survey has reported a prevalence in the child population of about 6%. The NGO CCEPE is currently providing diagnostic and education services for patients but it is reported, anecdotally, that the requirement for special feeding products for this group of patients is difficult to meet.

There appears to be a lack of a functioning health information system and indicators such as the crude mortality rate and under-five mortality rate are not available. Likewise, no quantitative information on infectious disease prevalence is available. These information gaps have made a full appraisal of the health and nutrition situation in the camps impossible. They also limit the interpretation of the results of the current survey as described below.

Survey Objectives

A preliminary visit was conducted by ICH, the UNHCR implementing partner, to assess the need and feasibility of providing technical support for a nutritional survey to be conducted in the Saharawi refugee camps, Tindouf. Based on these discussions, a visit decided that the survey should combine a conventional anthropometric survey of child malnutrition with an assessment of micronutrient malnutrition. The TOR for the survey were issued by UNHCR, Algeria and are included as Annex 1.

Following detailed discussions with key informants and a variety of stakeholders specific survey objectives were identified. This survey is designed to complement, update, and build on the useful data obtained during the two previous surveys conducted by CISP. Adult malnutrition levels and other aspects have been well described in those surveys and are unlikely to have changed significantly in the last year so were not scheduled for the 2002 survey. The work on infant feeding during the 1997 survey indicated serious cause for concern and it was intended to confirm these findings by using a larger sample size, so as to provide a baseline for any possible future intervention work. The objectives of the survey were therefore:

1. Determine the prevalence of global and severe acute malnutrition
2. Investigation of the aetiology of anaemia by measurement of ferritin levels and iron status
3. Assessment of iodine status
4. Assessment of clinical signs for goitre, scurvy and rickets
5. Establish baseline information on infant feeding practices
6. Build capacity in nutrition survey design and implementation

¹Diaper C et al. (1997) *State of Nutrition in the Camps of the Saharawi*. UNO, 244, 947-948

Methods

Staff training and team organisation

All survey team members were Sahrawi refugee staff with the exception of one UNICEF Algerian staff member. Suitable staff were identified by the Sahrawi Ministry of Health. Staff training was conducted over 4 days prior to the survey and covered the following areas:

- + Survey methodology
- + Sample selection
- + Anthropometry
- + Rationale and importance of looking for micronutrient deficiencies in a population
- + Recognition of signs and symptoms for micronutrient deficiencies
- + Correct recording of information
- + Correct methodology for testing and collection of peripheral blood and urine samples
- + Overview of the treatment of severe malnutrition

Practical training sessions were held on anthropometry and sample collection and volunteer children were used to provide practice. Designated team members were responsible for questionnaire administration, sample collection, and anthropometry. Questionnaire staff were awarded during the training session on the basis of accuracy and written legibility using a mock interview test. Sample collection staff were qualified doctors, nurses or laboratory technicians. Each team had an agreed leader who was responsible for the organisation of the teamwork, household selection, and collection of the questionnaires and samples.

A pilot survey was conducted prior to the start of the full survey during which teams gained experience in selection of cluster staff points, use of questionnaires and sample taking. During the survey, regular supervision and support to the field teams was also provided by the two international nutritionists who spent much of their time working with teams in the field.

Target Population Groups for the Survey

Table one shows the different population groups that were sampled with in each cluster and the measurements taken.

Table 1 - Target Population Groups and Procedures

Population Group	Procedures
Infants (0-3 months)	Questionnaire, weight, height, MUAC
Children (6-59 months)	Questionnaire, weight, height, MUAC, clinical examination for oedema and squiny, haemoglobin measurement, peripheral blood collection, sTFR analysis for determination of iron status
Adolescents (10-19 years)	Questionnaire, clinical examination for oedema, urine sample collection
Women (15-45 years)	Questionnaire, haemoglobin measurement

Sample Size Calculation

The following calculations were carried out using EpiCalc in EpiInfo (10) to determine the required sample sizes for the different aspects of the survey.

Global acute malnutrition (GAM, wasting) in children 6-59 months

Based on the expected 6-59 month global malnutrition figure of 13.2% (obtained during last years survey), a required precision of $\pm 0\%$, 95% confidence (5% alpha risk) and an expected design effect of 2, the minimum sample size required is 702 children ($\pm 5\%$ actual = 370). However, due to sample size requirements for other parameters given below and the requirement to detect small changes from previous surveys a full 90x30 sample size of 900 will be taken.

Infant feeding indicators in children 0 - <24 months

To measure the prevalence of non-used breastfeeding in 12 and 24 months a sample of 34 infants aged 20-23 months would be required for each age. This assumes a prevalence of 30% and a desired precision of $\pm 15\%$. This sample size requirement should be met from within the CAHF sample if a standard sample size of 600 were used.

A separate sample of 105 (100 + 10% inflation) 0 - 6 month infants was aimed for in addition to the 0-23 month children (i.e. 6 per cluster) so as to allow for the measurement of exclusive breastfeeding. This assumed that the true prevalence of exclusive breastfeeding was 5% and that we wished to detect an improvement of 10 percentage points following any subsequent intervention with an alpha risk of 5% and 80% power. In reality, it proved difficult to achieve this required sample size due to the apparently low birth rate and survey time constraints.

Iodine status

Median urinary iodine concentration is usually measured in a sample of 40 (8 from school aged) children. As it was hypothesised that any iodine deficiency or excess problem would be associated with a common water supply, the population was stratified into the three regions receiving water from the same boreholes, i.e. Dhaka, Bonga and Aupward combined, and El Aun. A total sample size of 120 was required and the urine sample collection within each cluster was adjusted so that a sample of 40 would be obtained within each of the 3 regions or strata. Therefore, within each cluster in Dhaka and El Aun 3 urine samples were required. Within each cluster in Bonga and Aupward 2 samples were needed.

Anaemia

The sample size calculation for haemoglobin measurement was 210 children and women (i.e. 7 of each population group per cluster). This sample size is based on an assumed prevalence of 40%, a desired precision of 10%, a design effect of 2, and 10% refusal.

Sampling

Households were selected based on a standard two-stage (3) cluster sampling method. Each of the four camps is divided into 8-9 administrative units called Dairs. These were used as sectors for the allocation of clusters by PPS (see Annex 2) using population figures obtained from the Bangladesh Red Crescent (BRC). The population figure used in the cluster selection does not include the across-based population given as being resident in the boarding schools. As these schools were on holiday during the survey and there was no evidence that pupils would be selected preferentially from particular camps this should not have affected the probability of cluster selection to sectors.

Within each sector the Dair health dispensary lies approximately at the centre. This was used as the point for starting off a route to identify a random direction. Following this direction all the houses lying on a straight line between the Dair dispensary and the boundary of the Dair were counted. A random number was then picked from a table to identify which of these houses would be the start point for the cluster. Subsequent households were selected by walking the household and moving to the next dwelling on the way.

Households were defined as people sharing the same tent and food. Within each household all individuals of the appropriate age groups were interviewed and measured. Households were selected within each cluster until the required number from each age group was obtained. All eligible subjects were invited and encouraged to take part. If any refused or absent then they were not replaced in the sampling plan. Subjects who were reported to be in health centres or hospitals were located for interviewing and measurement. If a dwelling was empty, neighbours were asked about the normal occupants. If reliable information was obtained, eligible non-dwelling from within these households were included in the sample frame and not recorded. Time did not permit re-visiting to locate absent family members.

¹¹ WHO (2002) 'Management of Malnutrition in May 2002'.

¹² It would be noted that the administrative boundaries of territorial divisions has been updated since July 2000.

Data Collection

All questionnaire, anthropometry data and biological sample collection was performed in the household.

Measurement of Haemoglobin

Measurement of haemoglobin was performed directly in the household using a portable photometer Hemocue B-haemoglobin Photometer¹ utilizing the azidmethaemoglobin principle. Peripheral blood collection was collected from a finger prick made using a safety lancet (Hemostat). The first drop was allowed to form and wiped away using filter paper. The second drop was transferred into a Hemocue cuvette for the measurement of haemoglobin. The cuvette was filled from one drop using a continuous action and any blood was wiped away from the faces of the cuvette before immediate insertion in to the photometer.

Table 2 shows the cut off values used to define anaemia in this study. It should be noted that a number of different cut-off values are used in surveys and routine work. The ones used here are based on those recommended by WHO but differ slightly from those used in previous surveys of the Sahelian country by CESP.

Table 2 - Cut-off Points for Defining Anaemia²⁸

Age / sex group	Categories of Anaemia		
	Total	Mild (Haemoglobin levels (g/dl))	Moderate- Severe
Children 6 - 59 months	<11.0	10.0 - 10.9	9.0 - 10.0
Adult females ≥15 years	<12.0	11.0 - 11.9	10.0 - 11.0
Pregnant Women	<11.0	10.0 - 10.9	9.0 - 10.0

Collection of Dried Blood Spots for Biochemical Analysis

The first and forth drops of peripheral blood were transferred onto strips of Whatman filter paper that had been prepared by cutting Guthrie cards into the dimensions of a microscope slide. The paper strips were labelled and stored in a microscope slide box at 0°C until the end of the day. Approximately 7 card strips were then transferred into a zip-lock plastic bag, together with a sachet of desiccant and a humidity indicator card²⁹ and frozen at 0 - -10 °C. Humidity was maintained below 30%.

Collection of Serum for Biochemical Analysis

Approximately 200 µl of peripheral blood was then collected from the same of a second WHO stick into a serum separation tube (SST Microtainer³⁰). This was then labelled and placed on ice in a vacuette container at 4-8 °C until centrifugation at the end of the day. Following centrifugation, the serum was frozen in the same tube at between -10 and -15 degrees Celsius³¹. The temperature was maintained between -10 and -15 °C and shipped to London on ice for storage at -80 °C. Samples were stored at -80 °C until analysis³².

Measurement of Serum Transferrin Receptor (sTfR)

For analysis of iron status the concentration of serum transferrin receptor (sTfR) was measured. Analysis of sTfR concentration was performed using a sandwich based enzyme linked immunosorbent assay (ELISA) kit purchased from Diaclon (diaclon.com). The kit contains a plastic plate and in which there are 36 microwells. The microwells are coated with

¹ Hemocue AB, Box 1204, SE-200 20 Angelnska, Sweden.

²⁸ The management of nutrition in West-Saharan Africa, WHO, 2005.

²⁹ Values are given for a population living at sea level. To correct for altitude, add 1.0 g/dl for each 1000 m above

5000 m altitude up to 3000 m.

³⁰ Diaclon Technologies Inc.

³¹ Diaclon Diagnostics

³² Due to problems with freeze stability in Diagnostics vials, samples were stored in 100 µl vials from Diaclon at 0 °C for

up to 4 days before freezing.

³³ Diaclon Diagnostics Inc. Model: sTfR-014.

polyclonal antibodies which recognise soluble human sTfR. The sTfR captured in these wells during the assay is quantified by the addition of a monoclonal antibody which recognises soluble human sTfR and is labeled with the enzyme horseradish peroxidase. On addition of tetramethylbenzidine (a substrate for horseradish peroxidase) a blue colour is produced, which on the addition of acid, turns yellow. The optical density of the solution is then measured, with a plate reader, at wavelength 450nm and is proportional to the concentration of sTfR in the sample. Quantification is undertaken by comparison with a standard curve prepared on the same microtitre plate. The normal range of sTfR is given in table 2.

Table 2 - Iron Status - Serum Transferrin Receptor (sTfR)¹

sTfR normal range 3.0 - 6.5 µg/l ml

Collection of Urine and Analysis of Iodine

The survey teams collected urine from consenting adolescents in 100 ml collection cups or directly into collection tubes. The urine was transferred from the collection cups into a 10 ml Microvette[®] urine collection tube or 5 ml Nalgene cryovial[®] and labeled with the appropriate identification number of the adolescent. Urine tubes were stored in plastic bags at 0 - 5 Celsius until the end of the day when they were transferred into a freezer for storage at -5 - -15 °C.

Urinary iodine was measured according to routinely used techniques². An AutoAnalyzer II method was used with automatic handling of the samples, digestion with strong acid, and quantified with the Sandell-Kolthoff colorimetric reaction. In this method (also sets as optional) for the oxidation-reduction reaction between di-iodo ammonium sulfate and arsenious acid. The cut-off values for urinary iodine excretion are given in the table below.

Table 4 - Adolescent population Urinary Iodine³

Degree of intake in population	Population Median Urinary Iodine (µg/L)
Excessive intake ⁴	≥ 300
Normal intake	100 - 290
Mild deficiency	50 - 99
Moderate deficiency	20 - 49
Severe deficiency	< 20

Anthropometric Measurements

Anthropometric measurements were taken on children and infants in the household. Weight was determined using an electronic digital scale (SEC5 853) measuring to the nearest 100 grams for children or the nearest 20 grams for infants. Apertures on the underside of the scales were sealed with tape to prevent ingress of sand and dust. Scales were checked daily for stability using a known weight.

Children (5-59 months) were weighed either standing alone or while being held by a carer or member of the survey team. Scales were tared to zero before the child's weight was determined. Infants were placed on a detachable weighing tray for weighing. Children and infants were weighed either naked or if the child is parent/patiented, wearing one item of clothing such as a shirt or undershirt. Weighing a selection of these clothes confirmed that they weighed less than 100 grams.

¹ International Atomic Energy Agency (IAEA) Laboratory No. 1594

² Gendell

³ IAEA

⁴ A Fully Automated Method for the Determination of Serum Protein-Bound Iodine: McKillop and R. Cooper - *Diagnosis Symposium 1994*

⁵ *Trace Elements in Human Nutrition and Health* (1996) (World Health Organization)

⁶ DeGeorge F. de Bened. B. *Practical Dietetics* (2001) (John Wiley & Sons Ltd) p. 64-65, of the cellular? *Nutrition* 11: 432 - 447

Height and length was taken using a Storr (Ware-Child-Adult Height Board)¹ to the nearest mm. Children and infants less than 24 months old were weighed lying down while children from 24.58 months were measured standing.

Mid upper arm circumference (MUAC) was taken using a TAUC MUAC tape to the nearest mm².

Collection of Questionnaire Data

Four separate questionnaires (data collection forms) were developed and used for infants, children, adolescents and women. The questionnaires were formulated in English, translated into Spanish and then field-tested and revised prior to use in the survey. Questions were addressed to the subjects in Arabic. All survey staff conducting the interviews were native Arabic-speakers and fluent in Spanish.

Age and date of birth data was collected from vaccination cards for infants and children and by verbal recall for adolescents and women. For 3 children the date of birth was not obtainable from the vaccination card and age was taken from parental recall. The interviewers used a calendar sheet to determine age.

Infant feeding data was collected using the internationally recommended 24-hour recall method³. Vaccination history was taken from vaccination cards only and verbal reports were not accepted.

Assessment of Clinical Signs of Nutritional Deficiencies

Training was provided on the specific signs that were measured during the survey using photo cards. Medical doctors or nurses in the survey teams performed the assessments, which were conducted on children (oedema, oedema, scurvy) and adolescents (goitre).

Visible goitre was assessed as an indicator of iodine deficiency or excess. While total goitre prevalence is often used as an indicator in surveys, the difficulties in ensuring reliable detection of palpable goitre makes this a difficult parameter to measure in routine nutrition surveys. For visible goitre, a cut-off of 10% has been proposed as an indicator of a severe public health problem⁴.

Clinical oedema was assessed by looking for bowlegs and costo-ribondal beading (ribs/ribs) (scurvy). Scurvy was assessed by examining for bleeding gums and/or petechiae/haemorrhage on the arms and backs of the legs.

Spedal pitting oedema was assessed by placing thumb pressure on to both feet of children and infants for a period of 5 seconds. After releasing the pressure, the presence or absence of an indent was noted.

Qualitative data collection

This did not permit the holding of focus group discussions and qualitative data collection was limited to key informant interviews and observation. Key informants included medical doctors, mothers of infants and children and officials of the Saharawi MCH.

Data Management

Data was entered and stored in 4 separate data files corresponding to the different age groups. Each individual interviewed during the survey was assigned a unique ID number based on their cluster, household, individual number and age group (e.g. 03-11-03-02). EpiInfo v6.04c was used for data entry, validation, and cleaning.

EpiInfo v6.04d and SPSS v11.0 were used for data analysis and Excel for file interchange and graphing.

¹ Storr Productions, USA

² A full set of anthropometric and other equipment was purchased for the survey and shipped to Algeria. This equipment is now in storage at the UNICEF SO in Tripoli where it is available for future survey work.

³ Infant and Child Feeding Measurements Guide (1999) Willy S. Langstaff, Food and Nutrition Technical Agency.

⁴ Infant Feeding Database of Tropical Indicator (1999) FAO, Edmonde N. and David S.

Age was calculated by Gperts using the formula: Age in months = (date of interview - date of birth) / 0.25 * 24 * 12. The difference in calculated age and recorded age was determined and discrepancies between the two were resolved during data cleaning.

Ethics and informed consent

The aims and objectives of the survey were discussed and agreed with members of the Saharawi leadership (Ministry of Health, Ministry of Cooperation, Women Union etc.) Information about the survey was disseminated before commencement of the survey by the Saharawi leadership.

During the survey, when teams arrived at a household they first explained the purpose of the survey using an information sheet translated into Arabic. If agreement was given the team then entered the household sitting area within a tent or solid building. For questionnaire administration, height, weight, and MUAC measurements verbal consent was obtained. For sample collection, written consent was obtained from the subject, in the case of women or adolescents, or from the mother for children aged 0-59 months.

Individuals were able to elect to be measured for anthropometry but decline sample collection if they so wished. All records collected during the survey were considered as confidential and were not stored with name or address identifying data.

The English version of the information sheet used in the survey is given in Annex 5.

Implementation Schedule

A preliminary visit was conducted by the ICH in June 2002 during which agreement and logistical planning for the survey was undertaken. The ICH and WFP nutritionists arrived in Agadez at the start of September and travelled to Tindouf on the 3rd and 4th of September. A detailed schedule of the survey work undertaken in Tindouf is provided in Annex 3.

Logistics

UNHCR, Tindouf and the Saharawi MOH provided transport during training and survey periods. The Nursing School provided training venue and accommodation for the team during the training. Accommodation for the survey teams was provided by the Housing Administration while in the camps.

Results

Data was collected over 11 days from 12th to 22nd September 2002. The survey was concluded on consecutive days and included two Fridays. Table 5 summarises the number of people assessed during the survey in the different population groups and their ages and gender.

A total of 231 eligible women were sampled of which one refused to participate and 2 were absent from the household at the time of the survey. Data was therefore collected on 228 but after ages were calculated from reported birth dates during analysis, only 223 fell within the desired age range of 15-45.

A total of 628 adolescents were sampled of which 3 refused to participate, 12 were absent from the household and 3 were later found to be outside the desired age range. Data was collected and analysed on the remaining 598. It is interesting to note that the higher ages of 15-19 are under represented in comparison to younger age groups. The gender distribution for adolescents is also biased in favour of females. This may reflect the demographic composition of the camps or be due to some unknown selection bias. However, in terms of point and urinary toxine measurements it is unlikely to bias the results.

A total of 807 children were sampled during the survey of which 13 were absent from their household. Consent was refused for 5 children to participate in the survey. In addition, agreement for blood collection from two children was refused but consent was obtained for them to participate in questionnaire and anthropometric data collection. Three children were found to be out of the desired age range during analysis and data was therefore excluded. One child was excluded from analysis due to missing data.

Anthropometric and questionnaire data was therefore analysed from 881 eligible children and 1600 samples were taken from 204 for analysis of haemoglobin.

Newly-born infants were sampled and data was collected from 51 participants.

Table 3 - Characteristics of the population sample groups

Population Group	Biologic Age Range	N	Actual Age range	Mean Age	Median Age	% Male	% Female
Infants	0 - 5 months	81	0 - 5	2.1	3.6	42.9	57.1
Children	6 - 59 months	321	6 - 59	30.5	29.0	49.9	50.1
Adolescents	10 - 19 years	390	10-19	13.4	13.0	48.8	51.2
Women	15 - 45 years	223	16-45	29.5	29.0	-	100

Anthropometry in 6-59 month children

The age and sex distribution of children included in the anthropometric and questionnaire surveys is shown in table 6. There are no significant differences in the age or sex distribution of the subjects (p<0.05) although fewer girls in the eldest age category were included in the sample.

Table 6 - Age and Sex Distribution of 6 - 59 Month Children

Age class (months)	Boys		Girls		Combined	
	n	%	n	%	n	%
6 - 17	85	30.8	111	26.3	200	33.5
18 - 29	96	23.4	79	16.7	175	20.6
30 - 47	83	15.4	68	23.2	151	21.3
48 - 53	65	20.6	60	19.0	125	19.6
54 - 59	73	16.8	54	12.5	126	14.8
Total	403	50.4	422	49.6	825	100.0

The overall prevalence of global and severe acute malnutrition is shown in table 7 and a breakdown of acute malnutrition by age is given in table 8. It should be noted that the analysis was performed on records (n=850) excluding out of range values identified using the standard Epstein flag criteria. Prevalence is given for the weight for height (WFH) indices in both z-scores and % of the median. The internationally recommended method of reporting malnutrition is through the use of z-scores as these provide a more statistically valid and comparable indicator. However, the % of the median indices is also widely used, as it is conceptually easier to understand and calculate and forms the basis for admission and discharge criteria for supplementary and therapeutic feeding programmes. As normally found, the z-score indicator gives a higher estimate of the prevalence of malnutrition than the % of the median. The global prevalence of acute malnutrition is at a moderate level. The average MUAC in children 1-5 years was 14.6 cm (95% CI 14.5 - 14.8; n=779).

Table 7 - Prevalence and Mean Levels of Acute Malnutrition (Wasting) in Children

Acute Malnutrition	Global (95 % CI)	Severe (95 % CI)	Mean (95 % CI)
	(< -2 z-scores or $< 80\%$)	(< -3 z-scores or $< 70\%$)	
WFH z-score	10.6% (7.7 - 13.5)	2.2% (1.5 - 3.1)	-0.61 (-0.69 - -0.72)
WFH % median	8.5% (6.4 - 10.6)	0.7% (0.2 - 1.2)	103.1 (92.3 - 103.6)

Figure 1 - Distribution of Weight for Height z-scores in 6-59 Month Children

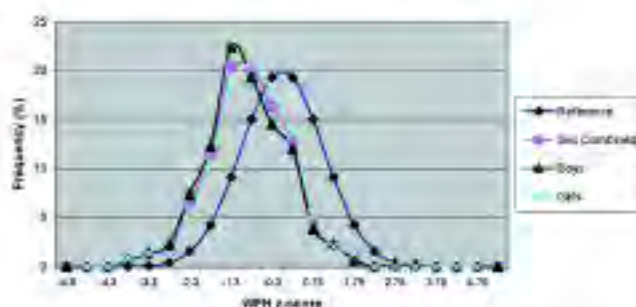


Table 8 - Acute Malnutrition (Wasting) by Age Class

Age class (months)	Severe		Moderate		Normal		Global	
	n	%	n	%	n	%	n	%
6 - 17	6	3.0	19	9.5	175	87.5	0	0
18 - 29	2	1.1	14	8.0	159	90.9	0	0
30 - 41	3	1.7	19	10.5	158	87.8	0	0
42 - 53	2	1.2	8	4.6	156	84.0	0	0
54 - 59	6	4.8	11	8.7	101	86.5	0	0
Total	19	2.2	71	8.4	760	89.4	0	0.0

No significant differences in acute malnutrition by age were detected ($p > 0.05$). Analysis of malnutrition by camp revealed significant higher levels of acute malnutrition in El Arin compared with the other camps (Chi square, $p < 0.05$). This was true for both global and severe wasting.

No significant difference in global malnutrition was seen between genders with 11.9% for boys vs. 9.2% for girls. There was also no difference in the prevalence of severe acute malnutrition.

The number of other children less than 5 years old in the same family ranged from 1 to 5 with a mean of 1.9. No relationship between the number of children under five and global malnutrition in the household was observed in this equation (Chi squared; $p > 0.5$).

Chronic Malnutrition (Stunting)

The prevalence of chronic malnutrition (stunting) is given in table 9 and a breakdown by age in table 10 using the height for age (HFA) z-score indices. No difference in stunting by sex was found (33.6% for boys vs 32.0% for girls) or by age category (Chi square, $p > 0.3$).

Table 9 - Prevalence of Chronic Malnutrition in Z-scores (Stunting) in Children

Chronic Malnutrition	Global (95% CI)		Severe (95% CI)		Mean (95% CI)
	< -2 z-scores	(29.7 - 36.1)	< -3 z-scores	(8.2 - 13.6)	
HFA z-score	32.6%	(29.7 - 36.1)	11.2%	(8.2 - 13.6)	-1.48 (-1.67 - -1.38)

Figure 2 - Distribution of Height for Age z-scores in 9-59 Month Children

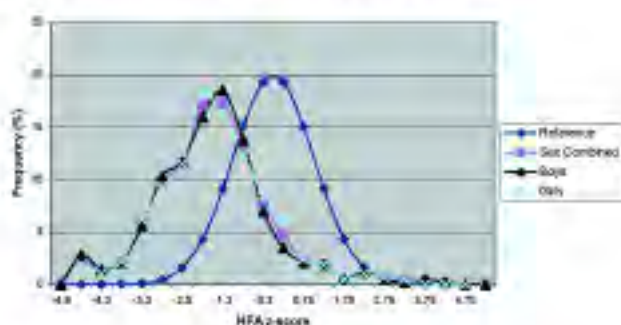


Table 10 - Chronic Malnutrition (stunting) by Age Class

Age class (months)	Severe		Moderate		Normal	
	≤ -3 z-score	%	≥ -3 & < -2 z-score	%	≥ -2 z-score	%
6 - 17	24	12.0	39	18.0	140	70.0
18 - 29	25	14.3	47	23.4	109	52.3
30 - 41	26	13.0	39	21.0	119	56.2
42 - 53	17	10.1	32	23.2	112	66.7
54 - 59	4	3.2	30	23.8	92	73.0
Total	96	11.2	154	21.8	571	57.2

Anthropometry in infants <6 months

The age and sex distribution of infants <6 months who were included in the anthropometric and questionnaire surveys is shown in table 11. There are no significant differences in the age or sex distribution of the subjects ($p < 0.47$) but the sample size is small.

Table 11 - Age and Sex Distribution of Infant Sample

Age (months)	Boys		Girls		Combined	
	n	%	n	%	n	%
0	10	67	5	33	15	16
1	8	38	13	62	21	23
2	7	44	9	56	16	17
3	6	40	9	60	15	16
4	4	29	10	71	14	15
5	4	40	6	60	10	11
Total	39	49	52	57	91	100

Three subjects could not have their weight for length determined, as they were less than 49 cm in length (the lower cut-off for the reference data). Length data was missing for one subject. Anthropometric data was analysed on the 87 infants for which complete data was available.

The overall prevalence of global and severe acute malnutrition is shown in table 12. Prevalence is given for the weight for height (WFH) indices in both z-scores and % of the

median. The global prevalence of acute malnutrition by z-score is 1.1%, which is very low and accounted for by one case of moderate malnutrition. No oedema was detected ($n=0$). The good anthropometric status of this age group is confirmed by the mean z-score and % of the median, both of which are only slightly below the reference values.

Table 12 - Prevalence and Mean Levels of Acute Malnutrition (Wasting) in Infants

Acute Malnutrition:	Global (95% CI) (≤ -2 z-scores or $<80\%$)	Severe (95% CI) (≤ -3 z-scores or $<70\%$)	Means (95% CI)
WFA z-score	1.1% (0.0-3.4)	0.0%	-0.27 (-0.43 - -0.10)
WFA % median	0.0%	0.0%	97.3 (95.4 - 99.2)

Similarly the prevalence of stunting is very low in this age group with only 2.3% total stunting and 1.1% severe. This data indicates that both the acute and chronic anthropometric status of this age group is good.

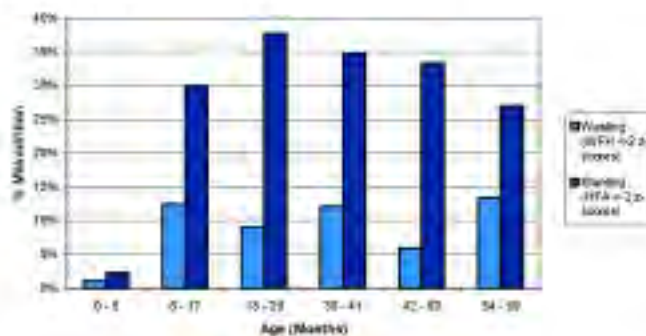
Table 13 - Prevalence and Mean Levels of Chronic Malnutrition (Stunting) in Infants

Acute Malnutrition:	Total (95% CI) (≤ -2 z-scores)	Severe (95% CI) (≤ -3 z-scores)	Mean (95% CI)
WFA z-score	2.3% (0.0-5.3)	1.1% (0.0-3.3)	-0.08 (-0.23 - 0.23)

Trends in Malnutrition with Age

The prevalence of wasting and stunting against age is plotted in figure 3. It can be seen that the prevalence of stunting and wasting is low during the first 5 months of life but increases rapidly thereafter. The prevalence of wasting shows no clear trend between 6 and 59 months, whereas stunting is seen to increase up to 18-29 months and then gradually decline until 59 months. These data suggest that chronic malnutrition begins early and leads to rapid growth faltering which continues through early childhood.

Figure 3 - Trends in Malnutrition with Age



Infant and Young Child Feeding Practices

To investigate infant and young child feeding practices a recall questionnaire was used to ask mothers of children, aged 0-23 months, what they had fed them in the last 24 hours. This method is not accurate for determining individual normal dietary patterns, due to large day-to-day variations, but is very useful for measuring practices at a population level¹⁰

¹⁰Infant and Child Feeding Measurements Guide (1998) Mary G. Lung'aho, Food and Nutrition Technical Assistance

Table 14 - Indicators of Infant and Young Child Feeding Practices

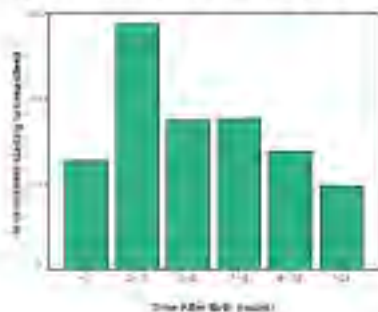
Indicator	Sampled Age Range	n	Prevalence (%)	95% CI
Ever Breastfed	0 - 23	371	97.3	95.7 - 98.4
Timely Initiation of Breastfeeding	0 - 23	369	12.7	8.9 - 18.7
Exclusive Breastfed (<6 months)	< 6	67	2.3	0.0 - 6.6
Continued Breastfeeding at 12 months	12 - 15	62	64.1	75.3 - 83.0
Continued Breastfeeding at 24 months	20 - 23	59	47.5	32.1 - 62.0
Timely Complementary Feeding	6 - 10	74	58.4	44.0 - 72.2
Infant Formula Feeding (<6 months)	< 6	87	28.7	17.5 - 39.7
Reported Prevalence of Diarrhoea*	0 - 23	367	22.3	16.9 - 27.8
Continued Feeding During Diarrhoea**	0 - 23	75	90.7	70.6 - 97.2
Increased Feeding During Diarrhoea**	0 - 23	75	13.3	4.5 - 22.7

* The figure reported is for a 14-day period prevalence.

** Only those mothers reporting diarrhoea in their infants/children within the last 14 days were included.

Key indicators of infant feeding practice are summarised in table 14. The proportion of infants who had been breastfed at some time in their lives was high, with no significant differences by sex or camp ranging from in 93% in Dhaka to 98% in Mirasa.

However, the prevalence of Timely Initiation of Breastfeeding is only 12.7%. This indicator defines the percentage of infants and young children <24 months who were put to the breast within one hour of birth. The purpose of this indicator is to assess whether mothers initiate early breastfeeding with its respective benefits for both mother and infant. The situation in Dhaka is clearly far from ideal with regards to this indicator. As shown in figure 4 although all the sampled mothers did initiate breastfeeding fairly delayed the soon of breastfeeding for some time after birth with a sizeable minority not initiating feeding within the first 24 hours.

Figure 4 - Time of Initiation of Breastfeeding After Birth

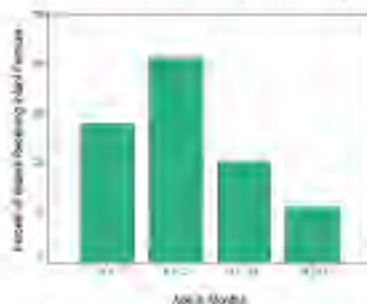
The Exclusive Breastfeeding indicator shows the percentage of infants 0 - 6 months who are currently being exclusively breastfed, i.e. who are receiving only breastmilk and no water, other liquids or solids. Drops or syrups of vitamins, mineral supplements, or medicines are allowed. This indicator provides a measure of the degree to which women have adopted behaviours consistent with the WHO recommendation that infants should be fed exclusively on breastmilk from birth to about six months. As seen in table 14, the prevalence of exclusive breastfeeding is only 2.3% indicating that many women are not following the recommendations.

The Continued Breastfeeding at 12 Months indicator measures the percentage of children 12 - 15 months who are breastfed. This is a measure of breastfeeding duration as it is

prevalence of Continued Breastfeeding at 24 Months. In this survey the prevalence of breastfeeding at 12 months was 34.1% and at 24 months it was 21.5% implying that some women are stopping breastfeeding earlier than the recommended two years.

Use of infant formula was 24.1% overall with 26.7% use under 6 months of age and the highest use at 6-12 months old (33.8%). Although the prevalence of bottle-feeding was not assessed in this survey, observations and anecdotal accounts indicate that it is a fairly common practice. Given the difficulty in maintaining hygienic preparation conditions in the home environment, the wide spread use of infant formula is a cause for concern. Figure 5 indicates the frequency of infant formula use with age.

Figure 5 - Trend in Use of Infant Formula With Age

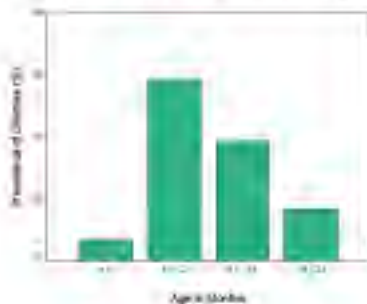


The Timely Complementary Feeding Rate Indicator gives an overall measure of the degree to which women have complied with the recommendation that infants aged 6 - 10 months receive appropriate and adequate complementary foods in addition to breastmilk. The complementary feeding indicator is intended as a basic, simple indicator of feeding practices among children in the age group 6 - 10 months. By this age, it is recommended that infants should be receiving solid foods in addition to breastmilk. "Solids" are defined as foods of many (semi-solid) or solid consistency such as porridge but does not include fluids such as fruit juice.

Prevalence of Diarrhoea and Feeding Response

As described below, water, sweetened water, Goflo (a blended cereal food), other solid or mushy foods and other milks are introduced to some infants before 6 months of age and at increasing frequency thereafter. These other foods, especially infant formula and powdered milk, are known to carry a high risk of contamination and causing intestinal infections in young children and infants. It is interesting to note that the 14-day period prevalence for diarrhoea in this survey was 22.5%. No case definition was used, as the validity of a stool count method has not been established in young breastfed infants. Rather, we relied on the perceptions of the mother as to what was abnormal bowel movements in her child. The main purpose of this question was to assess the mother's response when she perceived her child had diarrhoea in how she fed her child. The age trend in diarrhoea prevalence is shown in Figure 5. It can be seen that the prevalence is highly age dependent with relatively low levels up to 6 months of age, a peak of nearly 40% at 6 - 12 months of age and slowly declining until 24 months. The high levels of diarrhoea at 6 - 12 months coincide with the increasing consumption of a range of foods implying that food hygiene may be an important issue.

Figure 5- Trend in Diarrhoea Prevalence With Age



The percentage of Wāhānā/Children <24 Months offered continued feeding during diarrhoeal episodes was assessed by asking about feeding practices for those infants who had suffered diarrhoea in the last 14 days. This indicator measures the change in frequency with which foods (breastfeeding and/or other foods) are offered during diarrhoea compared to when the child is healthy.

This indicator is a measure of the mother's reported behaviour rather than that of the child. This measure is useful for monitoring the quality of home care for childhood diarrhoea and is a measure of whether the carer is following recommended messages about the management of childhood diarrhoea. Over 90% of mothers offered continued feeding during diarrhoea but only 13.3% offered increased feeding. It is still concerning that 8% of infants/children suffering from diarrhoea had their feeding withdrawn as this can reduce the chances of a full recovery and is an important risk factor for developing severe malnutrition.

Introduction of Different Foods By Age

The normal introduction of different foods to infants and children is summarized in the following three figures. In figure 7 it can be seen that while breastmilk consumption decreases with age the consumption of powdered milk shows a marked increase. In figure 8 it can be seen that water is introduced at a very early age and that fruit/ juice is first introduced in some children between 6 and 12 months. The consumption of tea also shows an increasing prevalence from the age of 8 - 12 months. This is concerning given the established role of tea in reducing iron absorption and increasing the risk of iron deficiency.

Figure 7 - Milk Consumption in Infants and Young Children

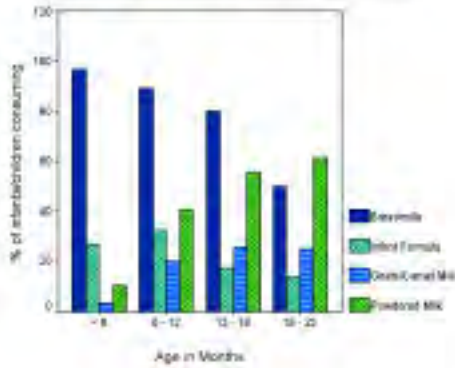
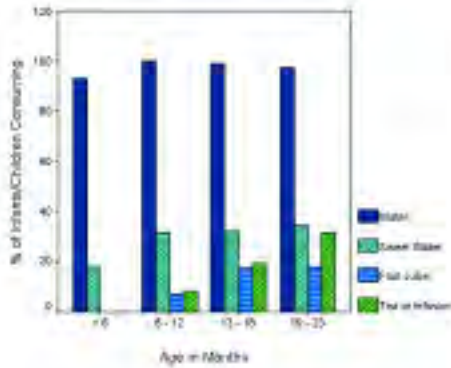
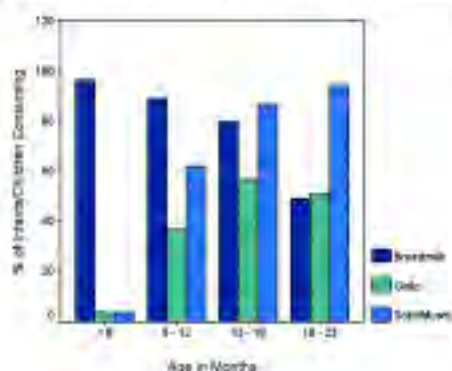


Figure 8 - Consumption of Non-milk Fluids in Infants and Young Children



In Figure 8 it can be seen that the introduction of complementary infant foods in addition to breastmilk on a daily basis increases steadily with age. However, as demonstrated by the low prevalence of the timely introduction of complementary infant foods, many infants are not receiving adequate complementary food until late on in their development.

Figure 9 - Consumption of Solid and Mashed Complementary Infant Foods



Vaccination Coverage

A vaccination health card for children was possessed by 72.5% (95% CI 68.1-76.9) of the mothers (n=643) of 6-59 month old children. Possession of vaccination health cards ranged from 75.6% in Smeru to 67.1% in Awerd.

Vaccination coverage was calculated for children aged 12-23 months. Of these 211 children, 75.8% (95% CI 69.3 - 84.3) had a vaccination card. Vaccination coverage ranged from 25.0% for BCG down to an alarming 66.7% for measles. Verbal reports of vaccination in the absence of a card record were classified as negative. It should be noted that the recommended minimum standard for measles vaccination coverage is 95%.²

Table 16 - Vaccination Coverage from Card Records

% Coverage of Vaccination Programme (12 - 23 month children)		
BCG (n=106)	DPT3 (n=106)	Measles (n=105)
78.2% (95% CI 69.4 - 87.7)	77.0% (95% CI 68.4 - 85.6)	66.7% (95% CI 58.3 - 75.0)

Anaemia

Peripheral blood was taken from finger sticks and used for the analysis of nutritional status and risk factors in children and women. Anaemia was tested using the Hemocue Phoximeter³, which measures the amount of haemoglobin in a blood drop placed into a specialised disposable cuvette.

Of 204 children tested for anaemia, 36.3% (95% CI 26.7 - 45.9) were anaemic (p<0.05). Boys and girls were equally affected with 35.1 and 34.4% being anaemic (RR 1.05, 95% CI 0.72 - 1.53). The mean haemoglobin level in children was 11.5 g/dl with a range of 7.0 - 15.9 g/dl. The table below summarises the prevalence and severity of anaemia in children and women.

² Minimum Standards in Health Care: The Solway Project (2000).

³ Hemocue AG, Angelholm, Sweden.

Table 16 - Haemoglobin levels and the Prevalence (%) of Anaemia

Population Group	N	Mean Hb (g/dl)	Range (g/dl)	Total Anaemia (%)	Mild Anaemia (%)	Moderate Anaemia (%)	Severe Anaemia (%)
Children 6-59 months	204	11.5 (SD 1.6)	7.0-15.4	36.3 (26.7-45.8)	17.7 (11.8-23.4)	17.6 (11.5-23.4)	0.0
NP Women 15-45 years	204	11.6 (SD 2.0)	5.0-13.1	47.6 (38.8-56.5)	16.6 (11.8-21.7)	26.5 (19.8-33.8)	4.4 (1.2-7.8)
P Women 15-45 years	19	9.8 (SD 2.1)	4.0-13.5	79 (60-95)	36 (11-59)	36 (15.2-55.8)	5 (0.0-15.2)

NP=non-pregnant, P=pregnant. Cut offs for anaemia in the different population groups are based on the 'Management of Nutrition in Rural Communities' (WHO, 2000). Full details see methods section. Figures in brackets are 95% confidence intervals for prevalence; estimates and means calculated using C-Sample. Mean haemoglobin levels are given with standard deviation in brackets.

Figures in brackets are 95% confidence intervals calculated using the programmatic C-Sample in EpiInfo to allow for the design effect of the cluster survey. It has been proposed that anaemia prevalence levels of <5-20%, 20-40% and >=40% define the level of public health significance within a population as low, medium, and high¹¹. From these data it can be seen that the levels of anaemia in non-pregnant women of reproductive age in Tindouf (47.6%) constitute a situation with high public health significance while that of 6-59 month old children (25.3%) can be regarded as moderate. Caution should be used in interpreting the prevalence of anaemia in pregnancy due to the small sample size and the lack of determination of gestational age.

Figure 10 - Distribution of Haemoglobin Concentrations in 6-59 month Children

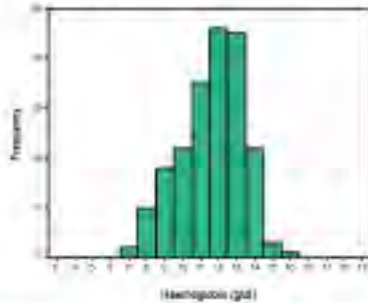
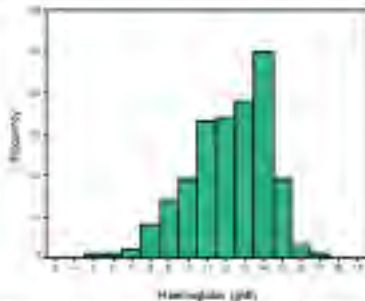


Figure 11 - Distribution of Haemoglobin Concentrations in Women, 15-45 years



¹¹ The Management of Nutrition in Rural Communities (2000) (WHO) Health Organization

Risk Factors for Anaemia

There are a large number of risk factors that may contribute to the development of anaemia. These include nutritional deficiencies, parasitic and other infections, inherited conditions, and blood loss due to menstruation and other causes. In women, 15-45 years, 4.5% reported being pregnant and pregnancy was associated with anaemia with a RR of 1.7 (95% CI 1.2 - 2.3).

Iron deficiency can often precede anaemia and can be measured biochemically before it results in a reduction in haemoglobin and the development of anaemia. To assess the extent of iron deficiency and the contribution that it makes to the anaemia seen in children in Tindouf, a biochemical test was performed and this involved measuring the level of serum transferrin receptor.

Iron Status

Serum transferrin receptor levels are considered a good indicator of iron status and are less affected by infection rates than measurements of ferritin¹¹. They are also reported to be independent of age and sex although some work indicates that children may have slightly higher levels than adults. Analysis was performed using the Rando sTfR enzyme immunoassay (ELISA) kit on all samples collected from children 6-59 months old. Two hundred samples were analysed. The results in table 17 are for the 182 subjects in which complete data on anaemia and sTfR were available.

The overall level of iron deficiency in children is 34.1% (95% CI 27.4 - 40.7) as determined by measurement of sTfR with a cut-off of $\geq 6.5 \mu\text{g/l}$ as seen in indicating deficiency¹².

It can be seen in figure 10 that the extent of iron deficiency increases with the degree of anaemia. Iron deficiency is strongly associated with anaemia (RR = 2.87 (95% CI 2.0 - 4.2) in this population and is therefore likely to account for a significant proportion of this condition in the absence of malaria and with no evidence of significant levels of helminth infections. The data suggests that dietary modification may be the most important intervention to tackle the identified iron deficiency anaemia. Widespread consumption of tea was observed in this population and confirmed by key informant interviews. Data collected on infant feeding confirms that this practice begins at an early age for some children (before 2 years of age). Evidence from other studies indicates that consumption of tea is an important risk factor for iron deficiency due to chelation of iron in the intestine that makes it unavailable for absorption by the body.

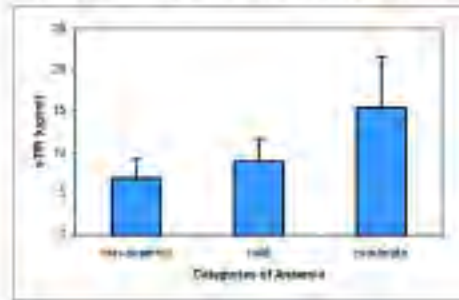
Table 17 - Serum Transferrin Receptor (sTfR) Levels in Anaemic and non-Anaemic Children

	n	Mean sTfR level ($\mu\text{g/l}$)	Iron-Deficient (sTfR $\geq 6.5 \mu\text{g/l}$)	% Iron-Deficient (sTfR $\geq 6.5 \mu\text{g/l}$)
Anaemic	87	12.0 (SD 6.7)	40	59.7 (95% CI 50.9)
Non-anaemic	115	4.6 (SD 2.8)	39	34.1 (11.8 - 40.7)
Combined	182	8.6 (SD 4.6)	62	34.1 (27.4 - 40.7)

¹¹ Cobb GD. The measurement of human transferrin receptor. *Am J Hematol* 53(114): 269-276 (1996)

¹² [Biochemical data sheet](#)

Figure 12 - Relationship between iron Deficiency and Anaemia



Iodine Status

Iodine status was assessed by clinical observation of goitre and measurement of urinary iodine excretion.

Urinary Iodine Excretion

Concern has been expressed in the past about possible high levels of iodine consumption in the Saharawi population. Anecdotal reports have indicated that this may be due to high environmental levels of iodine in water and soil.

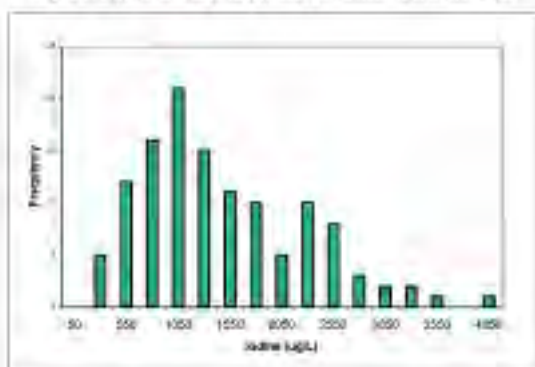
To investigate these concerns the iodine status of the population was assessed by measurement of the iodine concentration in urine samples collected from 122 adolescents (10-19 years old). Approximately 10 ml of urine was collected into Sarstedt Urine Monovette tubes or Nalgene cryovials and then frozen for storage and transport. Analysis was conducted using the Sandel-Koffhoff reaction automated using a Technicon AutoAnalyzer. The work was performed in the laboratory of the Department of Clinical Chemistry, University Hospital Saint-Pierre, Belgium²³ under contract to ICH, London. Results are summarised below.

Table 18 - Urinary iodine levels in Adolescents

n	Mean (µg/L)	Median (µg/L)	Range (µg/L)
122	1361 (92-781)	1200	60 - 3600

²³ We would like to express our gratitude to Dr J. Deleage and Mrs. D. Grel for their assistance in the analysis of 189 samples.

Figure 13 - Distribution of Urinary Iodine Concentrations in Adolescents



Samples were collected and analysed from 53 males and 52 females. No significant differences in urinary iodine levels were found for sex or age.

The median level of urinary iodine is frequently used as a means of assessing the iodine status of populations. Median levels of ≈ 100 µg/L in samples taken from school age children may be considered as indicating no deficiency³¹ while levels above 300 µg/L has been identified as being excessively high³¹. The median level of urinary iodine excretion found in the Saharawi refugee camps indicates that there is evidence of excess iodine consumption at the population level. The concentration of urinary iodine found in this survey is high. Possible causes of excess iodine intakes are from deficient quality control of salt iodination combined with consumption of other diet items high in iodine³².

The water sources for the camps may be divided into three, with Dhaka being served by one source, Smara and Awserd by another and El Aun by a third. If iodine ingestion from the water source is a significant source of iodine consumption then it might be expected that there would be different levels of urinary iodine according to which water source people were consuming. To investigate this possibility we divided the camps into the three water source areas and collected and analysed urinary iodine samples from each of these. The results from the analysis are given in table 15 below. Note that the table contains data on the 115 subjects for who location information was available.

Table 15: Urinary Iodine Levels in Individual Camps

Camp	n	Mean (µg/L)	Median (µg/L)	Range (µg/L)
Dhaka	42	741	390	82 - 1390
Smara	23	1823	7600	350 - 3320
Awserd	15	1416	5335	126 - 2350
El Aun	34	1754	5770	390 - 3600

All the camps show high levels of urinary iodine. While no significant difference in urinary iodine levels were seen between Smara, Awserd and El Aun they are all significantly higher

³¹ This is presented in Human Nutrition and Health (1986) World Health Organization.

³² George F. DeGroot & Peter C. Deroo (2007) Iodine deficiency in the world: where do we stand & the role of the urinary?

[http://dx.doi.org/10.1007/s12010-007-9047-4]

³³ Food sources rich in iodine include fish and some sea foods.

than wells found in Dhaka (Kuski Wells, $n=400$). This data suggests that environmental factors such as the water supply may significantly affect iodine intake.

These results indicate that there is an urgent need to investigate environmental sources of iodine exposure from water and soil as well as to test the distributed salt for levels of iodine to ensure that the fortification level is appropriate.

Goitre assessment

Visible goitre was assessed in a sample of 599 adolescents. As shown in table 14, there is an alarmingly high prevalence of visible goitre, which is especially high in Simra camp. As described above, the analysis of urinary iodine also indicates excessive intake of iodine. To investigate whether there was an association between the level of iodine intake in each camp and the prevalence of visible goitre the data was analysed to compare the goitre prevalence in Dhaka compared to the other 3 camps. No significant association was detected. The causal relationship between iodine intake and goitre prevalence remains unclear. However, it should be noted that an iodine intake may be regarded as excessive in all the camps and the overall prevalence of goitre is also high, there is a need to further investigate the public health significance of these findings.

Table 20 - Prevalence of Visible Goitre in Adolescents ($n=599$)

Camp	N	Prevalence (%)	95% Confidence Interval
Dhaka	162	6.8	0.8 - 12.8
Simra	168	13.9	4.7 - 23.1
Swamed	112	4.5	0.4 - 8.6
Ethyan	157	3.8	0.0 - 5.6
Combined	599	7.1	3.6 - 10.7

Clinical signs of scurvy and rickets

Assessment of children for clinical signs of rickets ($n=49$) revealed only two individuals (1/24) with signs of bowlegs and none with rachitic rosary. There is therefore no evidence of rickets existing as a widespread public health problem. However, it should be noted the criteria for defining a public health problem are not well defined and the appropriate sample size calculation was therefore not possible. Sporadic cases of rickets occur in deprived communities throughout the world and are often associated with poor infant feeding practices. Promoting awareness of this important health problem within the Saharawi refugees is recommended.

Examination of children ($n=49$) for signs of scurvy (bleeding gums and perifollicular haemorrhage) was performed. It has been proposed by WHO that a mild public health problem exists even if only isolated cases are detected and a severe problem exists if the prevalence exceeds 5%. The sample size used in this survey would only be sufficient to clearly detect a severe public health problem. In the event, the survey revealed one case with suspected perifollicular haemorrhage but no other clinical signs were detected. In the absence of other signs of deficiency the significance of this observation remained unclear. It is recommended that any cases presenting with these signs are followed up through the medical facilities and receive appropriate nutritional supplements.

Food Distribution Analysis

The ORSCRA distribution records for the last 6 months were obtained from UNHCR and were analysed for energy and micronutrient content. The records include foods supplied by WFP and other donors. There has been a tendency for reported figures to only include WFP supplied food when in reality the contribution from other sources is significant. A full analysis is given below.

The beneficiary number of 150,430 is used in the calculations below. As noted previously, this number has not been updated recently.

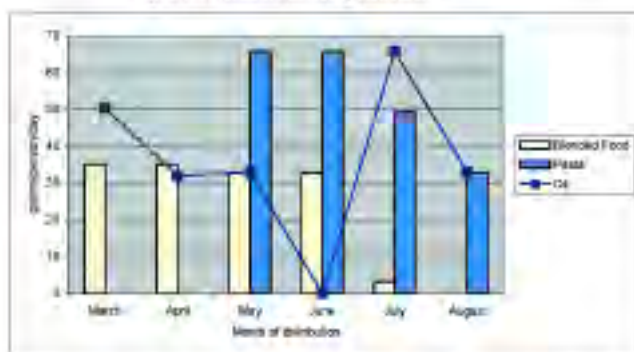
Commodities distributed through the IDSP supplementary feeding programme are included from the analysis. Items such as lime and dates are included as they formed part of the general ration distribution.

Complete identification information was not available for all commodities and it was not possible to obtain fortification specifications for all items. In some cases the nearest equivalent product composition was used (e.g. the composition of USA manufactured CSB was used to analyse the nutrient contribution from the various fortified cereal foods that were distributed).

Eggs produced from the farm income generation/sufficiency activities such as the poultry farm poultry project are not included and camel meat obtained from occasional distributions of livestock are also excluded as no quantitative data was available. UNHCR distributions of tea and yeast are also excluded due to their minimal nutritional contribution. However, it should be noted that frequent consumption of sweet tea is widespread and this practice contributes to the energy consumption patterns of the population and may influence the levels of adult obesity described in previous surveys¹⁶.

Reviewing the distribution records for the last six months reveals that the food basket in Fayoum is diversified in terms of the number of different commodities included in the distributions. During the six-month period prior to the survey, no less than 18 different commodities were distributed including 3 different types of blended foods, dates, fish and milk powder. However, the supply of these commodities was not consistent leading to a very variable and unpredictable ration for the refugees and distributing agencies to manage. The variation in commodity supply is indicated in the following figure for blended food, oil and pasta.

Figure 14 - Trends in Commodity Distribution



This data illustrates the important role of ad hoc food donations in filling holes in the food pipeline and emphasises the importance of maintaining stable donor support.

Using NutMat, a spreadsheet application developed by UNHCR, Geneva and ICH, the nutrient content of the distributed ration was analysed for macro and micronutrient content. The graphs below indicate the levels of energy and nutrients over the six months prior to the survey. It can be seen that the energy content of the ration occasionally exceeded 100% with an average of 125% of the 2100 kcal minimum requirement¹⁷. The protein and fat content of the distributed ration were generally good except in June, which corresponded with the lack of oil distribution. However, this was followed by an increased distribution in July. The

¹⁶ Nutritional Status of the highly vulnerable groups in disaster (refugee camps) Geneva 2001, IDSP/UNHCR/IFRC.

¹⁷ The requirement for 2100 kcal per person per day was established by the WFP/MICR Joint Assessment Mission, February 2002.

micronutrient and mineral content of the ration is variable with good levels of vitamin A, thiamine and niacin but low levels of vitamin C, calcium and riboflavin. These nutrients are seen to remain consistently low with an average of only 30%, 70% and 75% of the minimum requirement being supplied during the last six months.

Figure 15 - Trends in Macro-nutrient Content of Ration

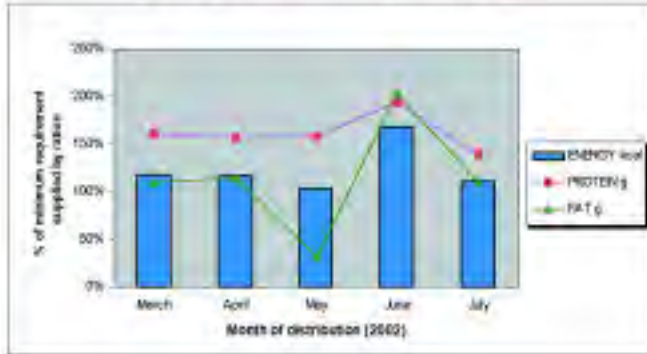
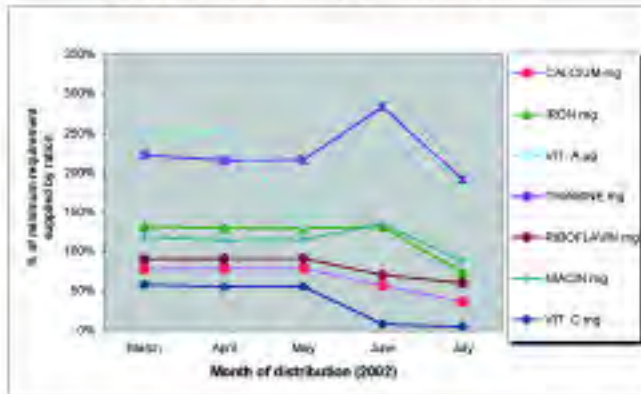


Figure 16 - Trends in Micro-nutrient and Mineral Content of Ration



It should be stressed that the calculations above are based on the distribution records supplied by the Algerian Red Crescent to UNHCR and, although food monitoring visits are made, there is currently no verification of the distribution by on-site distribution monitoring using an accepted random weighing procedure. In addition, the ration was only analysed for the nutrients listed above. Many other nutrients, such as iodine and zinc, are known to be

critical for long-term health and nutrition and a diversified diet is the best means of ensuring these requirements are met.

The requirement figures used above are calculated by WHO, UNHCR and WFP and are designed to be applied at the population level. It is important to note that it is therefore not possible to be sure that nutrient needs of particular groups within the population are being met even if the calculated population intake is adequate.

In conclusion, it should be emphasized that maintenance of the food aid pipeline and ensuring improvements in its reliability remains of the utmost importance in preventing malnutrition in this food aid dependent population.

¹ The management of nutrition in Mass Emergencies (MERC 0202). See annex 9 for details.

Discussion

The interpretation of acute malnutrition data is always difficult in the absence of reliable data on mortality. This is because high levels of severe malnutrition may be obscured if the death rate is elevated (i.e. if children are dying due to malnutrition then this may cause the malnutrition prevalence to appear low when measured in a survey). Although it was planned to include an assessment of crude mortality in this survey, time constraints did not permit this to occur. The malnutrition data presented here should be interpreted with the knowledge that no quantitative data on mortality was available. However, qualitative data obtained during the survey did not raise concern about an elevated mortality rate.

Other important causes of mortality and morbidity may also be going unnoticed due to the lack of a functional health information system. Consequently, opportunities to improve the public health of the Sahrawi population may be missed or resources allocated inappropriately. It is strongly suggested that efforts be made to improve the collection and dissemination of health information.

To compare the results of the current survey with national data on nutritional status in Algeria, the WHO Global database on Child Growth and Malnutrition was consulted¹³. A National Algerian nutrition survey conducted in May–July 2000 found a prevalence of global acute malnutrition of 6.4% and a prevalence of 1.7% for severe malnutrition in 0–59 month old children in Eastern Algeria. Although no confidence intervals were available from the WHO database this is over three times the results from the Sahrawi refugees, who are consistently worse than the host Algerian population.

A comparison of some key indicators from the current data with previous surveys conducted by CIAP and the National Research Institute for Food and Nutrition (INRAN) in Tlemcen in the Sahrawi camps is shown in Figure 17. It can be seen that there has been no significant change in global acute malnutrition over the last 3 surveys, although the level of severe malnutrition did rise significantly in 2002 compared to the other two years. Trends in anaemia show a consistent fall with no severe anaemia in children detected in 2002. The fall in total anaemia in 0–59 month children from 71.1% to 35.2% in 2002 is truly remarkable. Anaemia in women has evidently been a harder nutritional problem to solve and the prevalence appears to have stabilised at around 48% between 2001 and 2002 while childhood anaemia has continued to improve.

The generally poor infant feeding practice measured in this survey may be impacting a significant impact on child growth and development and the persistence of relatively high levels of wasting and stunting. The trends in acute and chronic malnutrition with age, as well as the overall prevalence may be amenable to improvement if the component is focussed on, as well as well-targeted supplementary and therapeutic feeding programmes. Strengthening of growth monitoring and promotion should be considered as a strategy to increase nutritional awareness and the early detection of malnutrition.

Seasonality is always an important factor to take into account when interpreting the results of nutrition and health surveys. While little data was available to allow an assessment of seasonal trends, it is reported anecdotally that the incidence of diarrhoeal diseases increases during the summer. An increased acute malnutrition prevalence might therefore be expected in the autumn months during which this survey was conducted.

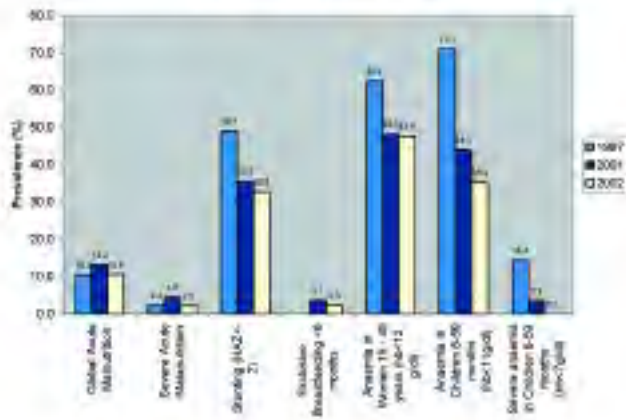
The analysis of the general ration distribution records indicates that, during the last six months, the energy requirements of the population were being more than adequately met. However, the micronutrient content of the ration, particularly for vitamin C, was inadequate. Indeed, the only significant source of vitamin C in the general ration is blended food and the supply of this commodity was seen to be erratic. Efforts should be made to enhance diet diversification with items rich in vitamin C, calcium and riboflavin. If this is found not to be possible through the general ration efforts to promote local production should be initiated.

While the consumption of fish was only quantified for infants and young children during the current survey, it is clear from qualitative data that large volumes are regularly consumed. If anaemia is to

¹³ WHO Global database

combined in a sustainable way, consideration should be given to assessing how consumption could be modified so as to minimise the impact on steel deficiency.

Figure 11 – Consumption of key indicators, 1997 - 2002



Anthropometric and Malnutrition Indicators, Technical Support Centre, Toronto, December 2007. Page 12 of 42.

Anthropometric and Malnutrition Indicators, Technical Support Centre, Toronto, December 2007. Page 14 of 42.

Recommendations

Based on the findings of this survey the following recommendations are made for improving the nutrition and health situation of the Sahrawi refugees:

1. Development of the Health Information System (HIS)

There is an evident lack of information on the health status of the refugee population. Basic indicators such as the crude mortality and under-five mortality rates were not available at the time of the survey and there appears to be no consistent monthly reporting on health service utilisation, disease prevalence or other key indicators. It is therefore recommended that an effective HIS is established as a high priority.

2. Vaccination coverage

The relatively low vaccination coverage found for measles, DPTs and BCGs are concerning. It is recommended that the management of the vaccination system is reviewed so as to identify obstacles for the low coverage and implement improvements. The distribution of vaccination/health cards should be improved to enable effective record keeping and monitoring.

3. Nutrition surveillance/GBM/IMCI strengthening at PHC Daira level

It is recommended that the GBM/ANC and other preventative activities at PHC level are reviewed and strengthened, as appropriate. The feasibility and desirability of incorporating IMCI treatment and prevention protocols into routine practice should be assessed.

4. Treatment of severe malnutrition

There is currently no programme for the treatment of severe malnutrition. This is alarming given the level of severe malnutrition found in this survey (2.2%). Severe malnutrition carries a high risk of mortality and should be considered a medical emergency. It is therefore recommended that a therapeutic feeding programme is urgently instituted at hospital level.

5. Treatment of moderate malnutrition

The global malnutrition prevalence of 10.6% (95% CI 7.7–13.5) may be considered as a moderate public health problem. It is recommended that consideration is given to introducing a supplementary feeding programme. Such a programme should be targeted using anthropometry and integrated into growth monitoring and promotion activities.

6. Nutrition education and promotion

An IEC campaign on maternal nutrition including folic acid supplementation should be introduced as compliance with iron/folate supplementation is undoubtedly reported to be low, and maternal anaemia has been shown to be a significant problem. Other issues such as infant feeding, prevention of obesity and chronic diseases and child spacing should also be addressed as these have been demonstrated to be significant public health problems in this population and are established risk factors for poor birth outcomes and infant and young child morbidity and mortality.

7. Vitamin A capsule distribution

It is recommended that routine vitamin A capsule distribution to children between 6 months and five years is integrated into the activities of the Sahrawi MCH.

8. Food aid monitoring

There is currently no on-site food distribution monitoring (food basket monitoring) performed and no post-distribution monitoring data from households or market levels were available. It is recommended that initiatives for improving the monitoring of food aid distribution are pursued.

9. Food security and income generation

Little formal assessment information is available on the food security situation within the camps. It is recommended that consideration be given to carrying out a detailed assessment of food security and livelihoods with the aim of enhancing effective risk diversification and income generation activities.

10. Obesity and chronic diseases

While no information was collected on obesity during this survey a review of previous survey data and field observations indicate that obesity and resultant chronic diseases such as diabetes are likely to continue to grow in significance, particularly amongst the Saharawi women. It is recommended that a programme of sports/exercise promotion is considered.

11. General ration composition and pipeline

The general ration remains deficient in a number of micronutrients and the supply of individual commodities is erratic. It is recommended that efforts be taken to provide a more stable food pipeline and that the supply of blended food, which remains the major source of several key micronutrients, is secured on a regular basis.

12. Knowledge gaps

Time and resource constraints meant that it was not possible to measure and analyse all aspects of interest during this current survey. Issues that were not addressed but should be considered for inclusion in the next survey include:

- The survey conducted by CBP in 2007 indicated an alarming low level of 5.8% oral rehydration therapy (ORT) in cases of diarrhoeal disease. It is recommended that this is examined in more detail.
- Chronic adult malnutrition with focus on obesity.
- Prevalence of diabetes.
- In depth assessment of the significance of the excessive (heavy) iron and vitamin gains prevalence.
- Qualitative data collection taking focus group discussions on key issues such as infant feeding and dietary preferences so as to inform and improve the effectiveness of IEC programmes.
- Assessment of the food security of the population and opportunities for further income generation and risk diversification.

ANNEXES

ANNEX 1 - Terms of Reference Issued by UNHCR Algiers

Nutritional Survey in Saharawi camps, Tindouf, Algeria
September 2002

It was agreed in February 2002, that a new nutritional survey should be conducted in the Tindouf camp. Although the latest nutritional survey was conducted by CISP in 2001, some of the results and the methodologies were rather unclear, and therefore somewhat unreliable. Furthermore, during the last Joint Food Assessment Mission held in early February 2002, it was agreed that there is a need for UNHCR and WFP to assess the needs of vulnerable groups, and to find ways to build the capacity of the Saharawi refugees in nutrition survey design and implementation.

UNHCR, through its implementing partner, Institute for Child Health, undertook an initial review of the specific objectives of the survey, methodology, target groups and mode of implementation for the survey in June 2002. These were decided following discussions with key informants and a variety of stakeholders (including WFP, ICHEC, Red Crescent Societies, and relevant Algerian and Saharawi ministries).

The overall objectives of the survey are to include:

- Capacitate building to enable implementation of regular anthropometric surveys by local entities in accordance with international recommendations;
- Implementation of a survey in collaboration with partners including UNHCR, WFP, Red Crescent Societies and the relevant Algerian and Saharawi ministries;
- Production of recommendations on actions to improve the nutritional status and health of the Saharawi refugee population.

The more specific objectives were identified as follows:

- Investigation of the aetiology of anaemia by measurement of haemoglobin, iron status;
- Measurement of iodine status;
- Assessment of clinical signs for vitamin A deficiency, goitre, scurvy and rickets;
- Establish baseline information on infant feeding practice;
- Determination of the crude mortality rate;
- Build capacity in nutrition survey design and implementation.

Target Population Groups for the survey:

- Children 0-24 months - anthropometric, biochemical, clinical signs, qualitative/quantitative indicators;
- Infants and children 0-24 months - infant feeding indicators;
- Mothers of the children - anthropometric, biochemical/qualitative indicators;
- Adolescents (10-19 years) - iodine biochemical status, goitre and questionnaire indicators.

Survey Schedule

The survey has been programmed to take place throughout the entire month of September 2002, which includes feed-back and de-briefing meetings in Raboun, Tindouf and Algiers.
27/07/02 B.O. Alger

ANNEX 2 - Cluster Selection Table

List of population

Wilayah	Darm	Tot pop	Cumul pop	Quater
Dakhs	Cum Chaga	5170	5170	1 y 2
	El-Agale	5853	11023	3
	Alm-Baida	5710	17733	4
	El-N-Zagat	5423	23156	5
	Imydnur	5224	28380	6
	Cheddi el Foula	4846	33226	7
El-Aazin	Urhala	4673	38000	8
	Hajouma	6569	44569	9
	Dabur	8587	53156	10 y 11
	Bou-Cris	6283	59439	12
	D' Chera	6269	65708	13
	Amgala	6946	72654	14
Auzawed	Quetta	5483	78137	15 y 16
	Ticra	6212	84349	17
	Laghaia	9285	93634	18
	El-Gareibou	5201	98835	19
	Mjak	5120	103955	20
	Aghiemh	9084	113039	21
Enno	Zoug	4982	118021	22
	Faria	7554	125575	23 y 24
	Hacem	7388	132963	25
	U'Dera	7288	140251	26 y 27
	T'farit	6480	146731	28
	El-Lahou	5249	151980	29
Others	Mahava	5580	157560	30
	Ecole 27 Février	2180	159740	
Total		148654	148654	

Sampling interval 4850

Random number 85

ANNEX 3 - Survey Timetable

Date	Time	Activity	Location
03/09/02	AM/PM	Arrival of international team in Tindouf	Tindouf and Rabouni
04/09/02	AM/PM	Planning meetings	Tindouf and Rabouni
05/09/02	AM/PM	Preparation and translation of documents	Weather Haven
06/09/02	AM/PM	Preparation and translation of documents	Weather Haven
07/09/02	AM/PM	Team training	Nursing School
08/09/02	AM/PM	Team training	Nursing School
09/09/02	AM/PM	Team training	Nursing School
10/09/02	AM/PM	Preparation of databases	Weather Haven
11/09/02	AM	Team training	Nursing School
11/09/02	PM	Teams travel to Dhakla	Rabouni/Dhakla
12/09/02	AM	Pilot survey	Dhakla
12/09/02	PM	Survey	Dhakla
13/09/02	AM/PM	Survey	Dhakla
14/09/02	AM/PM	Survey	Dhakla
15/09/02	AM/PM	Survey	Dhakla
16/09/02	AM	Survey	Dhakla
16/09/02	PM	Travel	Dhakla-Smara (Weather Haven)
17/09/02	AM/PM	Survey	Smara
18/09/02	AM/PM	Survey	Smara
19/09/02	AM/PM	Survey	Aweed
20/09/02	AM/PM	Survey	Aweed
21/09/02	AM/PM	Survey	El Aun
22/09/02	AM/PM	Survey	El Aun
23/09/02	AM/PM	Nutritionists' report	Tindouf - Aggles

ANNEX 4

Information for obtaining informed consent (translated into Arabic)

The Institute of Child Health / UNICEF will be working with implementing partners in order to assess the nutritional status of the population in the Sahrawi refugee camps. It is important to assess the nutritional status of a population in order to help humanitarian organisations plan and provide services for these people. These services include food distribution, health care and community workers, and water and sanitation. The more information that we have about the nutrition of a community, the more we can plan for their future. It is therefore important to collect information that can be used for the community. Information that we collect will help us plan for your population, and help us to understand other refugee populations and help them as well.

The survey that we are doing is similar to other surveys that have been conducted in this camp. In the past, children were weighed and measured by the survey teams. This time, the same will be done but we also ask people to be examined and give samples.

In order for us to understand the internal nutritional status of the refugee population, we will need to take some blood from randomly selected members of the population. This can be done without needles, and all that is needed is a finger prick, similar to testing for malaria. This time, however, we will collect a tiny taste from one drop of blood.

In randomly selected adolescents (age 10 – 19) we will take some urine and test this for iodine. Adolescents are the best people to test for iodine deficiency. People who are iodine deficient for a long time will develop a goitre.

In randomly selected individuals (anyone in the family) we will collect blood in a small plastic tube. We will test the blood for malaria here in the camp, and send the rest of the blood to England for analysis.

We will only test the blood for things that will help us understand the nutrition of people of this camp.

If you give us permission to take your blood and urine, then we will check if you have anaemia and iodine issues. We will also look for nutritional deficiencies on your skin and ask you some questions.

The risks of the study include only the risk from the finger stick. This may produce some discomfort.

If you decide not to participate in this survey, nothing bad will happen. You will continue to receive health care and food in the normal way.



“Food for Nutrition: Mainstreaming Nutrition in WFP”

While food availability is not the sole determinant of nutrition, food is an essential and important part of development equation. New evidence indicates, however, that it is possible to have positive nutritional trends without food aid. Some real opportunities exist in using largely people-led, community emergency systems (CERs) systems already in place, or using food as an incentive to encourage the use of existing systems, or to create new systems and deliver support from national governments as well.

Introduction

Malnutrition is not a just a physical state, a snapshot of current well-being. It is a process. Reduced food consumption, ill-health and poor coping practices lead to malnutrition, weight loss and compromised mental capacity. Some periods of life are more critical to nutrition than others, for example birth, infancy, early childhood, adolescence, pregnancy and lactation. WFP seeks to use food resources to address nutritional impacts in three complementary ways: (i) enhancing the effectiveness and impact of targeted mother-and-child health and nutrition interventions that contain food and appropriate non-food inputs; (ii) enhancing the nutritional value of WFP food; for instance through micronutrient fortification; and (iii) enhancing the nutritional impact of other WFP interventions. These approaches represent a mainstreaming of nutrition across WFP's activities.

Tradeoffs and the Millennium Development Goals

The burden of malnutrition is carried not only by individuals, but by entire societies. On the one hand, maternal malnutrition determines the course of evidence and the trajectory of infant growth, an “inheritance of hunger” passed from parents to offspring. On the other hand, malnutrition has serious

developmental implications. According to the World Bank, the Millennium Development Goals (MDGs) cannot be reached without significant progress in eliminating malnutrition. There are critical interactions between nutrition and most of the MDGs, but particularly between malnutrition and hunger (MDG 1), child mortality (MDG 4), maternal health (MDG 5) and diseases such as HIV/AIDS (MDG 6). Rapidly increasing, though less direct interactions exist between malnutrition and poverty (MDG 1), education (MDG 2) and gender equality (MDG 3). Productivity losses in developing countries from the combined effects of stunting and under and low deficiencies are estimated to be as much as 4 percent of gross domestic product per year. Such findings, in addition, suggest that WFP should pay more attention to nutrition in its activities to support the achievement of all MDGs, not just MDG 1 on hunger. This will require not only additional input through targeted nutrition interventions, but a mainstreaming of nutrition across its food-supported activities.

WFP and the Role of Food in Nutrition Programming

The importance of a food component in a nutrition project is increasingly demonstrated. However food is not the only or always the optimal resource needed in effective nutrition interventions. When malnutrition is linked to constrained food access, and where food of sufficient quality and quantity is required to meet identified needs in combination with relevant non-food resources, then food is an important element. Well designed trials involving food, document a range of positive health outcomes. Nutrition has long been important to WFP. During the 1960s, WFP began supporting mother-and-infant projects that delivered supplementary food through health clinics – an activity that accounted for 6 percent of WFP development expenditures during the decade. Today, WFP allocates roughly 10 percent of its development resources to vital activities related mother-and-child health and nutrition (MCHN) interventions.

MCHN Interventions

The provision of micronutrient-rich foods is a complex activity. To be effective, WFP should intervene where private home feeding child growth is minimal weight gain is inadequate food, including micronutrient intake, and where food can generate leverage for necessary non-food inputs to be provided as well. In such cases, food supplements can be an essential element of successful nutrition interventions. In all cases, WFP plays a key role in ensuring the quality of rations not only through balanced food baskets, but by adding nutritional value to food through micronutrient fortification. Important principles for designing MCHN interventions are:

► **Food problem analysis** that clarifies the role of food aid.

► **Complementary resources and skills training** around a set of mutually-reinforcing activities shown to reduce maternal and child malnutrition, including (i) complementary feeding, (ii) nutrition education (iii) health services (iv) micronutrient supplementation, (v) de-worming and (vi) disease control.

► **Focus on promoting motivation** as the key to obtaining good outcomes in the long term.

Enhancing the Nutritive Impact of other WFP Interventions

Maximizing nutritive impact requires recognizing the scope for enhancing nutrition results even through non-MCHN interventions. For example, increasing number of food-for-education activities supports goals of enhancing nutrition knowledge and reduce micronutrient deficiency through school meals. Enrichment is one of the most cost-effective ways of ensuring that food consumed by a child provides optimum benefits with regard to nutrition outcomes and is a source of growing income. Nutrition gains can also be achieved through WFP's income-generating activities if only it is supported to highlight WFP's role in advocacy and support for national policy development. WFP is increasingly involved with governments to:

► **Define more clearly the nature of nutrition problems** in the context of household risks and household food security.

► **Define the rules of food-supported programming** in addressing malnutrition.

► **Raise public and donor awareness** of the urgency of malnutrition and address these more explicitly in poverty-reduction processes and the MDGs.

► **Insist on promoting** new nutrition and/or food fortification policies and strategies.

Progressing Challenges

Capacity: Inadequate capacity is a problem to be overcome. Interventions are hampered by the limited reach of delivery infrastructure, a lack of skills or discipline beyond medical training and limited availability of non-food resources.

Partnership: Collaboration is needed with partners who not only contribute to programming but also support operational and skills development and who promote policy dialogue that brings malnutrition more-often alongside economic growth. Because so many factors interact to determine nutritional well-being, WFP must expand its network of collaborators.

Documentation: Nutrition Impact Evidence-based programming is essential to achieve nutrition goals. However, since the use of nutrition information is relatively new to WFP, much needs to be done on staff training, technical guidance, analytical support and interaction with field partners.

Conclusions and Policy Recommendations

The Strategic Plan 2004-2007 is committed to giving nutrition "a higher priority" and seeks to do so by broadening WFP's nutrition agenda, which will no longer be a niche activity but a mainstream activity known as food-for-nutrition. To achieve these goals, human and institutional capacity must be enhanced at all levels. The following requirements are essential:

► **Build capacity** needs to be enhanced to maximize deficit in capacity and regional levels to ensure that WFP can implement best practices in nutrition and documentation.

► **Multi-tier** to support the specific results needs of nutrition interventions are essential. Cash is critical for food fortification, food procurement of blended foods, production of nutrition education materials and support for food nutrition training.

► **The provision of transportation** requires creative, food-supported programming as part of an expansion of resources and skills. WFP will continue to longer-term capacity-building at the household and regional levels while seeking to facilitate policy-level and private-sector activities and focus on meeting the needs of nutritionally vulnerable individuals.

© 2004 WFP
All rights reserved. No part of this publication may be reproduced, stored in a retrieval system, or transmitted, in any form or by any means, electronic, mechanical, photocopying, recording, or by any information storage or retrieval system, without the prior written permission of WFP.





“Micronutrient Fortification: WFP Experiences and Ways Forward”



Introduction

According to the World Health Organization (WHO), deficiency in iron, vitamin A and zinc rank among the top ten leading causes of death through disease in developing countries. Most people affected by micronutrient deficiencies do not show any clinical symptoms, nor do they necessarily know the cause of the deficiency, a phenomenon called “hidden hunger”. Yet hidden hunger makes people susceptible to infectious diseases, impairs their physical and mental development, reduces their labor productivity and increases the risk of premature death.

There is a close relationship between malnutrition, which is often linked to lack of food and specific micronutrient deficiency diseases that are associated with consumption of food-poor or micronutrient-poor WFP’s beneficiaries are known to have limited access to a varied diet, a large proportion of them also suffer micronutrient deficiencies, especially those that depend on nature for survival such as non-pollinated religions. Iron deficiency, for example, is one of the most widely prevalent micronutrient deficiencies in the world, affecting at least half of all pregnant women and young children in developing countries. When iron deficiency is compounded by other vitamin and mineral deficiencies (VMDs), the economic impact may amount to 2 percent of gross domestic product per year. A lack of vitamin A can

only be leading cause of child mortality across developing countries, it affects children’s immune system and is directly responsible for 10.4 million deaths each year.

WFP’s Experience with Fortified Food Aid

Fortification of food is considered to be one of the most cost-effective approaches to addressing nutritional deficiencies. According to the World Bank¹, probably no other (including available today) effort so large in magnitude or scope from and under-serve development at such low cost and in such a short time². WFP addresses micronutrient deficiencies through (i) careful attention to micronutrient needs in menu planning, (ii) programming demonstrated or innovatively prepared fortified foods, (iii) promotion and use of locally produced fortified commodities and (iv) increasing advocacy for fortification at national and international policy-making levels.

Action Planning

During the past decade WFP has made some systematic efforts to improve conditions that increase the likelihood of VMDs and (and) operations accordingly. To facilitate this process can be consistently completed by the development, by WFP in collaboration with the Office of the United Nations High Commissioner for Refugees (UNHCR), of a web-accessible software called “NutriNet”, a food-basket calculator that defines micronutrient content of all commonly used foods and calculates the degree to which the food basket meets a population’s requirements based on FAO/WHO recommended nutrient intakes and allows for comparisons of alternative basket compositions.

International and Local Procurement of Fortified Food

During the 1990s, WFP established procurement specifications for several processed commodities, including oil, blended food, oil and high-energy biscuits. The guidelines prescribe the type and

quantity of vitamins and minerals such as iron and zinc. For example, WFP requires that vegetable oil be fortified with vitamin A and with vitamin D as appropriate. Salt must be fortified with iodine. Other wheat flour is rationally processed, it should be fortified with a mix of B vitamins as well as iron, folic acid and zinc. Already the leading producer of fortified blended maize seedlings WFP also promotes local capacity to produce fortified blended foods at several of the world's poorest countries.

Challenges

While the number of nation states continues to grow and guidance on best practice is being developed, many fortification interventions still face challenges:

Technical, Managerial and Industrial: Milling capacity is often a limiting factor when the need for large quantities of fortified staples is urgent. Capacity is also likely to be constrained in terms of managerial and supervisory skills.

Policy and Standards: WFP should stress national policies on fortification standards, but these do not yet exist everywhere. WFP has begun playing a more active role in partnership with UNICEF in helping some key agents in policy development or fortification. WFP should prepare more detailed guidance for its core operations including defining levels and standards, effective standards be made to ensure that fortified commodities are clearly labeled at the point of production or packaging, in at least accompanied by appropriate specifications.

Cost and Benefit: Fortification involves adding value to a food. Fats and biscuits are valued commodities and their use suitable integral daily nutrition interventions continues to grow. Usually more expensive than wheat or maize, a product such as blended food delivers more energy, protein, fat and considerably more micronutrients and the ate also more expensive.

Stability: The stability of vitamins and minerals added to food varies according to the history and depends on external conditions. Even under normal conditions, most vitamins lose their potency over time. To maximize micronutrient losses during storage and transport, processed fortified foods must be properly packed and effective pipeline management is essential to ensure the shortest possible period between production and consumption.

Conclusion and Policy Recommendations

WFP has already made significant and often pioneering contributions to addressing the global burden of micronutrient deficiencies. An increasing amount of WFP food is fortified, innovative approaches to enhancing food milling and fortification capacity have been developed, food production of fortified blended foods continues to grow, and more is work with partners in place, micronutrient-deficiency diseases higher on international and national political agendas. Next steps for WFP include the following:

- **Improve appropriate measurement techniques of WFP commodities.** To support this goal WFP will collaborate with partners in formulating guidelines and standards that establish appropriate methodologies and levels of fortification.
- **Support and strengthen capacity for food milling and fortification of cereals and production of fortified blended foods, with a view to processing and fortifying commodities as close to consumers as possible.**
- **Increase efforts to build capacity in-house and among partners in the field to plan and manage distribution of fortified foods.** This will entail more training on processing, milling and quality control, the programme, logistics and procurement staff and partners, as well as national development.
- **Enhance WFP's capacity to conduct rigorous needs assessments and baseline and impact surveys.** Documenting effectiveness and impact of fortification activities will be an important input to WFP's Strategic Plan.
- **Review existing commodity specifications and update internal procedures to support appropriate procurement, receipt and handling of commodities.**
- **Strengthen partnerships at national and international levels with technical agencies, research institutions and private-sector entities that can collaborate in identifying cost-effective approaches to meeting the micronutrient needs of WFP beneficiaries.** In particular support national fortification policies.

Author(s) and Contact:
 Dr. Barbara Stallings, Fellow
 The Global Food Security Program

Micro-nutrient deficiencies are a major public health problem and threaten many countries, in particular those in Sub-Saharan Africa, South Asia and Latin America. The micronutrient expert advisory group was established by the Global Food Security Program (GFSP) in 2009. The group's mandate includes the development of evidence-based policy and technical recommendations to support national fortification activities. This research and technical advisory group was convened to support the GFSP's efforts to address micronutrient deficiencies in Sub-Saharan Africa, South Asia and Latin America. The group's findings are presented in this report. The report was developed by the GFSP's Technical Advisory Group, Washington DC.





“Nutrition in Emergencies: WFP Experiences and Challenges”

The continuing need of emergency operations to be long-term, according to the World Health Organization (WHO), is due to the complex barriers for providing emergency relief. This is due to the fact that the majority of emergency operations are aimed at providing relief to the most vulnerable individuals.

Introduction

Malnutrition is an important determinant of mortality. Consequently food interventions play an important part in saving lives. WFP and its partners have made significant strides in the last decade towards tackling malnutrition in emergencies. These include interventions aimed to prevent deterioration in protein recovery of nutritional status have to be carefully tailored to the nature of each crisis and seek to address underlying causes. Ensuring that a nutritionally appropriate food basket is developed to meet local needs, and that it is coordinated and arrives in time remains fundamental. While malnutrition does not only result from lack of food, prolonged malnutrition or food shortages tend to higher malnutrition. An ability to offer sustained improvements in nutrition will depend on strong collaboration with partners, skilled personnel and public health and information management. Improved linking of emergency programming with non-emergency activities is required to food underlying processes contributing to chronic malnutrition are effectively tackled in the long run. Links between food shortage and malnutrition have been recognized for decades. Today it is acknowledged that (i) acute malnutrition is a strong predictor of excess mortality among young children; (ii) even moderate malnutrition increases mortality in emergencies, because a larger share of the affected

population is typically moderately under-nourished; (iii) malnutrition contributes to disease-related mortality in emergencies; and (iv) timely arrival of food assistance contributes to the prevention of mortality through its impact on reducing malnutrition.

Trends

Since the beginning of the twenty-first century, 75 percent in cases of WFP operations have been dedicated to emergency relief and recovery; in 2003, this figure reached almost 90 percent. However, despite the increase in number and scale of disasters, excess mortality in emergencies has been falling. Reported non-violent deaths in the context of major emergencies declined by almost 40 percent between 1991 and 2003 compared with the previous decade.

WFP and Nutrition in Emergencies

There are three main ways in which WFP addresses nutrition in emergencies:

General nutrition support. This involves the distribution of a basket of food commodities to crisis-affected populations. The associated aim is to meet food needs of people with constrained access to normal sources of food, and thus protect their nutrition.

Targeted malnutrition. This involves around selective feeding interventions that complement general distribution aimed at reversing a deterioration of the nutritional status of vulnerable groups and addressing such gaps. This could consist of: (i) targeted supplementary feeding, made to prevent malnourished people from becoming severely malnourished and improve their recuperation; (ii) hospital supplementary feeding is used to prevent malnutrition and related mortality when the threat is severe for high-mortality; and (iii) therapeutic feeding, aimed at treatment of acute malnutrition with nutrient and energy-dense foods combined with medical intervention.

Micro-nutrient interventions. They involve procurement of fortified foods or local fortification to

most people's needs to address outcomes of micronutrient deficiency.

Market Planning and Delivery

Local food basket is critical to assessing the nutritional status of affected populations, especially when beneficiaries are fully dependent on food aid and have limited coping capacities. Planning ration for emergencies is not a one-size-fits-all activity; the size and composition of the food basket has to be tailored to local food preferences, the demographic profile of the population, energy levels, climate conditions, food preferences, local coping capacity and existing levels of malnutrition and disease. The number of commodities in the food basket, the energy content, and the nutrient content (protein, fat, and micronutrients) are all issues of equal importance and need to be considered with regard to WFP and international standards.

Correcting Malnutrition

Targeted feeding interventions are used to stabilize and correct malnutrition among nutritionally vulnerable groups in emergencies. In 2002, more than 200,000 children benefited from WFP food in the context of emergency feeding, and 3 million children were assessed through supplementary feeding programs. Micronutrient deficiencies are a major contributor to mortality and morbidity, even in non-emergency settings. Emergencies can exacerbate micronutrient deficiencies disorders in all age groups. Heightened awareness of the dangers and better planning are necessary to resolve outcomes of micronutrient deficiency during emergencies.

Programming Challenges and Constraints

Timely Delivery of Food. The flow of food has to be regular and well coordinated for the food basket to be delivered as a whole, not as individual commodities at different times. A delayed start to food distribution for one or more commodities or breaks in an established pattern can seriously affect the nutrition of beneficiary populations. Therefore, ensuring the right foods to the right people at the right time is essential.

Partnering Capacity. Many of WFP's partners provide skills and resources that complement WFP's expertise and capacity. The experience of NGOs signed with UNHCR, UNICEF and the International Committee of the Red Cross (ICRC) in the late 1990s should not be underestimated, because they have taken practical and policy-level collaboration to a higher level.

Nutrition Information. Appropriate surveys and assessments are essential to quality programming because they allow WFP to understand the location and nature of nutritional problems, trends in nutritional status among population groups and individuals and the effectiveness of nutrition interventions. Refining WFP's own capacity to collect and interpret nutrition data is a priority.

Revised for Emergency. "Crisis" acute conditions and resolving underlying chronic conditions need to be better coordinated as mutually reinforcing activities. Examination of the role of nutritional improvement of populations in the transition out of emergency is required and certain situations include the opening of emergency and non-emergency systems, such as feeding through schools, should be designed where possible with a view to allowing a bridge for child nutrition between curative and preventive operations.

Conclusions and Policy Recommendations

WFP needs to continue to systematically monitor progress in assessments of food and non-food needs, in the design of interventions and in reporting results of R4CPs. This requires enhanced staff and partner capacity.

In operational terms, greater effort is required to ensure timely and full delivery of all elements of a nutritionally appropriate food basket, with special attention to nutritionally vital commodities, regardless of volume. Flexible funding modalities are needed to enhance WFP's ability to promote value-added foods through local purchases, local fortification and use of new ready-to-use foods where this is most effective.

Improved guidelines are needed on supplementary-feeding under diverse emergency settings with a particular focus on roles and responsibilities among partners who provide non-food resources, particularly UNHCR, UNICEF and major NGOs operating in nutrition and public health.

© International Emergency
Nutrition Programme, 2002
All rights reserved. No part of this
publication may be reproduced, stored in a
retrieval system, or transmitted, in any form or
by any means, electronic, mechanical, photocopying,
recording, or by any information storage and
retrieval system, without the prior written
permission of the International Emergency
Nutrition Programme.



Anthropometry

Simple steps to help in taking measurements

- 1) **Consent:** Before measuring the child, you should explain the purpose of both the visit and the survey and obtain the consent of the mother or caretaker. Do not pressure anyone into consent. It's best to measure children after the survey is completed because some children may become upset during the measurements and therefore interfere with the interview.
- 2) **Two trained people required:** At least two trained people are required to measure a child's length/height and weight. Anthropometric measurements should never be taken by one person alone.
- 3) **Instrument placement:** You should make sure that you have all the pieces of the measuring board and the scale and that they are working properly. You should recalibrate the scales as necessary and install your equipment in a quiet place, on level ground, with adequate light.
- 4) **Weigh and measure one child at a time:** If there are numerous eligible children in the home, weigh and measure one child at a time.
- 5) **Control the child:** You have to be firm yet gentle while measuring the child. Firm, so the child will be correctly positioned on the measuring board and will not move. Gentle, so the child (and the mother) will be at ease and more likely to cooperate. While measuring the child, you can talk to him or her, explaining the procedure, etc.
- 6) **Recording:** Use a pencil to record the measurements so that you will be able to correct mistakes. Ideally, the measurer will measure and call out the measurement while a separate person - the assistant - will record the measurement while repeating it out loud.

AGE

The child's accurate age is required to determine whether they are eligible to be in the survey and whether the child is measured standing or reclining for height or length; accurate age is also necessary for calculating height-for-age and weight-for-age Z-scores. At the time of measurement, an age estimate is needed for decisions on sampling and for the position on the measuring board. The preferred method of finding the age of the child is by obtaining the exact birth date of the child, after which the age of the child in months is then calculated. If available, the enumerator needs to examine docu-

mentary evidence of the birth date (such as a birth certificate or immunization card). Where there is a general registration of births and where ages are generally known, recording age to the nearest month is relatively easy. Cross-checking is necessary when the date of birth is given verbally by the mother, as recall errors are common.

If dates cannot be recalled, use of a local events-based calendar will assist mothers in recalling the date of birth. A local calendar should be developed and should span 5 years (since nutrition surveys gather information about children

under 5 years of age), starting with the month the survey commences. Annual national events are important to include, as significant annual landmarks can easily jog the memory and help to pinpoint the timing of a birth. Additionally, large national events should be detailed (such as elections, religious holidays,

harvest seasons, etc.) as well as events that are more local to the region in question. The local calendar should be constructed before the survey and tested using the enumerators; thus, it is essential that all staff are comfortable using local calendars to ensure that the fewest mistakes are made.

Example of estimation of age using a local calendar

A child is selected for inclusion in the survey. The mother is unable to tell you how old the child is, and there is no vaccination card or birth record to determine the age. At this point, a local calendar of events is invaluable and should be referred to for further investigation of age. For this example, a local calendar developed for use in the September 2004 Nutrition survey in Darfur, Sudan, should be followed.

Surveyor: What year was the child born in?
Mother: 2000
Surveyor: Was the child born before or after the start of the rainy season?
Mother: She was born after the rainy season began.
Surveyor: Was she born during Jobraka?
Mother: Yes!
Surveyor: That means your child was born in September 2000.

If you refer to the sample local calendar (below), you will see that the child was born in September 2000 and is therefore 47 months old.

Figure 1 Local calendar of events for use in age estimation, Darfur, Sudan

2004	2003	2002	2001	2000	1999	Events	Month
7	19	31	43	55	5 years	Eid El Istiklal (independence)	January
6	18	30	42	54	5 years	Eid Alada (slaughter animals after Mecca)	February
	17	29	41	53	5 years	Seyeff (Tswig Albamia) (summer crops)	March
	16	28	40	52	5 years	Shem Elnaseem (Mosim Alhijra) (migration time)	April
	15	27	39	51	5 years	Cultivation of Millet (Alnathafa, AlGoada, Alrimel)	May
	14	26	38	50	5 years	Bdait El Karif (start rainy season)	June
	13	25	37	49	5 years	El-Karif rainy season (Altirab) (planting season)	July
	12 months	24 months	36 months	48 months	5 years	Cleaning weeds (Fadrat ELHashasha)	August
	11	23	35	47	59	Jobraka (harvest of vegetables)	September
	10 Ramadan begins the 22nd	22	34	46	58	Dard Hassad (harvest)	October
	9 Eid al fitter the 18th	21	33	45	57	Fatrain Shita (Hassad) Darad (second harvest)	November
	8	20	32	44	56	Dahia Eid El-milad; Darad um Nwal (late harvest)	December

Note that the calendar has been created to be used right to left to accommodate the local practice of reading from right to left.

SEX

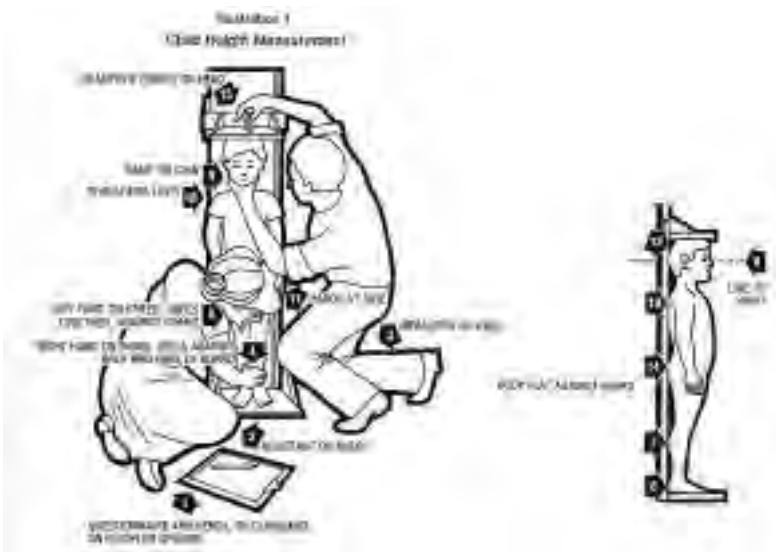
This variable is easy to determine - by asking the caretaker and direct observation. You need this information to determine your reference population according to gender. WFP is required to break out report data by gender.

LENGTH OR HEIGHT

Height measurement (for children over 2 years)

- Place the measuring board on a hard flat surface against a wall, table, tree, staircase, etc. Make sure the board is not moving.
- Ask the mother to remove the child's shoes and hat, and unbraid any hair that would interfere with the height measurement. Ask her to walk the child to the board and to kneel in front of the child.
- Kneel on your right knee on the child's left side. This will give you maximum mobility.
- Place the child's feet flat and together in the center of and against the back and base of the board/wall. Place your right hand just above the child's ankles on the shins, your left hand on the child's knees and push against the board/wall. Make sure the child's legs are straight and the heels and calves are against the board/wall.
- Tell the child to look straight ahead at the mother, who should stand in front of the child. Make sure the child's line of sight is level with the ground. Place your open left hand under the child's chin. Gradually close your hand. Do not cover the child's mouth or ears. Make sure the shoulders are level, the hands are at the child's side, and the head, shoulder blades and buttocks are against the board/wall. With your right hand, lower the headpiece on top of the child's head.
- When the child's position is correct, read and call out the measurement to the nearest 0.1 cm.

Figure 2 Measurement Techniques for Height (children over 2 years)



Source: How to Weigh and Measure Children: Assessing the Nutritional Status of Young Children. United Nations: 1986

WEIGHT

Using an electronic scale

- Put the scale on the floor. The display window should be blank. The display window will show in kilograms and 1/10ths of a kilogram.
 - This scale has no push-button switch. The best way to turn the scale on is by closely passing one foot over the top of the switch window from one side to the other. In 5 seconds, the scale will adjust itself to zero.
 - To measure a child, ask the mother to step on the scale by herself, without the child. She should stand still on the scale.
 - Wait for the mother's weight to be displayed, then tare (zero-out) the measurement.
 - Pass the child to the mother on the scale. The child's weight will be displayed.
 - Ask the mother to step off the scale. Pass your foot across the switch window to
- reset the scale before weighing the next person. The display window should indicate 0.0.
 - If a child is old enough to stand alone, ask him or her to stand still on the scale. Make sure that the child's feet or clothes do not cover the switch window. Wait until the child's weight is displayed. Note it, and ask him or her to step off the scale. Pass your foot across the switch window to reset the scale before weighing the next person. The display window should indicate 0.0.

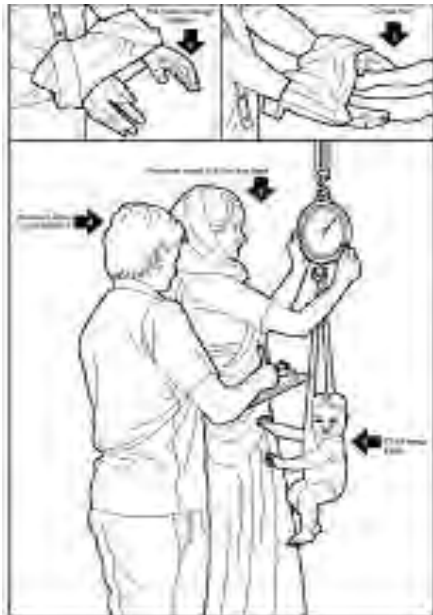
Using a hanging scale

- Hang the scale from a secure place. Ask the mother to undress the child as much as possible.
- Attach a pair of the empty weighing

Figure 4 Measurement techniques for child weight



Figure 5 Measurement techniques for child weight



Source: How to Weigh and Measure Children: Assessing the Nutritional Status of Young Children. United Nations: 1986

- pants to the hook of the scale and adjust the scale to zero, then remove the pants from the scale.
- Have the mother hold the child. Put your arms through the leg holes of the pants (Arrow 1). Grasp the child's feet and pull the legs through the leg holes (Arrow 2). Make certain the strap of the pants is in front of the child.
 - Attach the strap of the pants to the hook of the scale. **DO NOT CARRY THE CHILD BY THE STRAP ONLY.** Gently lower the child and allow the child to hang freely. Check the child's position. Make sure the child is hanging freely and not touching anything. Repeat any steps as necessary.
 - Hold the scale and read the weight to the nearest 0.1 kg (Arrow 5). Call out the measurement when the child is still and the scale needle is stationary. Even children who are very active, which causes the needle to wobble greatly, will become still long enough to take a reading. **WAIT FOR THE NEEDLE TO STOP MOVING.**
 - Immediately record the measurement to the nearest 0.1 kg.

MID-UPPER ARM CIRCUMFERENCE (MUAC)

- First, locate the tip of the child's shoulder with your fingertips.
- Bend the child's left arm at the elbow to make a right angle.
- Measure the mid-point between the elbow and the shoulder using the tape applied on the arm.
- Wrap the tape around the arm at the midpoint mark. Cover the mark with the tape. Put the end of the tape through the slot.
- Check the tension of the tape around the arm. Do not pull too tightly, but do not have the tape too loose. The tape should always be flat on the skin.
- Read the measurement in the window when the tape is in the correct position.

Figure 6 Child mid-upper arm circumference measurement



Source: How to Weigh and Measure Children: Assessing the Nutritional Status of Young Children. United Nations: 1986

OEDEMA

To measure the presence of oedema, exert medium pressure for three seconds on the upper part of both feet. If the thumb leaves an indentation, known as pitting, on the upper side of both feet, then nutritional oedema is present. Nutritional oedema is always bilateral (present on both feet); therefore, only individuals with pitting on both feet are recorded as positive for nutritional oedema.



Oedemous pitting occurring as a result of malnutrition

Recommended equipment for anthropometric measurements

Anthropometric data	Equipment	Characteristics	Providers and contacts
Height/ Length	Measuring boards for infants/adults	<p>Measures both height and length of children</p> <p>A measuring board should be lightweight, durable and have few moving parts. Length/height boards should be designed to measure children under 2 years of age laying down (recumbent), and older children standing up (note: only one board with dual purposes is standard). The board should measure up to 120 cm for children and be readable to 1/10th of a centimeter. Each field team should have their own board.</p> <p>Local Construction: Various plans exist for the local construction of foldable height/length boards and they can be made for around US\$ 20. It is important that the materials are durable and lightweight. The wood should be well seasoned to guard against warping. Sealing the wood with water repellent and ensuring the measuring tape is protected from wear will improve the durability of the board.</p> <p>The tape measure should be durable with 0.1 cm increments. The numbers of the tape measure must be next to the markings on the board when the measure is glued to the side of the board. Blueprints for the construction of portable measuring boards are also available from the National Center for Chronic Disease Prevention and Health Promotion of the Centers for Disease Control and Prevention, Web site: http://www.cdc.gov/nccdphp/</p>	<p>UNICEF*: http://www.supply.unicef.dk/catalogue/ Item No. 0114500</p> <p>UNICEF Supply Division; Telephone: (45) 35 27 35 27; Fax: (45) 35 26 94 21; Email: supply@unicef.org; Website: www.supply.unicef.dk</p>

Weight	Electronic scale (Uniscale)	<p>The scale is manufactured by SECA. It is a floor scale for weighing children as well as adults (capacity 150 kg). It can measure from 1 kg to 150 kg in 100 g divisions, with an accuracy of +/-100 g. Weight of adult on scale can be stored (tared) in memory, allowing the weight of baby or small child held by adult to show on scale indicator.</p> <p>The major advantage of this scale is the microcomputer chip, which allows it to adjust to zero and weigh people quickly and accurately. The child may be weighed directly. If a child is frightened, the mother can first be weighed alone and then weighed while holding the child in her arms, and the scale will automatically compute the child's weight by subtraction.</p> <p>The portable scale, weighing 4 kg, includes a solar cell on-switch and is powered by long-life lithium battery. Instructions are available in English, French and Spanish.</p>	<p>UNICEF http://www.supply.unicef.dk/catalogue/ Item No. 0141015</p> <p>UNICEF Supply Division; Telephone: (45) 35 27 35 27; Fax: (45) 35 26 94 21; Email: supply@unicef.org; Website: www.supply.unicef.dk.</p>
	Hanging scale	<p>UNICEF Hanging Scale (Item No. 0145555 Scale, infant, spring, 25 kg x 100 g with No. 0189000 weighing trousers/pack of 5): This is a Salter-type spring scale with a capacity of 25 kg and 100-g increments.</p> <p>Salter Hanging Scale Model 235-6S: This is a lightweight scale that has a durable, rust-resistant metal case and an unbreakable plastic face. Its capacity is 25 kg, marked in 100-g increments.</p>	<p>For more information contact: UNICEF Supply Division; Telephone: (45) 35 27 35 27; Fax: (45) 35 26 94 21; Email: supply@unicef.org; Website: www.supply.unicef.dk. The price of this scale is about US\$ 30.</p> <p>For more information contact: Salter Industrial Measurement, Ltd.; Telephone: (44) 121 553 1855. The price is US\$ 77.</p>
	Bebe way	<p>Infant weighing scale for use in growth monitoring and obtaining birthweight.</p>	<p>UNICEF http://www.supply.unicef.dk/catalogue/</p>

Item No.0557100
Scale,birthweight indicator,
2.5kg x 100g

Infant scale

Infant weighing scale to use
when taking infant weights.

UNICEF
<http://www.supply.unicef.dk/catalogue/>

Item No.0145520
Scale,infant,clinic,metric,
16kg x 10g

**Mid-upper arm
circumference
(MUAC)**

MUAC tape

This insertion tape measures
mid-upper arm circumferen-
ce. It is made of stretch-resi-
stant plasticized paper.

UNICEF
<http://www.supply.unicef.dk/catalogue/>

Item No. 145600 Arm
circumference insertion
tape/pack of 50)

UNICEF Supply Division;
Telephone: (45) 35 27 35
27; Fax: (45) 35 26 94 21;
Email: supply@unicef.org;
Website: www.supply.unicef.dk

**Height/weight/
MUAC**

OXFAM
Anthro-pometric
kit

The anthropometric kit con-
tains equipment for measur-
ing the weight and height of
children to assess their nutri-
tional status, and other
materials needed for nutritio-
nal surveys. The kit contains
measuring and survey mate-
rials for two survey teams, or
measuring equipment for
two feeding centers.

UNICEF
<http://www.supply.unicef.dk/catalogue/>

Item No. 0000824

UNICEF Supply Division;
Telephone: (45) 35 27 35
27; Fax: (45) 35 26 94 21;
Email: supply@unicef.org;
Website: www.supply.unicef.dk

Weight-for-Height Reference Values in Z-scores

NCHS/CDC/WHO

Weight in kilograms					
Height (centimeters)	Mean Wt	Std Dev	Mean - 2 SD	Mean - 3 SD	Mean - 4 SD
50.0	3.4	0.400	2.6	2.2	1.8
50.5	3.4	0.400	2.6	2.2	1.8
51.0	3.5	0.400	2.7	2.3	1.9
51.5	3.6	0.430	2.7	2.3	1.9
52.0	3.7	0.450	2.8	2.4	1.9
52.5	3.8	0.460	2.9	2.4	2.0
53.0	3.9	0.480	2.9	2.5	2.0
53.5	4.0	0.485	3.0	2.5	2.1
54.0	4.1	0.500	3.1	2.6	2.1
54.5	4.2	0.500	3.2	2.7	2.2
55.0	4.3	0.515	3.3	2.8	2.2
55.5	4.4	0.520	3.4	2.8	2.3
56.0	4.6	0.550	3.5	2.9	2.4
56.5	4.7	0.555	3.6	3.0	2.5
57.0	4.8	0.565	3.7	3.1	2.5
57.5	4.9	0.570	3.8	3.2	2.6
58.0	5.1	0.600	3.9	3.3	2.7
58.5	5.2	0.600	4.0	3.4	2.8
59.0	5.3	0.600	4.1	3.5	2.9
59.5	5.5	0.630	4.2	3.6	3.0
60.0	5.6	0.630	4.3	3.7	3.1
60.5	5.7	0.625	4.5	3.8	3.2
61.0	5.9	0.660	4.6	3.9	3.3
61.5	6.0	0.650	4.7	4.1	3.4
62.0	6.2	0.680	4.8	4.2	3.5
62.5	6.3	0.675	5.0	4.3	3.6
63.0	6.5	0.700	5.1	4.4	3.7
63.5	6.6	0.685	5.2	4.5	3.9
64.0	6.7	0.675	5.4	4.7	4.0
64.5	6.9	0.700	5.5	4.8	4.1
65.0	7.0	0.700	5.6	4.9	4.2
65.5	7.2	0.725	5.8	5.0	4.3
66.0	7.3	0.715	5.9	5.2	4.4
66.5	7.5	0.730	6.0	5.3	4.6
67.0	7.6	0.730	6.1	5.4	4.7
67.5	7.8	0.760	6.3	5.5	4.8
68.0	7.9	0.750	6.4	5.7	4.9
68.5	8.0	0.750	6.5	5.8	5.0
69.0	8.2	0.770	6.7	5.9	5.1
69.5	8.3	0.760	6.8	6.0	5.3
70.0	8.5	0.785	6.9	6.1	5.4
70.5	8.6	0.780	7.0	6.3	5.5

Weight in kilograms

Height (centimeters)	Mean Wt	Std Dev	Mean - 2 SD	Mean - 3 SD	Mean - 4 SD
71.0	8.7	0.770	7.2	6.4	5.6
71.5	8.9	0.800	7.3	6.5	5.7
72.0	9.0	0.800	7.4	6.6	5.8
72.5	9.1	0.800	7.5	6.7	5.9
73.0	9.2	0.800	7.6	6.8	6.0
73.5	9.4	0.830	7.7	6.9	6.1
74.0	9.5	0.830	7.8	7.0	6.2
74.5	9.6	0.830	7.9	7.1	6.3
75.0	9.7	0.825	8.1	7.2	6.4
75.5	9.8	0.825	8.2	7.3	6.5
76.0	9.9	0.825	8.3	7.4	6.6
76.5	10.0	0.825	8.4	7.5	6.7
77.0	10.1	0.825	8.5	7.6	6.8
77.5	10.2	0.825	8.5	7.7	6.9
78.0	10.4	0.880	8.6	7.8	6.9
78.5	10.5	0.880	8.7	7.9	7.0
79.0	10.6	0.880	8.8	8.0	7.1
79.5	10.7	0.880	8.9	8.1	7.2
80.0	10.8	0.885	9.0	8.1	7.3
80.5	10.9	0.885	9.1	8.2	7.4
81.0	11.0	0.900	9.2	8.3	7.4
81.5	11.1	0.900	9.3	8.4	7.5
82.0	11.2	0.900	9.4	8.5	7.6
82.5	11.3	0.900	9.5	8.6	7.7
83.0	11.4	0.900	9.6	8.7	7.8
83.5	11.5	0.925	9.6	8.7	7.8
84.0	11.5	0.900	9.7	8.8	7.9
84.5	11.6	0.900	9.8	8.9	8.0
85.0	12.0	1.080	9.8	8.8	7.7
85.5	12.1	1.100	9.9	8.8	7.7
86.0	12.2	1.100	10.0	8.9	7.8
86.5	12.3	1.100	10.1	9.0	7.9
87.0	12.4	1.100	10.2	9.1	8.0
87.5	12.5	1.100	10.3	9.2	8.1
88.0	12.6	1.100	10.4	9.3	8.2
88.5	12.8	1.150	10.5	9.4	8.2
89.0	12.9	1.150	10.6	9.5	8.3
89.5	13.0	1.150	10.7	9.6	8.4
90.0	13.1	1.160	10.8	9.6	8.5
90.5	13.2	1.160	10.9	9.7	8.6
91.0	13.3	1.175	11.0	9.8	8.6
91.5	13.4	1.170	11.1	9.9	8.7
92.0	13.6	1.200	11.2	10.0	8.8
92.5	13.7	1.200	11.3	10.1	8.9

Weight in kilograms

Height (centimeters)	Mean Wt	Std Dev	Mean - 2 SD	Mean - 3 SD	Mean - 4 SD
93.0	13.8.	1.200	11.4	10.2	9.0
93.5	13.9	1.215	11.5	10.3	9.0
94.0	14.0	1.215	11.6	10.4	9.1
94.5	14.2	1.260	11.7	10.4	9.2
95.0	14.3	1.260	11.8	10.5	9.3
95.5	14.4	1.260	11.9	10.6	9.4
96.0	14.5	1.275	12.0	10.7	9.4
96.5	14.7	1.300	12.1	10.8	9.5
97.0	14.8	1.300	12.2	10.9	9.6
97.5	14.9	1.300	12.3	11.0	9.7
98.0	15.0	1.300	12.4	11.1	9.8
98.5	15.2	1.350	12.5	11.2	9.8
99.0	15.3	1.350	12.6	11.3	9.9
99.5	15.4	1.350	12.7	11.4	10.0
100.0	15.6	1.380	12.8	11.5	10.1
100.5	15.7	1.380	12.9	11.6	10.2
101.0	15.8	1.380	13.0	11.7	10.3
101.5	16.0	1.400	13.2	11.8	10.4
102.0	16.1	1.415	13.3	11.9	10.4
102.5	16.2	1.415	13.4	12.0	10.5
103.0	16.4	1.440	13.5	12.1	10.6
103.5	16.5	1.450	13.6	12.2	10.7
104.0	16.7	1.480	13.7	12.3	10.8
104.5	16.a	1.480	13.8	12.4	10.9
105.0	16.9	1.475	14.0	12.5	11.0
105.5	17.1	1.500	14.1	12.6	11.1
106.0	17.2	1.500	14.2	12.7	11.2
106.5	17.4	1.530	14.3	12.8	11.3
107.0	17.5	1.525	14.5	12.9	11.4
107.5	17.7	1.560	14.6	13.0	11.5
108.0	17.8	1.550	14.7	13.2	11.6
108.5	18.0	1.580	14.8	13.3	11.7
109.0	18.1	1.575	15.0	13.4	11.8
109.5	18.3	1.600	15.1	13.5	11.9
110.0	18.4	1.600	15.2	13.6	12.0
110.5	18.6	1.600	15.4	13.8	12.2
111.0	18.8	1.630	15.5	13.9	12.3
111.5	18.9	1.625	15.7	14.0	12.4
112.0	19.1	1.650	15.8	14.2	12.5
112.5	19.3	1.680	15.9	14.3	12.6
113.0	19.4	1.660	16.1	14.4	12.8
113.5	19.6	1.680	16.2	14.6	12.9
114.0	19.8	1.700	16.4	14.7	13.0
114.5	19.9	1.700	16.5	14.8	13.1

Weight in kilograms

Height (centimeters)	Mean Wt	Std Dev	Mean - 2 SD	Mean - 3 SD	Mean - 4 SD
115.0	20.1	1.700	16.7	15.0	13.3
115.5	20.3	1.730	16.8	15.1	13.4
116.0	20.5	1.750	17.0	15.3	13.5
116.5	20.7	1.760	17.2	15.4	13.7
117.0	20.8	1.760	17.3	15.5	13.8
117.5	21.0	1.775	17.5	15.7	13.9
118.0	21.2	1.785	17.6	15.8	14.1
118.5	21.4	1.800	17.8	16.0	14.2
119.0	21.6	1.815	18.0	16.2	14.3
119.5	21.8	1.830	18.1	16.3	14.5
120.0	22.0	1.850	18.3	16.5	14.6
120.5	22.2	1.860	18.5	16.6	14.8
121.0	22.4	1.875	18.7	16.8	14.9
121.5	22.6	1.900	18.8	16.9	15.0
122.0	22.8	1.900	19.0	17.1	15.2
122.5	23.1	1.950	19.2	17.3	15.3
123.0	23.3	1.960	19.4	17.4	15.5
123.5	23.5	1.975	19.6	17.6	15.6
124.0	23.7	2.000	19.7	17.7	15.7
124.5	24.0	2.030	19.9	17.9	15.9
125.0	24.2	2.050	20.1	18.1	16.0
125.5	24.4	2.060	20.3	18.2	16.2
126.0	24.7	2.100	20.5	18.4	16.3
126.5	24.9	2.115	20.7	18.6	16.4
127.0	25.2	2.155	20.9	18.7	16.6
127.5	25.4	2.175	21.1	18.9	16.7
128.0	25.7	2.200	21.3	19.1	16.9
128.5	26.0	2.260	21.5	19.2	17.0
129.0	26.2	2.275	21.7	19.4	17.1
129.5	26.5	2.300	21.9	19.6	17.3
130.0	26.8	2.36	22.1	19.7	17.4
130.5	27.1	2.400	22.3	19.9	17.5
131.0	27.4	2.450	22.5	20.1	17.6
131.5	27.6	2.460	22.7	20.2	17.8
132.0	27.9	2.500	22.9	20.4	17.9
132.5	28.2	2.550	23.1	20.6	18.0
133.0	28.6	2.630	23.3	20.7	18.1
133.5	28.9	2.660	23.6	20.9	18.3
134.0	29.2	2.700	23.8	21.1	18.4
134.5	29.5	2.760	24.0	21.2	18.5
135.0	29.8	2.800	24.2	21.4	18.6
135.5	30.2	2.880	24.4	21.6	18.7
136.0	30.5	2.925	24.7	21.7	18.8
136.5	30.9	3.000	24.9	21.9	18.9
137.0	31.2	3.050	25.1	22.1	19.0

Weight-for-Height Reference in Percentage of the Median for both Boys and Girls (Supine)

Length (cm)	Median (kg)	Percents of median				Length (cm)	Median (kg)	Percents of median			
		85%	80%	75%	70%			85%	80%	75%	70%
49.0	3.2	2.7	2.6	2.4	2.3	67.0	7.6	6.5	6.1	5.7	5.3
49.5	3.3	2.8	2.6	2.5	2.3	67.5	7.8	6.6	6.2	5.8	5.4
50.0	3.4	2.9	2.7	2.5	2.4	68.0	7.9	6.7	6.4	5.9	5.5
50.5	3.4	2.9	2.7	2.6	2.4	68.5	8.0	6.8	6.4	6.0	5.6
51.0	3.5	3.0	2.8	2.7	2.5	69.0	8.2	7.0	6.6	6.1	5.7
51.5	3.6	3.1	2.9	2.7	2.5	69.5	8.3	7.1	6.7	6.2	5.8
52.0	3.7	3.1	3.0	2.8	2.6	70.0	8.5	7.2	6.8	6.3	5.9
52.5	3.8	3.2	3.0	2.8	2.6	70.5	8.6	7.3	6.9	6.4	6.0
53.0	3.9	3.3	3.1	2.9	2.7	71.0	8.7	7.4	7.0	6.5	6.1
53.5	4.0	3.4	3.2	3.0	2.8	71.5	8.9	7.5	7.1	6.6	6.2
54.0	4.1	3.5	3.3	3.1	2.9	72.0	9.0	7.6	7.2	6.7	6.3
54.5	4.2	3.6	3.4	3.2	2.9	72.5	9.1	7.7	7.3	6.8	6.4
55.0	4.3	3.7	3.5	3.2	3.0	73.0	9.2	7.9	7.4	6.9	6.5
55.5	4.4	3.8	3.5	3.3	3.1	73.5	9.4	8.0	7.5	7.0	6.5
56.0	4.6	3.9	3.6	3.4	3.2	74.0	9.5	8.1	7.6	7.0	6.6
56.5	4.7	4.0	3.7	3.5	3.3	74.5	9.6	8.2	7.7	7.2	6.7
57.0	4.8	4.1	3.8	3.6	3.4	75.0	9.7	8.2	7.8	7.3	6.8
57.5	4.9	4.2	3.9	3.7	3.4	75.5	9.8	8.3	7.9	7.4	6.9
58.0	5.1	4.3	4.0	3.8	3.5	76.0	9.9	8.4	7.9	7.4	6.9
58.5	5.2	4.4	4.2	3.9	3.6	76.5	10.0	8.5	8.0	7.5	7.0
59.0	5.3	4.5	4.3	4.0	3.7	77.0	10.1	8.6	8.1	7.6	7.1
59.5	5.5	4.6	4.4	4.1	3.8	77.5	10.2	8.7	8.2	7.7	7.2
60.0	5.6	4.8	4.5	4.2	3.9	78.0	10.4	8.8	8.3	7.8	7.2
60.5	5.7	4.9	4.6	4.3	4.0	78.5	10.5	8.9	8.4	7.8	7.3
61.0	4.9	5.0	4.7	4.4	4.1	79.0	10.6	9.0	8.4	7.9	7.4
61.5	6.0	5.1	4.8	4.5	4.2	79.5	10.7	9.1	8.5	8.0	7.5
62.0	6.2	5.2	4.9	4.6	4.3	80.0	10.8	9.1	8.6	8.1	7.5
62.5	6.3	5.4	5.0	4.7	4.4	80.5	10.9	9.2	8.7	8.1	7.6
63.0	6.5	5.5	5.2	4.8	4.5	81.0	11.0	9.3	8.8	8.2	7.7
63.5	6.6	5.6	5.3	5.0	4.6	81.5	11.1	9.4	8.8	8.3	7.7
64.0	6.7	5.7	5.4	5.0	4.7	82.0	11.2	9.5	8.9	8.4	7.8
64.5	6.9	5.9	5.5	5.2	4.8	82.5	11.3	9.6	9.0	8.4	7.9
65.0	7.0	6.0	5.6	5.3	4.9	83.0	11.4	9.6	9.1	8.5	7.9
65.5	7.2	6.1	5.7	5.4	5.0	83.5	11.5	9.7	9.2	8.6	8.0
66.0	7.3	6.2	5.9	5.5	5.1	84.0	11.5	9.8	9.2	8.7	8.1
66.5	7.5	6.4	6.0	5.6	5.2	84.5	11.6	9.9	9.3	8.7	8.2

Length (cm)	Median (kg)	Percents of median				Length (cm)	Median (kg)	Percents of median			
		85%	80%	75%	70%			85%	80%	75%	70%
85.0	12.0	10.2	9.6	9.0	8.4	107.5	17.7	15.0	14.1	13.3	12.4
85.5	12.1	10.3	9.7	9.1	8.5	108.0	17.8	15.2	14.3	13.4	12.5
86.0	12.2	10.4	9.8	9.1	8.5	108.5	18.0	15.3	14.4	13.5	12.6
86.5	12.3	10.5	9.8	9.2	8.6	109.0	18.1	15.4	14.5	13.6	12.7
87.0	12.4	10.6	9.9	9.3	8.7	109.5	18.3	15.5	14.6	13.7	12.8
87.5	12.5	10.6	10.0	9.4	8.8	110.0	18.4	15.7	14.8	13.8	12.9
88.0	12.6	10.7	10.1	9.5	8.8	110.5	18.6	15.8	14.9	14.0	13.0
88.5	12.8	10.8	10.2	9.6	8.9	111.0	18.8	16.0	15.0	14.1	13.1
89.0	12.9	10.9	10.3	9.7	9.0	111.5	18.9	16.1	15.1	14.2	13.3
89.5	13.0	11.0	10.4	9.7	9.1	112.0	19.1	16.2	15.3	14.3	13.4
90.0	13.1	11.1	10.5	9.8	9.2	112.5	19.3	16.4	15.4	14.4	13.5
90.5	13.2	11.2	10.6	9.9	9.2	113.0	19.4	16.5	15.5	14.6	13.6
91.0	13.3	11.3	10.7	10.0	9.3	113.5	19.6	16.7	15.7	14.7	13.7
91.5	13.4	11.4	10.8	10.1	9.4	114.0	19.8	16.8	15.8	14.8	13.8
92.0	13.6	11.5	10.8	10.2	9.5	114.5	19.9	16.9	16.0	15.0	14.0
92.5	13.7	11.6	10.9	10.3	9.6	115.0	20.1	17.1	16.1	15.1	14.1
93.0	13.8	11.7	11.0	10.3	9.7	115.5	20.3	17.3	16.2	15.2	14.2
93.5	13.9	11.8	11.1	10.4	9.7	116.0	20.5	17.4	16.4	15.4	14.3
94.0	14.0	11.9	11.2	10.5	9.8	116.5	20.7	17.6	16.5	15.5	14.5
94.5	14.2	12.0	11.3	10.6	9.9	117.0	20.8	17.7	16.7	15.6	14.6
95.0	14.3	12.1	11.4	10.7	10.0	117.5	21.0	17.9	16.8	15.8	14.7
95.5	14.4	12.2	11.5	10.8	10.1	118.0	21.2	18.0	17.0	15.9	14.9
96.0	14.5	12.4	11.6	10.9	10.2	118.5	21.4	18.2	17.1	16.1	15.0
96.5	14.7	12.5	11.7	11.0	10.3	119.0	21.6	18.4	17.3	16.2	15.1
97.0	14.8	12.6	11.8	11.1	10.3	119.5	21.8	18.5	17.4	16.4	15.3
97.5	14.9	12.7	11.9	11.2	10.4	120.0	22.0	18.7	17.6	16.5	15.4
98.0	15.0	12.8	12.0	11.3	10.5	120.5	22.2	18.9	17.8	16.7	15.5
98.5	15.2	12.9	12.1	11.4	10.6	121.0	22.4	19.1	17.9	16.8	15.7
99.0	15.3	13.0	12.2	11.5	10.7	121.5	22.6	19.2	18.1	17.0	15.8
99.5	15.4	13.1	12.3	11.6	10.8	122.0	22.8	19.4	18.3	17.1	16.0
100.0	15.6	13.2	12.4	11.7	10.9	122.5	23.1	19.6	18.4	17.3	16.1
100.5	15.7	13.3	12.6	11.8	11.0	123.0	23.3	19.8	18.6	17.5	16.3
101.0	15.8	13.5	12.7	11.9	11.1	123.5	23.5	20.0	18.8	17.6	16.5
101.5	16.0	13.6	12.8	12.0	11.2	124.0	23.7	20.2	19.0	17.8	16.6
102.0	16.1	13.7	12.9	12.1	11.3	124.5	24.0	20.4	19.2	18.0	16.8
102.5	16.2	13.8	13.0	12.2	11.4	125.0	24.2	20.6	19.4	18.2	16.9
103.0	16.4	13.9	13.1	12.3	11.5	125.5	24.4	20.8	19.6	18.3	17.1
103.5	16.5	14.0	13.2	12.4	11.6	126.0	24.7	21.0	19.7	18.5	17.3
104.0	16.7	14.2	13.3	12.5	11.7	126.5	24.9	21.2	19.9	18.7	17.5
104.5	16.8	14.3	13.4	12.6	11.8	127.0	25.2	21.4	20.1	18.9	17.6
105.0	16.9	14.4	13.6	12.7	11.9	127.5	25.4	21.6	20.4	19.1	17.8
105.5	17.0	14.5	13.7	12.8	12.0	128.0	25.7	21.8	20.6	19.3	18.0
106.0	17.2	14.6	13.8	12.9	12.1	128.5	26.0	22.1	20.8	19.5	18.2
106.5	17.4	14.8	13.9	13.0	12.2	129.0	26.2	22.3	21.0	19.7	18.4
107.0	17.5	14.9	14.0	13.1	12.3	129.5	26.5	22.5	21.2	19.9	18.6
						130.0	26.8	22.8	21.4	20.1	18.7

Height-for-Age Index Z-scores for Combined Sexes 0-59 Months of Age

NCHS/CDC/WHO

COMBINED SEXES 0-59 months of age

Age (months)	Z score median	-4	-3	-2	-1
0	50.2	41.2	43.5	45.7	48.0
1	54.1	44.5	46.9	49.3	51.7
2	57.4	47.4	49.9	52.4	54.9
3	60.3	50.1	52.7	55.2	57.8
4	62.8	52.4	55.0	57.6	60.2
5	65.0	54.4	57.1	59.7	62.4
6	66.9	56.1	58.8	61.5	64.2
7	68.5	57.9	60.6	63.2	65.9
8	70.0	59.4	62.1	64.7	67.4
9	71.4	60.6	63.3	66.0	68.7
10	72.7	61.9	64.6	67.3	70.0
11	74.0	63.0	65.8	68.5	71.3
12	75.2	64.2	67.0	69.7	72.5
13	76.4	65.2	68.0	70.8	73.6
14	77.5	66.1	69.0	71.8	74.7
15	78.6	67.0	69.9	72.8	75.7
16	79.7	67.9	70.9	73.8	76.8
17	80.7	68.7	71.7	74.7	77.7
18	81.7	69.5	72.6	75.6	78.7
19	82.6	70.2	73.3	76.4	79.5
20	83.6	70.8	74.0	77.2	80.4
21	84.5	71.7	74.9	78.1	81.3
22	85.4	72.4	75.7	78.9	82.2
23	86.2	73.0	76.3	78.6	82.9
24	85.0	72.2	75.4	79.4	81.8
25	85.9	72.9	76.2	80.1	82.7
26	86.7	73.5	76.8	80.8	83.4
27	88.4	74.0	77.4	81.5	84.2
28	89.2	74.6	78.1	82.2	85.0
29	89.8	75.2	78.7	82.9	85.7
30	90.7	76.0	79.5	83.6	86.4
31	91.5	76.5	80.1	84.3	87.2
32	92.2	77.1	80.7	84.9	87.9

COMBINED SEXES 0-59 months of age

Age (months)	Z score median	-4	-3	-2	-1
33	93.0	77.6	81.3	85.6	88.6
34	93.7	78.2	81.9	86.3	89.3
35	94.4	78.9	82.6	86.9	90.0
36	95.1	79.4	83.2	87.5	90.7
37	95.8	79.9	83.7	88.2	91.3
38	96.5	80.6	84.4	88.8	92.0
39	97.2	81.1	85.0	89.4	92.7
40	97.8	81.6	85.5	90.0	93.3
41	98.5	82.2	86.1	90.6	93.9
42	99.2	82.7	86.7	91.2	94.6
43	99.8	83.2	87.2	91.7	95.2
44	100.4	83.6	87.7	92.3	95.8
45	101.1	84.2	88.3	92.9	96.4
46	101.7	84.7	88.8	93.4	97.0
47	102.3	85.1	89.3	94.0	97.6
48	102.9	85.7	89.9	94.5	98.2
49	103.5	86.1	90.3	95.1	98.7
50	104.1	86.7	90.9	95.6	99.3
51	104.7	87.1	91.4	96.1	99.9
52	105.2	87.5	91.8	96.7	100.4
53	105.8	88.2	92.5	97.2	101.0
54	106.4	88.6	92.9	97.7	101.5
55	106.9	89.0	93.4	98.2	102.1
56	107.5	89.5	93.9	98.7	102.6
57	108.1	89.9	94.3	99.2	103.1
58	108.6	90.3	94.8	99.7	103.7
59	109.2	90.8	95.3	100.1	104.2

Weight For Age Reference Values for Boys

Age (months)	Mean weight	Std Dev	-2 SD	-3 SD	- 4 SD
0	3.3	0.4	2.4	2.0	1.6
1	4.3	0.7	2.9	2.2	1.6
2	5.2	0.9	3.5	2.6	1.8
3	6.0	1.0	4.1	3.1	2.2
4	6.7	1.0	4.7	3.7	2.7
5	7.3	1.0	5.3	4.3	3.3
6	7.8	1.0	5.9	4.9	3.9
7	8.3	1.0	6.4	5.4	4.5
8	8.8	1.0	6.9	5.9	4.9
9	9.2	1.0	7.2	6.3	5.3
10	9.5	1.0	7.6	6.6	5.6
11	9.9	1.0	7.9	6.9	5.9
12	10.2	1.0	8.1	7.1	6.1
13	10.4	1.0	8.3	7.3	6.3
14	10.7	1.1	8.5	7.5	6.4
15	10.9	1.1	8.7	7.6	6.5
16	11.1	1.1	8.8	7.7	6.6
17	11.3	1.1	9.0	7.8	6.7
18	11.5	1.2	9.1	7.9	6.8
19	11.7	1.2	9.2	8.0	6.8
20	11.8	1.2	9.4	8.1	6.9
21	12.0	1.3	9.5	8.3	7.0
22	12.2	1.3	9.7	8.4	7.1
23	12.4	1.3	9.8	8.5	7.2
24	12.3	1.1	10.1	9.0	7.8
25	12.5	1.2	10.2	9.0	7.9
26	12.7	1.2	10.3	9.1	7.9
27	12.9	1.3	10.4	9.1	7.9
28	13.1	1.3	10.5	9.2	7.9
29	13.3	1.3	10.6	9.3	7.9
30	13.5	1.4	10.7	9.4	8.0
31	13.7	1.4	10.9	9.4	8.0
32	13.9	1.5	11.0	9.5	8.0
33	14.1	1.5	11.1	9.6	8.1
34	14.3	1.5	11.2	9.7	8.1
35	14.4	1.6	11.3	9.7	8.2
36	14.6	1.6	11.4	9.8	8.2
37	14.8	1.6	11.5	9.9	8.3

Age (months)	Mean weight	Std Dev	-2 SD	-3 SD	- 4 SD
38	15.0	1.7	11.7	10.0	8.4
39	15.2	1.7	11.8	10.1	8.4
40	15.3	1.7	11.9	10.2	8.5
41	15.5	1.7	12.0	10.3	8.6
42	15.7	1.8	12.1	10.4	8.6
43	15.8	1.8	12.3	10.5	8.7
44	16.0	1.8	12.4	10.6	8.8
45	16.2	1.8	12.5	10.7	8.8
46	16.4	1.9	12.6	10.8	8.9
47	16.5	1.9	12.8	10.9	9.0
48	16.7	1.9	12.9	11.0	9.1
49	16.9	1.9	13.0	11.1	9.2
50	17.0	1.9	13.1	11.2	9.3
51	17.2	2.0	13.3	11.3	9.4
52	17.4	2.0	13.4	11.4	9.5
53	17.5	2.0	13.5	11.5	9.5
54	17.7	2.0	13.7	11.6	9.6
55	17.9	2.0	13.8	11.8	9.7
56	18.0	2.0	13.9	11.9	9.8
57	18.2	2.1	14.1	12.0	9.9
58	18.3	2.1	14.2	12.1	10.0
59	18.5	2.1	14.3	12.2	10.1

Weight for Age Reference Values for Girls

Age (months)	Mean weight	Std Dev	-2 SD	-3 SD	- 4 SD
0	3.2	0.5	2.2	1.8	1.3
1	4.0	0.6	2.8	2.2	1.6
2	4.7	0.7	3.3	2.7	2.0
3	5.4	0.7	3.9	3.2	2.4
4	6.0	0.8	4.5	3.7	2.9
5	6.7	0.8	5.0	4.1	3.3
6	7.2	0.9	5.5	4.6	3.7
7	7.7	0.9	5.9	5.0	4.1
8	8.2	0.9	6.3	5.4	4.4
9	8.6	1.0	6.6	5.7	4.7
10	8.9	1.0	6.9	5.9	4.9
11	9.2	1.0	7.2	6.2	5.2
12	9.5	1.0	7.4	6.4	5.3
13	9.8	1.1	7.6	6.6	5.5
14	10.0	1.1	7.8	6.7	5.6
15	10.2	1.1	8.0	6.9	5.8
16	10.4	1.1	8.2	7.0	5.9
17	10.6	1.2	8.3	7.2	6.0
18	10.8	1.2	8.5	7.3	6.1
19	11.0	1.2	8.6	7.5	6.3
20	11.2	1.2	8.8	7.6	6.4
21	11.4	1.2	9.0	7.7	6.5
22	11.5	1.2	9.1	7.9	6.7
23	11.7	1.2	9.3	8.1	6.8
24	11.8	1.2	9.4	8.3	7.1
25	12.0	1.2	9.6	8.4	7.2
26	12.2	1.2	9.8	8.5	7.3
27	12.4	1.3	9.9	8.7	7.4
28	12.6	1.3	10.1	8.8	7.5
29	12.8	1.3	10.2	8.9	7.6
30	13.0	1.3	10.3	9.0	7.7
31	13.2	1.4	10.5	9.1	7.8
32	13.4	1.4	10.6	9.2	7.9
33	13.6	1.4	10.8	9.4	7.9
34	13.8	1.4	10.9	9.5	8.0
35	13.9	1.5	11.0	9.6	8.1
36	14.1	1.5	11.2	9.7	8.2
37	14.3	1.5	11.3	9.8	8.3

Age (months)	Mean weight	Std Dev	-2 SD	-3 SD	- 4 SD
38	14.4	1.5	11.4	9.9	8.4
39	14.6	1.5	11.5	10.0	8.5
40	14.8	1.6	11.6	10.1	8.6
41	14.9	1.6	11.8	10.2	8.7
42	15.1	1.6	11.9	10.3	8.8
43	15.2	1.6	12.0	10.4	8.9
44	15.4	1.6	12.1	10.5	8.9
45	15.5	1.6	12.2	10.6	9.0
46	15.7	1.7	12.3	10.7	9.1
47	15.8	1.7	12.5	10.8	9.2
48	16.0	1.7	12.6	10.9	9.2
49	16.1	1.7	12.7	11.0	9.3
50	16.2	1.7	12.8	11.1	9.4
51	16.4	1.8	12.9	11.2	9.4
52	16.5	1.8	13.0	11.3	9.5
53	16.7	1.8	13.1	11.4	9.6
54	16.8	1.8	13.2	11.5	9.6
55	17.0	1.8	13.3	11.5	9.7
56	17.1	1.8	13.4	11.6	9.8
57	17.2	1.9	13.5	11.7	9.8
58	17.4	1.9	13.6	11.8	9.9
59	17.5	1.9	13.7	11.9	9.9

Nutrition and Health Survey Questionnaire

Province _____ District _____ Village _____
 Cluster number: _____ Household number: _____
 Team code: _____ Interviewer code: _____ Date of interview: _____ / _____
 Day / Month

HOUSEHOLD DATA

- 1) Does your family now live in your usual place of residence? (circle one) _____ Yes / No / Unk
 1a) If NO, how long since the family has lived there? _____ months OR _____ years
- 2) Has anyone in the family received any relief food in the last month? _____ Yes / No / Unk
- 3) What is your main source of water? (circle one) _____ Central piped system / Truck or water seller / Bore hole
 Open Well / River or stream / Lake or pond / Other
- 4) Do you use the same source of water now as you did this time last year? _____ Yes / No / Unk
- 5) Results of iodine testing of salt used for last night's food (circle one) _____ Positive / Negative / Not Done

I would like to ask you about each person who lived in this household at the time of [beginning of recall period] and who lives here now:

1	2	3	4	5	6
ID	Sex (M/F)	Current age (in years, < 1 year = 0)	Present now (Y/N)	Present at the beginning of recall period (Y/N)	Current status (1=Alive; 2=Dead; 3=Unknown)
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					
13					
14					
15					
16					
17					
18					
19					
20					

Tally (if data on household members will not be entered into the computer):

a. Number of current HH members - total	Column 4
b. Number of current HH members < 5 years	Columns 3 & 4
c. Number of HH members at beginning of recall period - all ages	Column 5
d. Number of HH members at beginning of recall period < 5 years	Columns 3 & 5
e. Total number of deaths during recall	Column 6
f. Number of deaths in children < 5 years of age	Columns 3 & 7

Nutrition and health survey - data collection form (child 0-59 months)

Cluster number: _____ HH: _____ Child's person number: _____ Mother's person number: _____

Questions for adult caretaker

- 1) Relationship of respondent to child: _____ Mother Father Grandmother Grandfather Other
- 2) Is this child's mother alive? _____ Yes / No / Unk
- 3) Sex _____ Male / Female
- 4) Date of birth OR Age in months _____ / _____ / _____ OR _____ months
Day Month Year .
- 5) Does this child have difficulty seeing at night or in the evening when other people do not? Yes / No / Unk
- 6) Since this time yesterday, has this child breast fed? Yes / No / Unk
6a) If YES, was breast milk this child's main source of food since yesterday? Yes / No / Unk
6b) If YES, how long after birth did this child first breast feed? _____ hours
- 7) Since this time yesterday, has this child received anything other than breast milk? Water, tea, or juice /
(circle all that are true) Powdered milk or infant formula / Semi-solid or solid food / None of these
- 8) Since this time yesterday, has this child drunk anything from a bottle with a nipple? Yes / No / Unk
- 9) Has this child received any vitamin A? Vitamin A is given as drops from a capsule Yes / No / Unk
(show example)
- 10) Since 2 weeks ago, has this child had diarrhea? Yes / No / Unk
Diarrhea is 3 or more stools in 24 hours.
10a) If YES, was this child taken to a clinic or hospital for this problem? Yes / No / Unk
- 11) Since two weeks ago, has this child had fever and difficulty breathing? Yes / No / Unk
10a) If YES, was this child taken to a clinic or hospital for this problem? Yes / No / Unk
- 12) Has this child received measles vaccination? Yes / No / Unk
This vaccine is given by injection.

Examination of child

- | | |
|---|----------|
| 13) Bitot's spots | Yes / No |
| 14) Angular stomatitis | Yes / No |
| 15) BCG scar | Yes / No |
| 16) Bilateral edema | Yes / No |
| 17) Does this child have a physical deformity making it difficult to obtain an accurate height? | Yes / No |

Anthropometry and laboratory

- 18) Weight: (kgs)
- 19) Length/Height: (cms)
- 20) MUAC: (cms)
- 21) Hemoglobin:

Random Number Table

64612	77930	16137	12927	89071	72799	41537	36124	90640	31518
68866	19304	42847	17249	97332	86300	39716	03893	06408	32722
50198	35604	77895	61969	51985	08141	33488	78995	04992	75339
76698	11509	43552	41494	83724	01956	75786	19758	45947	94834
73412	52071	43503	62873	53324	11284	43196	06348	30008	62652
42295	74036	20944	62432	59331	89684	88553	32377	93850	12720
14980	35863	08297	96342	19765	47025	29892	81190	68117	08072
76350	78339	37830	99947	43444	98453	50998	75554	04195	85201
01581	46405	52672	46305	08886	33547	38993	18768	14469	72645
67238	13884	20162	80008	62569	22205	30546	28072	44837	49459
66570	33762	21469	00199	27172	15397	82047	61497	07638	97270
10557	21230	49179	29167	91844	51682	71808	45604	47827	87184
09219	97504	31797	55465	99417	95123	17753	98301	97544	98741
32543	64753	03363	75921	19893	88730	18290	20197	61643	60201
05689	43380	65162	24128	11352	45001	03769	89504	99057	83269
03507	88301	79068	65814	83846	19277	66548	97374	68215	52775
28225	32562	80334	30146	61413	91111	43080	28520	49848	82813
99646	08072	73891	72968	00687	38170	31-09	05309	49248	05801
26756	07050	27244	13452	53824	42973	53428	95469	10687	17704
25235	65105	57132	92464	29317	60554	06727	88036	74389	67967
25656	67440	05564	71519	49575	64287	00165	16939	41789	66082
33390	91113	08488	81634	16286	46749	73217	41865	19390	67245
43992	57138	00819	15070	20945	25400	57957	71599	16271	57901
13893	92231	60466	90318	37897	66912	90283	37008	36989	78760
66398	01315	02014	70505	34941	76983	61435	54541	97455	39820
31762	31972	63350	36644	33992	44364	85710	21443	77930	38707
30127	40804	64291	59007	77904	18539	75234	65215	67092	58640
32105	53327	84967	52173	65105	98585	56590	57180	25674	84454
57981	21947	84104	02266	33572	35803	16381	96110	52509	16049
56126	26952	92400	94553	96271	66806	89957	86934	47075	94908
13006	34316	09174	78732	96563	29286	02657	02883	18857	37822
71463	03840	20296	13460	48767	73046	59743	77656	04051	18536
85318	60674	67335	63363	48627	83227	35832	12923	73892	07336
88510	93235	41827	12682	46688	41684	97946	93028	99020	15613
00429	98471	73469	59309	02463	11443	64722	09558	33674	17649

Example of Application for Approval of Research Proposal

[shortened]

Nepal health research council, Kathmandu, Nepal

PART I

Administrative data sheet

1. Name and title of principal investigator responsible for the proposed research:

Mr. X. X., programme officer

Signature: Date:

Postal address:

2. Full name of the institution / University / NGO / INGO associated with the principal investigator (if applicable): World Food Programme

Declaration of the head of the institution / University / NGO / INGO

If the proposed research is approved, we will allow him/her to conduct the research in this institution.

Signature: Date:

4. Name and title of co-investigator (if any) responsible for the proposed research:

Last (Surname)	Middle (if any)	First name	Title (eg., Mr. Ms. Dr.)
XY	XY	Mr.	

Designation: public health nutrition officer

Signature: Date:

Postal address (if different from the address given above):

5. Is the research responsive to the health priorities and needs of Nepal?

Yes (X) No () Explain.

6. Is the research sensitive to the Nepali culture and the social values?

Yes (X) No () Explain.

7. Is health insurance being made available to the research participants?

If yes, please provide the necessary insurance data. No

8. List the name(s) and institutional affiliation of foreign researcher(s) (other than co-investigator) to assist your project in Nepal and abroad (if any)

- None

Name

Institution

(a)

Nepal health research council, Kathmandu, Nepal

9. List the name(s) of Nepali researcher(s) (other than co-investigator) or Nepalese institution/hospital/NGO(s) etc. from whom you may seek co-operation (if any) - *None*

PART II

Financial data sheet

10. Which funding organization or agency is going to fund your research project?

United Nations World Food Programme, Nepal country office

Contact information of funding organization or agency:

Total amount of funds (in US \$) allocated for the proposed research project:

Overall gross budgetary breakdown of the research project:

Personnel:

Equipment:

Operational expenses:

Laboratory/Office expenses:

Clinical expenses:

Field expenses:

Data analysis:

Others:

PART III

Research proposal description sheet

11. Title: *Baseline survey in two Makwanpur VDCs (Phaparbari and Dhiyal) prior to implementation of WFP's Mother and Child Health Care (MCHC) activity.*

12. Objectives: *Collection of baseline data prior to implementation of the MCHC activity.*

13. Summary

WFP Nepal is planning to implement its Mother and Child Health Care Activity in two VDCs of Makwanpur district (Phaparbari and Dhiyal). Prior to implementation, it is necessary to collect baseline data to be able to measure the progress of the different indicators during the project lifecycle. The baseline data to be collected is directly related to the logical framework developed for the MCHC Activity.

The long-term objective of the MCHC Activity is to support government efforts to reach the goals set under the Nutrition and Safe Motherhood Programmes of the Ministry of Health (MoH), namely to improve the overall health and nutritional status of children, expectant and nursing mothers.

More specifically, it is expected that provision of a fortified blended food and MCHC services to expectant and nursing mothers (until 6 months after delivery) and children between 6 months and 3 years of age will contribute to:

Nepal health research council, Kathmandu, Nepal

- prevention or reduction of the prevalence of underweight among young children;
- reduction in iron-deficiency anaemia among expectant and nursing mothers and young children;
- raising awareness and knowledge of expectant and nursing mothers on their health and nutrition and that of their children;
- increased and more regular utilization of community-based and MCHC outreach services (e.g., growth monitoring).

The indicators to be measured in the baseline survey are consequent with the objectives of the MCHC activity. These indicators include:

- Weight of children 6-36 months old;
- Height/length of children 6-36 months old;
- Hb level (analysis done in the field using HemoCues of Expectant and Nursing Mothers (ENMs) and of children 6-36 months old;
- Knowledge and practice of appropriate health, nutrition, caring and feeding practices of ENMs and caretakers of young children;
- Awareness and use of outreach clinic services by ENMs and caretakers of young children;
- Household history;
- Knowledge and practices of appropriate health, nutrition, caring and feeding practices of household members.

14. Rationale / Justification

It is essential to conduct a baseline survey, measuring all the indicators chosen to measure the achievement of the activity's objectives prior to implementation. The baseline data collected will allow us to adapt the project to the specific needs of the communities and to its socio-cultural specificity, as well as enabling us to measure the progress of the different indicators over the project lifecycle.

15. Research design and methodology

Research method

Qualitative (), Quantitative (), Combined (x)

Study Variables

The quantitative data collected will include, amongst others:

- Age;
- Weight of children 6-36 months old;
- Height/length of children 6-36 months old;
- Hb level (analysis done in the field using HemoCues provided by WFP) of ENMs and of children 6-36 months old;
- Knowledge and practice of appropriate health, nutrition, caring and feeding practices of ENMs and caretakers;
- Awareness and use of outreach clinic services.

The qualitative interviews will include questions on:

- Household history;
- Knowledge and practices of appropriate health, nutrition, caring and feeding practices of household members; Awareness and use of outreach clinic services.

Nepal health research council, Kathmandu, Nepal

Type of study

Descriptive study ()

(Specify)

Analytical study ()

(Specify)

Experimental study ()

(Specify)

Other ... Baseline survey: In order to collect the baseline information prior to the implementation of the Mother and Child Health Care Activity in Makwanpur district.

Study site and its justification

Target population

Expectant and nursing mothers and children of 6 months to 3 years of age in these two VDCs.

Sampling methods

Non-probability Sampling ()

(Specify)

Probability sampling (o)

(Specify: systematic sampling method)

Sample Size

- Expectant and nursing mothers: 268 (1,500 households to be visited)
- Children aged 6-36 months: 203 (560 households to be visited)

Sampling frame (if relevant) and sampling process including criteria for sample selection

A percentage of the total number of households in each of the 18 wards of the two VDCs will be visited, to reach the total number of households for each target group. A list of households will be made in collaboration with the local authorities. Surveyors will visit every Xth household (to be determined), following a systematic sampling method, and ask simple questions in order to determine if there are any target beneficiaries in the household. If the criterion is met, the full questionnaire will be filled in, anthropometric measurements will be taken if applicable, and a blood sample will be taken and analyzed.

Tools and techniques for data collection

- Household questionnaire: Questionnaires have been developed for the expectant and nursing mothers and the caretakers of the children of 6-36 months. Additionally, there will be a questionnaire for identifying eligible households.
- Qualitative interview: The qualitative part of the baseline will consist of a minimum of 10 semi-directive household interviews. The 10 households to be interviewed will be selected in collaboration with the VDC officials and health staff.
- Test of Haemoglobin level for both ENMs and the children of 6-36 months: The lab assistant hired by the NEW ERA will be involved mainly for collecting blood samples and examining the Hb level using HemoCues, microcuvettes and lancets.

Nepal health research council, Kathmandu, Nepal

- Anthropometric measurements: Salter scales will be used for taking weights of the children and a measuring board will be used for measuring heights of the children. The entire fieldwork will be carried out by 5 teams each team consisting of two female interviewers and a lab assistant.

Pretesting the data collection tools (if relevant)

Validity and reliability of the research (if relevant)

Biases (if relevant)

Limitation of the study (if relevant)

16. Plan for supervision and monitoring

17. Plan for data management

18. Plan for data analysis

19. Expected outcome of the research

20. Plan for dissemination of research results

The research results are meant exclusively for the internal use of the organization. However, the results can be made available to any of the interested organizations working in the field of nutrition as appropriate.

21. Plan for utilization of the research findings (optional)

The baseline survey will establish a socio-cultural standard for the two VDCs and also provide baseline information prior to the project implementation on certain indicators. This baseline information will provide a ground for monitoring and evaluating the project throughout its lifecycle.

PART IV

Ethical consideration

22. Regarding the human participants:

Are human participants required in this research? If yes, offer justification.

Yes, the targeted beneficiaries of the MCHC activity are the expectant mothers and nursing mothers and the children of 6-36 months age. Therefore, the ENMs and the children of 6-36 months age are the participants for this baseline survey.

How many participants are required for the research? Explain.

A total of 268 expectant and nursing mothers and 203 children (6-36 months) in Phaparbari and Dhiyal VDCs will be reached during the survey.

What is the frequency of the participant's involvement in the research? Explain.

Each of the participants will be interviewed (ENMs and Caretakers) and weighed and measured for the height (only children) once during the survey. Likewise, a blood sample will be collected from each of the participant, both ENMs and children, during the survey. Additionally, 10 semi-directive household interviews will be conducted.

Nepal health research council, Kathmandu, Nepal

Clearly indicate the participants' responsibilities in the research. What is expected of the research participants during the research?

- Participants are expected to agree to finger prick in order to collect a drop of blood to be analysed with a HemoCues machine for determination of HB levels
- Participants are expected to attend the interviews
- Participants are expected to allow the enumerators to measure their height and weight
- Participants are expected to help the survey teams as appropriate

Are vulnerable members of the population required for this research? If yes, offer justification.

The expectant and nursing mothers and children of 6-36 months of age are the participants for this survey and supposedly the vulnerable members of the population. In order to track the achievements towards the above-mentioned objectives, some baseline information on the beneficiaries are required.

Are there any risks involved for the participants? If yes, identify clearly what are the expected risks for the human participants in the research and provide a justification for these risks.

A few drops of blood will be collected by pricking the fingers of the participants in the survey. Sterile, disposable lancets will be used for finger pricking.

Are there any benefits involved for the participants? If yes, identify clearly what are the expected benefits for the participants.

Following the survey, the MCHC activity will be implemented in these two VDCs. Upon implementation of the activity, the participants will benefit with the following:

- A take-home ration for expectant and nursing mothers (7.5 kg/month), linking food supplementation to the local health services.
- A take-home ration for children 6 months to 3 years (6 kg/month), linking food supplementation to the local health services.
- Deworming tablets for expectant women after the first trimester of pregnancy
- Mass counseling on Antenatal Natal Care, Growth Monitoring and other health and nutrition related issues through the existing local health system

23. Informed Consent Form / Ethical issues:

Statements required in the Informed Consent Form include:

A statement that the human participants can withdraw from the study at any time without giving reason and without fear. State clearly how the participants can opt out the study.

A statement guaranteeing the confidentiality of the research participants.

If required, a statement on any compensation that might be given to the research participant and/or their community.

A statement indicating that the participant has understood all the information in the consent form and is willing to volunteer/participate in the research. Signature space for the research participants, a witness, and the date.

(Informed Consent Form should be submitted in English and in the language appropriate to the research participants)

Nepal health research council, Kathmandu, Nepal

Obtaining the consent

How is informed consent obtained from the research participants?

During the survey the enumerators will get the consent from the participants.

Please indicate who is responsible for obtaining informed consent from the participants in this research study.

Enumerators

Is there anything being withheld from the research participants at the time the informed consent is being sought?

No (x) Yes ()

If yes, explain

PART V

Annexes

24. Annexes should include

- a. References,
- b. Data collection instruments including questionnaires,
- c. Information sheet and informed consent form (if relevant),
- d. List of abbreviations,

Recently updated Curriculum Vitae of principal investigator

Resources

A list of useful publications, information sources, and Web links (see reference lists at the end of chapters also).

World Health Organization Publications

Field guide on rapid nutritional assessment in emergencies. Cairo; 1995. Available at URL: <http://whqlibdoc.who.int/emro/1994-99/9290211989.pdf>.

Global database on child growth and malnutrition (standardized compilation of anthropometric data from population-based surveys around the world from 1960 onwards). Available at URL: <http://www.who.int/nutgrowthdb>.

Guidelines for the inpatient treatment of severely malnourished children. SEARO Technical Publication No. 24. Geneva: 2003. Available at URL: http://w3.whosea.org/nhd/pdf/pub24/malnourished_children.pdf.

Infant feeding in emergencies. A guide for mothers. EURO, 1997. Available at URL: <http://www.who.dk/nutrition/pdf/breastfeed.pdf>.

Iron deficiency anaemia: assessment, prevention and control - a guide for programme managers. 2001. WHO/NHD/01.3. Available at URL: http://www.who.int/nut/documents/ida_assessment_prevention_control.pdf.

Management of severe malnutrition: a manual for physicians and other senior health workers. Geneva; 1999. Available at URL: http://www.who.int/nut/documents/manage_severe_malnutrition_eng.pdf.
Physical Status: The Use and Interpretation of Anthropometry - Report of a WHO Expert Committee. WHO, Geneva. 1995

The management of nutrition in major emergencies. Geneva; 2000. Available at URL: <http://wholibdoc.who.int/publications/2000/9241545208.pdf>.

World Food Programme Publications

Food and Nutrition Handbook. Rome; 2000.

Food and Nutritional Needs in Emergencies. Rome; 2003.

Guidelines for selective feeding programmes in emergency situations (based on WHO's norms and standards). Rome; 1999. Available at URL: <http://www.unsystem.org/scn/archives/rnis26/ch7.htm>.

Nutrition Policy Papers <http://www.wfp.org/policies/Introduction/policy/>

Other Publications, Organizations, and Web Sites

Action Contre la Faim. Web site: <http://www.acf-fr.org/>.

Concern. Web site: <http://www.concern.ie/>.

Demographic and Health Surveys. Web site: <http://www.measuredhs.com>.

Food and Nutrition Technical Assistance (FANTA). Web site: <http://www.fantaproject.org>.

Institute of Child Health, London. Web site: <http://www.ich.ucl.ac.uk/>.

The Micronutrient Initiative. Web site: <http://micronutrient.org>

Save the Children. U.K. Web site: <http://www.savethechildren.org.uk>.

Save the Children. U.S. Web site: <http://www.savethechildren.org>.

Stoltzfus RJ, Dreyfuss ML. Guidelines for the use of iron supplements to prevent and treat iron deficiency anemia. Washington: International Nutritional Anemia Consultative Group; 1998. Available at URL <http://www.ilsa.org/file/guidelinesforuseofiron.pdf>.

The Sphere Project. Humanitarian charter and minimum standards in disaster response. Chapter 3: Minimum standards in nutrition. Geneva; 2004. Available at URL: http://www.sphereproject.org/handbook/hdbkpdf/hdbk_c3.pdf

Tufts University, Feinstein International Famine Center. Web site: <http://famine.tufts.edu/>.

UNICEF. Multiple Indicator Cluster Surveys. Available at URL: <http://www.childinfo.org>

United Nations Standing Committee on Nutrition (SCN). Web site: <http://www.unsystem.org/scn/>.

Valid International. A limited company specializing in improving the quality and accountability of humanitarian assistance. Web site: <http://www.validinternational.org>.

Glossary of Terms

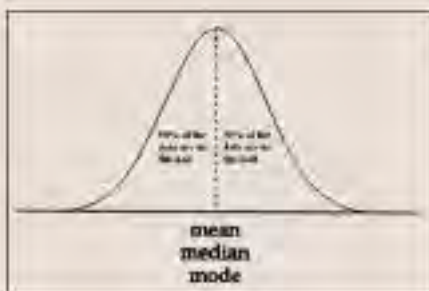
Accuracy	Indicates how close the survey estimates are to the true value. Accurate measurements are essential to obtain accurate estimates. Accuracy, contrary to precision, cannot be quantified.
Anaemia	Abnormally low hemoglobin levels; can be caused by lack of iron, folate, vitamin B12.
Anthropometry	The technique that deals with the measurements of the size, weight and proportions of the human body.
Baseline data	Baseline data represent the situation before or at the beginning of a programme or intervention. Survey data may be compared to baseline data if defined criteria for comparison are met (e.g., similar methods and coverage).
Benchmark	The prevalence of mortality rate used as a population threshold in a classification of severity of a situation.
Bias	Anything other than sampling error which causes the survey result to differ from the actual population prevalence or rate.
Body mass index (BMI)	Anthropometric measure defined as weight in kilograms divided by height in meters squared
Chronic malnutrition	Chronic malnutrition is an indicator of nutritional status over time. Chronically malnourished children are shorter (stunted) than their comparable age group.
Cluster sampling	Cluster sampling requires the division of the population into smaller geographical units, e.g., villages or neighborhoods. In a first step, usually 30 units are selected among all geographical units. In a second and sometimes third step, households are selected within the units using either simple random sampling, systematic random sampling or the EPI method.

Confidence interval	Computed interval with a given probability (e.g., 95%) that the true value of a variable (mean, proportion, rate) is contained within the interval.
Crude mortality rate or death rate (CMR/CDR)	Mortality rate from all causes of death for a population Formula: $\frac{\text{(Number of deaths during a specified period)}}{\text{(Number of persons at risk of dying during that period)}} \times \text{time period}$
Cut-off points	The point on a nutritional index used to classify or screen individuals' anthropometric status.
Design effect	Cluster sampling results in greater statistical variance (see definition below) than simple random sampling because health outcomes tend to be more similar within than between geographical units (see cluster sampling). To compensate for the resulting loss in precision, the sample size calculated for simple random sampling must be multiplied by a factor called "design effect": a measure of how evenly or unevenly the outcome (for example wasting, stunting, anaemia or mortality) is distributed in the population being sampled.
Expanded Program of Immunization (EPI) sampling method	A proximity sampling method in which households are selected according to their proximity or distance from the previously sampled household.
Fortificant	The micronutrient compound that is added to a food either singularly, or as a part of a vitamin-mineral premix.
Global acute malnutrition (GAM)	GAM includes all children suffering from moderate and severe malnutrition; percent of children under 5 who have low weight-for-height measured by -2 z-scores and with or without oedema.
Growth monitoring	Observation of child growth over time by periodic measurement of weight-for-height.
Incidence rate	The number of new events, e.g., new cases of a disease in a defined population within a specified period of time. The numerator is the number of new cases occurring during a given time period while the denominator is the population at risk.

Indicators	At the population level, it is a measure used to describe the proportion of a group below a cut-off point.
Infant mortality rate (IMR) (per 1,000)	A measure of the yearly rate of deaths in children under 12 months. This is often cited as a useful indicator of the level of health in a community; To calculate it, the number of deaths of infants under 12 months of age in a given year is divided by the total number of live births in that year multiplied by 1,000.
Iron deficiency	Shortage, insufficiency of iron in the body. Iron deficiency is one of the most common causes of anaemia.
Low birth weight	Birth weight of less than 2500 grams.
Malnutrition	State in which the physical function of an individual is impaired to the point where he or she can no longer maintain adequate bodily performance processes, such as growth, pregnancy, lactation, physical work and resisting and recovering from disease.
Mean	Measure of central location commonly called the average. It is computed by adding all the individual values in the group and dividing by the number of values in the group.
Measurement error	Measurement error may lead to two types of error: (1) random error, resulting in a larger standard deviation of Z scores for weight-for-height or other measures of malnutrition, and (2) systematic error, if measurements, on average, are biased in one direction or the other.
Median	Measure of central location which divides a set of observations into two equal parts.
Mode	The most frequently occurring value in a set of observations.
Monitoring	The systematic and continuous assessment of the progress of an intervention over time.
Morbidity	A condition related to a disease or illness

Normal distribution

The symmetrical clustering of values around a central location. The arithmetic mean, the mode and median are identical in a normal distribution.



Nutritional index (indices plural)

Derived by relating a child's measurement with the expected value of a child of the same height (or age) from the reference population.

Oedema

An accumulation of excessive fluid in extracellular fluid in the body; a distinguishing characteristic of kwashiorkor when bilateral.

Outcome

Wasting and mortality are examples of outcomes measured in surveys.

P-value

If you want to know whether there is a significant difference between two survey estimates, frequently a statistical test is applied and a P value calculated. The P value is the probability that the two estimates differ by chance or sampling error.

Percentile

The set of numbers from 0 to 100 that divide a distribution into 100 parts of equal area, or divide a set of ranked data into 100 class intervals with each interval containing 1/100 of the observations.

Precision

Indicates how similar the survey estimates are to each other if a survey is repeated over and over. Precision is decreasing with increasing sampling error (see definition). Precision or sampling error, contrary to accuracy, can be quantified (e.g., in a confidence interval).

Prevalence	Proportion of a population with a disease or condition of interest at a designated time.
Protein-energy malnutrition (PEM)	Clinical disorders of malnutrition; the two more severe nutritional outcomes are marasmus and kwashiorkor.
Recall period	A defined period in the past used to calculate mortality rates.
Reference population	The WHO/NCHS/CDC reference values are based on two large surveys of healthy children, whose measurements represent an international reference for deriving an individual's anthropometric status.
Sample	A part of the sampling universe that should be selected at random to guarantee a sample representative of the sampling universe (see definition below).
Sampling error	Sampling error is the degree to which a sample might differ from the whole target population, e.g., how well it represents a target population or sampling universe (see definition). Sampling error can be quantified (e.g., in a confidence interval).
Sampling frame	The list of all the sampling units from which you choose the sample.
Sampling interval	The sampling interval is the total number of sampling units in the population divided by the desired sample size.
Sample size	The size of the sample calculated based on objectives of the survey and statistical considerations.
Sampling unit	The unit that is selected during the process of sampling; depending on the sampling process, the sampling unit can be a person, household, district, etc.
Sampling universe	The entire group of sampling units who are eligible to be included in the survey sample; this population should match the population for which you are trying to estimate the outcomes measured in the survey (e.g., all children under 5 years old).

Severe acute malnutrition (SAM)	SAM includes all children suffering from severe malnutrition; percent of children under 5 who have low weight-for-height measured by -3 Z-scores and with or without oedema.
Simple random sampling	The process in which each sampling unit is selected at random one at a time from a list of all the sampling units in the population.
Standard deviation	A measure of dispersion or variation. It is the most widely used measure of dispersion of a frequency distribution. It is equal to the positive square root of the variance. The standard deviation is a summary of how widely dispersed the values are around the center mean.
Standard error	Standard error is a measure of sampling error or precision, however, the most common method used when presenting survey results is confidence intervals.
Stunting (chronic malnutrition)	Growth failure in a child that occurs over a slow cumulative process as a result of inadequate nutrition and/or repeated infections; measured by the height-for-age index. Stunted children are short for their age and may look younger than their actual age; it is not possible to reverse stunting.
Surveillance	Surveillance is a regular and continuous collection of information for use in analysis, interpretation and decision-making about actions or policies in question.
Survey	An assessment of health and nutrition outcomes that requires a random sampling process. Surveys are cross-sectional because results are representative only for the day of survey or (for mortality) during the recall period.
Systematic random sampling (SRS)	A methodology which selects a sampling unit at random, then selects every n th household thereafter, where " n " equals the sampling interval.
Vulnerable groups	Categories of people who are at heightened risk; common vulnerable groups are women, children, elderly and displaced peoples.
Wasting (acute malnutrition)	Growth failure as a result of recent rapid weight loss or failure to gain weight; wasting is measured by the weight-for-height index. Wasted children are extremely thin; readily reversible once conditions improve.

Under-five mortality rate (U5MR)	<p>Probability of dying between birth and exactly five years of age expressed per 1,000 live births; or the (number of deaths among children under five years divided by the number of children under 5 in that population) X 1,000.</p> <p>U5MR is a critical indicator of the well-being of children.</p>
Underweight	<p>Percentage of children under the age of five with weight-for-age below -2SD from median weight-for-age of reference population.</p>
Variance	<p>A measure of the dispersion of an outcome in a sample. A higher variance for the same outcome in cluster sampling than simple random sampling reduces the precision of the measured outcome (see design effect).</p>
Wasting (acute malnutrition)	<p>Percentage of children under the age of five suffering from moderate or severe wasting (below -2SD from median weight-for-height of reference population).</p>
Z-score	<p>Score expressed as a deviation from the mean value in terms of standard deviation units; the term is used in analysing continuous variables such as heights and weights of a sample.</p>

Q & A Sheet

1. Q: Is mid-upper arm circumference (MUAC) acceptable as an indicator of nutritional status in our survey?

A: No. We do not recommend that MUAC be used to measure the prevalence of malnutrition in young children in a population. MUAC is more suitable as a screening tool for determining admission to supplementary feeding programs and for rapid assessments. If you are working with a partner agency that requires that MUAC be included in a population-based nutrition survey of children, it is essential that weight-for-height indices are also included. WFP should use weight-for-height instead of MUAC to measure acute malnutrition in children. (Refer to Common Mistake #3 for more information)

2. Q: How do I measure nutritional status of pregnant women?

A: Pregnant women are often targeted by WFP's mother and child nutrition programs because of their additional nutritional needs. As a result, WFP seeks to measure the nutritional outcomes associated with these programs.

During pregnancy, women experience significant weight gain, particularly during the second and third trimesters. Unfortunately, the variable nature of this weight gain and the difficulty of establishing gestational age, means that body mass index (weight in kilograms/height in meters²) alone is not an appropriate indicator to use for assessing the nutritional status of pregnant women.

The proportion of newborns with low birth weight (<2.5 kg) is currently being piloted as one of the strategic objective indicators associated with MCHN programs reaching pregnant women. Although many factors can lead to a baby being born with low birth weight, mother's under-nutrition is a major cause, particularly in developing countries. As such, this indicator is a good proxy indicator for women's nutritional status during pregnancy. However, it should be noted that this indicator is best collected through programme monitoring rather than through population-based surveys due to reporting bias. For programmes providing fortified foods (such as CSB/WFSB) or iron supplements, the prevalence of iron deficiency anaemia is another indicator that is being piloted by WFP.

In population-based surveys, mid-upper arm circumference is sometimes used to assess the nutritional status of pregnant women because it is relatively stable during pregnancy. However, the disadvantages are: (1) it is less responsive than weight to short term changes in food consumption or health status; (2) if collected through surveys it can be difficult to get a sufficient sample size to get a reliable estimate; and (3) different cut-offs are used by different organizations to define who is "malnourished" (18.5 cm and 22.5 cm are often used). In situations where weight gain is measured over time and gestational age is estimated, it is conceivable that the percentage of women who gain weight at or above expected weight gain rates could be used as an indicator. However, such settings are rather unusual for WFP to work in.

3. Q: What indicators can I use to assess the nutritional status of lactating women?

A: Following childbirth, women still retain additional weight, which is often lost over the course of the few months following delivery. The amount and rate of weight loss during lactation depends on many factors, including the woman's nutritional status prior to pregnancy, the amount of weight gained during pregnancy and whether or not the woman is breastfeeding. Unfortunately, little published data exist on the rate of post-partum weight loss in developing country populations. In absence of guidance from technical agencies on whether or not body mass index is a reliable indicator of the nutritional status of lactating women, WFP is piloting the prevalence of lactating women with BMI<18.5 as an outcome indicator for WFP's MCHN programs. Other outcome indicators, such as the prevalence of women who are exclusively breastfeeding, are sometimes used as well.

4. Q: Are there any cut-off points for the prevalence of low body mass index which indicate that an emergency situation exists?

A: No. To date, WHO has published guidance to help interpret the situation based on the prevalence of various indicators of child under-nutrition. Information on adult body mass index, however, is increasingly collected through nutrition surveys.

5. Q: Do I always have to use 30 x 30 cluster survey?

A: No. Cluster surveys should be carried out in large, geographically dispersed populations where no accurate list of households is available and where households cannot be visited systematically. If the need for a cluster survey methodology is established, do not automatically plan on doing a cluster survey of 900 basic sampling units in a 30 cluster by 30 unit formation. You should calculate the sample size which provides the desired statistical precision and use this sample size to determine the size of your clusters. (Refer to common mistake #6 for more information).

6. Q: Is the design effect of a cluster survey always 2?

A: No. The design effect is a measure of how evenly or unevenly an outcome is distributed in the population. Therefore, the design effect varies from survey population to survey population, and differs depending on the outcome of interest. For example, the design effect for malnutrition is usually in the range of 1.5-2.0, although it can be higher if there is reason to believe that the malnutrition outcome of interest is distributed unevenly in the population (for example, higher levels of wasting in the lowlands included in the survey sample compared with that of the highlands). Some outcomes, such as mortality, can be quite different in different parts of the population and, as a result, their design effects can be quite high. The best source for estimates of design effect are prior surveys done in the same or similar populations. (See page 70 for more information.)

7. Q: Should I present results using percentage of the median or Z-scores?

A: Z-scores are the standard and the preferred mode of presenting anthropometric indicators in nutrition surveys. Percentage of the median can be presented in addition to Z-scores in the survey report if there is a specific need for this alternative expression (such as when results will be used as a programmatic tool in selective feeding programs).

8. Q: Can I use clinic data to measure and report on the prevalence of malnutrition in a population?

A: No. These data are not truly representative of the population of interest because they are a self-selected and potentially biased sample. The principle of random probability selection is not implemented when clinic data is collected; therefore, clinic data do not give an accurate estimate of the prevalence of malnutrition in the larger population.

9. Q: Can I report UNICEF's figure for under-5 mortality from the State of the World's Children as the "base" rate against which to compare changes in mortality due to emergencies?

A: The UNICEF under-5 mortality rate and the age-specific mortality rate for children under 5 years of age are very different measures of mortality and should not be confused or compared. An age-specific mortality rate is expressed as the number of deaths in an age group divided by the number of individuals in that age group who are at risk of death. For example, if the age-specific death rate for children under 5 years of age is 35 deaths per 1,000 children under 5 per year, this means that, in a population of 1,000 children, 35 will be expected to die over the course of one year. This is a true mortality rate because it is expressed as the number of deaths per the number of people at risk of death over a certain time period.

The UNICEF under-5 mortality rate is expressed as the number of children who die before their fifth birthday per 1,000 live births. It tells you how many children who are born alive will die before their fifth birthday. This gives the risk during the entire five years between birth and the fifth birthday. As a result, it is usually almost five times higher than an annual age-specific mortality rate for children under 5. However, because the UNICEF under-5 mortality rate is based on live births and not the actual population of children under 5 years of age, even dividing the UNICEF rate by 5 cannot provide a direct comparison.

For example, Ethiopia has an under-5 mortality rate of 169 per 1,000 live births - that is, the expected rate of death relative to a rate of live births. That is very different from a survey-derived mortality rate which reflects an absolute number (per 10,000 per day).

See page 40 in the manual for additional explanation.

10. Q: Can I use the same reference population for all populations, regardless of race or ethnicity?

A: Different studies carried out on children have shown that up to the age of 5, growth in children of different populations is very similar (Habicht, 1974). The difference in growth becomes apparent on the onset of adolescence; therefore it is commonly agreed that the same reference population can be used for all populations.

11. Q: If my nutrition baseline results were calculated using the NCHS/CDC/WHO reference population, should my follow-up survey use the NCHS/CDC/WHO reference or the new WHO 2005 reference population?

A: If the primary purpose of the second, or follow-up, survey is to measure the difference in prevalence between the baseline and the follow-up, then it is essential that the same reference population be used to calculate results. Therefore, if the 1977 reference was used in the baseline survey,

the 1977 reference should be used to calculate the results for the follow-up survey as well. Alternately, the data from the baseline survey could be re-analysed using the new WHO reference population. Then the data from the follow-up survey could be analysed using this new reference and compared to the baseline.

12. Q: I collected data on nutritional status through a VAM “Baseline” (situation analysis). Is this sample adequate for measuring outcomes of MCH programs?

A: Typically, it is not. Although VAM situation analyses are intended to reflect the situation of the overall sampled area prior to programme implementation, the sample is typically not large enough to be able to represent specific working areas of nutrition programmes. As such, unless other information exists on the baseline prevalence of key nutritional indicators, a separate baseline survey is usually required.

13. Q: Is it still necessary to collect monitoring data on beneficiary outcomes for MCHN programmes if we are planning to do baseline and follow-up surveys of the overall population?

A: Absolutely. Population-based surveys provide a critical role in assessing the extent to which food interventions have achieved outcomes in the general population where those interventions are operating. Nonetheless, indicators collected through programme monitoring play an even more important role, because: (1) they are collected more frequently and can therefore be used for rapid decision-making and fine-tuning the programme, and (2) they provide an insight on what is happening to those who are receiving the intervention (in contrast to population-based surveys which normally collect information from beneficiaries and non-beneficiaries living in the same area). Examples of monitoring information include beneficiary numbers, regularity of receipt of programme services (including food), as well as outcome indicators specific to beneficiaries (such as recovery rates or dropout rates for beneficiaries enrolled in supplementary or therapeutic feeding programmes).

Monitoring information plays an essential role in interpreting changes in nutritional status (or lack of change) observed at a population level. If positive changes are observed, monitoring information can be used to help determine if the programme was responsible for this improvement and, if it was, why the programme was effective. Such information can help to build a case for expansion of the programme. If no change was observed or if the situation deteriorated over time, information from monitoring can help to explain why (for example, was it due to low coverage or was it due to a lack of inputs?).

14. Q: I have data on crude mortality rates from refugee camps collected through surveillance. Is this acceptable for corporate reporting?

A: Generally, yes. Many camps, particularly well-established ones, have quite reliable mortality surveillance systems, which may even provide more accurate information about mortality than retrospective surveys. Regardless, mortality rates from routine surveillance systems can be subject to many biases, the most important of which is incomplete reporting of deaths. Never accept such data at face value; you should always try to get some idea if death reporting is complete, if the population estimate used to calculate the mortality rates is accurate, etc.

15. Q: Can I understand the causality of malnutrition from a cross-sectional survey?

A: Results from a nutrition survey, in combination with complementary information, can help interpret potential causes of malnutrition. However, survey results cannot establish definitive causality; results must be interpreted in context and with caution (see chapter 4, step 4 onwards).

16. Q: Where can I learn about how to use nutrition information in the context of emergency needs assessments (ENA) or vulnerability analysis and mapping (VAM)?

A: Analysis of the nutritional situation plays a critical role in the process of needs assessments, both in emergency settings and in development contexts. Guidance on how to use nutritional information in the context of emergency needs assessment is available in chapter 6 of the WFP Emergency Food Security Assessment Handbook (available at <http://home.wfp.org/oen/EFSA/EFSALIndex.htm>). VAM has also developed thematic guidelines related to Nutrition and Health which are available at http://vam.wfp.org/main/them_guid.jsp.

17. Q: Should we collect information about causes of death as part of a mortality survey in an emergency?

A: If data on the causes of death are unavailable from other sources, this information can be collected during a cross-sectional survey, but the questions should probably be limited to those on injury/trauma and other causes of mortality that are well known and/or that have local terms. (See page 49 for more details.)

18. Q: Can nutrition surveys be used to collect mortality data?

A: Yes, but the nutrition survey should be explicitly designed and conducted with attention to this additional objective. Sample size should be calculated including mortality as one of the multiple outcomes (see page 70). Additionally, in order to correctly estimate mortality, the sample selected for the survey should be representative of all households in the population. Mortality information should not be collected from a sample which only contains households which have a child under 5 years of age (see common mistake #9).

19. Q: Where can I get assistance identifying a consultant to help me do a survey?

A: Often there are specialized technical agencies (international or national NGOs, UNICEF, MOH, etc.) in the country of operation that can provide you with support or collaborate to design and conduct the survey in partnership. If this is not available or is not sufficient, please contact nutrition@wfp.org for further support.

