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COMPARATIVE STUDIES 12

CHILDREN'S NUTRITIONAL STATUS

DHS Demographic and Health Surveys

MACRO INTERNATIONAL INC

The Demographic and Health Surveys (DHS) is a 13-year project to assist government and private agencies in developing countries to conduct national sample surveys on population and maternal and child health. Funded primarily by the United States Agency for International Development (USAID), DHS is administered by Macro International Inc. in Columbia, Maryland.

The main objectives of the DHS program are (1) to promote widespread dissemination and utilization of DHS data among policymakers, (2) to expand the international population and health database, (3) to advance survey methodology, and (4) to develop in participating countries the skills and resources necessary to conduct high-quality demographic and health surveys.

For information about the Demographic and Health Surveys program, write to DHS, Macro International Inc., 11785 Beltsville Drive, Suite 300, Calverton, MD 20705, U.S.A. (Telephone 301-572-0200; Telefax 301-572-0999).

Demographic and Health Surveys
Comparative Studies No. 12

Children's Nutritional Status

A. ELISABETH SOMMERFELT
M. KATHRYN STEWART

Macro International, Inc.
Calverton, Maryland USA

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Preface

One of the most significant contributions of the DHS program is the creation of an internationally comparable body of data on the demographic and health characteristics of populations in developing countries. The *DHS Comparative Studies* series examines these data across countries in a comparative framework, focusing on specific topics.

The objectives of the *DHS Comparative Studies* are: to describe similarities and differences between countries and regions, to highlight subgroups with specific needs, to provide information for policy formulation at the international level, and to examine individual country results in an international context. The comparative analysis of DHS data is carried out primarily by staff at the DHS headquarters in Calverton, Maryland. The topics covered in the series are selected by DHS staff in conjunction with the DHS Scientific Advisory Committee and USAID.

The reports in this series are based on a variable number of data sets that generally represent those countries for which data sets were available at the time the report was prepared. Each report provides detailed tables and graphs for countries in four regions: sub-Saharan Africa, Near East/North Africa, Asia, and Latin America/Caribbean. Survey-related issues such as questionnaire comparability, survey procedures, data quality, and methodological approaches are addressed in each report, as necessary. Where appropriate, data from previous survey programs, primarily the World Fertility Survey and the Contraceptive Prevalence Surveys, are used to evaluate trends over time.

As more surveys are conducted under the DHS program and additional data sets become available, some of the reports published early in the series will be updated.

It is hoped that the availability of comparable information for a large number of developing countries will have long-term usefulness for analysts and policymakers in the fields of international population and health.

Martin Vaessen
Project Director

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1 Introduction

Nutritional, or anthropometric, status is an objective indicator of children's overall health and nutrition. Childhood undernutrition results from the synergistic effects of repeated, improperly treated illnesses and inadequate food intake. Undernourished children are at greater risk of dying than well-nourished children (Pelletier et al., 1993). Periodic assessment of the nutritional status of young children in a population, combined with knowledge of the mortality rate in this age group can reveal changes in general health and nutrition.

Socioeconomic differences are related to differences in the nutritional status of young children. The types of water supply and sanitation facilities influence children's growth (Esrey et al., 1988). Insufficient dietary intake as well as repeated infectious illnesses, especially diarrhea, adversely affect growth, and seasonal patterns have been described (Brown et al., 1982). Studies have shown that under optimal conditions young children from diverse ethnic and geographic backgrounds follow similar growth patterns (Habicht et al., 1974; Martorell and Habicht, 1986). Since the nutritional status of young children is primarily influenced by external factors and does not reflect ethnic differences, cross-national comparisons of nutritional, or anthropometric, status can be made.

The Demographic and Health Surveys (DHS) program, funded by the United States Agency for International Development, helps developing countries implement nationally representative surveys. The surveys provide information for program planning, decision making, and scientific research. During the first phase of the program (DHS-I), carried out from 1984 to 1989, surveys in 29 developing countries collected information on fertility levels, trends, and preferences; knowledge and use of family planning methods; infant and child mortality rates; and maternal and child health. In 19 of these surveys, the height and weight of respondents' young children were measured allowing an assessment of their nutritional status. During the second five-year phase of the program (DHS-II), which began in 1989, surveys were carried out in 22 countries. This report covers all DHS-I surveys that collected data on nutritional status.

Since DHS samples are nationally representative, it is possible to derive population-based estimates of the degree of undernutrition among children in each of the countries surveyed. The only two exceptions are the surveys in Nigeria, which was limited to a single state (Ondo State), and in Brazil, where height and weight measurements were obtained only for children in one region. Since the sample sizes are generally quite large, it is possible to analyze differentials in nutritional status according to demographic, socioeconomic, and some health-related characteristics.

This report describes the nutritional status in each of the countries surveyed, as well as differentials in the levels of undernutrition by selected demographic, socioeconomic, and health-related characteristics. Only findings based on anthropometric indices derived from the measurement of children's height and weight will be presented in this report. Information was not collected on other aspects of malnutrition, such as micronutrient deficiencies. Breastfeeding and infant feeding practices are discussed in another report.

2 Methods and Data

2.1 SAMPLE OF CHILDREN

The DHS program is based on cross-sectional surveys of women of reproductive age at the household level, with interviews conducted by trained interviewers who are proficient in the respondent's language or dialect. The sample comprises all women age 15-49 in the selected households, regardless of their marital status, except for surveys in North Africa and Asia, which limited respondents to ever-married women.[1] All of the DHS respondents' children born during a specified time period were eligible for height and weight measurement. The exceptions were three countries where all children of only a subsample of respondents were selected for anthropometric assessment. In Egypt, children from half the households were measured; in Senegal, children of one-third of the respondents were measured; and in Brazil, measurements were taken only in the Northeast, the least developed region of the country. The survey in Ondo State, Nigeria also does not provide national data; there, however, the children of all survey respondents were eligible for height and weight measurements. The first DHS survey, in El Salvador, functioned as a pretest for the anthropometric assessment, measuring the heights and weights of a small group of children.

The age group of the children selected for anthropometric assessment varied somewhat from country to country. The standard DHS-I recommendation was to measure all children 3-36 months of age, and 11 of the 19 surveys followed this guideline (see Table 2.1). Three of the earliest surveys, however, limited measurements to children age 6-36 months (Dominican Republic, Ondo State/Nigeria, and Senegal), while five other surveys measured a wider age group than was standard. Measurements were made of children from birth to age 60 months in Northeast Brazil, Morocco, and Uganda; from birth to 36 months in Togo; and from 6 to 60 months in Zimbabwe. DHS-II surveys measure height and weight for children from birth through age 60 months. For the sake of comparability, the analyses here cover children age 3-35 months (6-35 months in the Dominican Republic, Ondo State Nigeria, and Senegal) unless otherwise specified.

DHS surveys use either self-weighted samples or, when necessary, some areas are over-sampled to ensure a sufficient number of respondents to obtain reliable estimates. The analyses in this report use the weighted data. The number of respondents to each survey ranges from about 3,000 to 9,000; the number of children age 3-35 months whose anthropometric measurements are analyzed in this report ranges from 571 to 2,523.

[1]In Brazil and Guatemala the respondents were women 15-44 years of age.

2.2 EQUIPMENT AND TRAINING OF MEASURERS

The selection of measurers varied in different regions. The typical approach in Francophone African countries was to train all interviewers to take measurements. In Anglophone Africa and in Asia, two team members were usually designated to measure the children. In most Latin American and Caribbean countries, the supervisor and field editor on each team were trained to take the measurements, while the interviewers served as assistants.

Training followed the guidelines in the United Nations manual, *How to Weigh and Measure Children* (United Nations, 1986). It included both classroom instruction and field practice and was conducted either by a specialist from DHS or by local personnel with expertise in the area of nutrition. A quality control test was usually administered at the end of the training period to ensure the proficiency of the trainees. In some countries, a second test was conducted halfway through the survey.

A hanging spring-balance weighing scale was used to weigh the children, and the measurers were taught to read the weight to 100 grams. An adjustable wooden measuring board was used for height (or length) measurements, and measurers were instructed to read the measurement to the nearest 0.1 centimeters. It is recommended that recumbent length be measured for children under 24 months of age and standing height for older children. Most surveys that included anthropometric measurements through 36 months of age, however, measured recumbent length for all children. Since there is a systematic difference between recumbent length and standing height, one centimeter was subtracted from the stature of children 24 months and older who were measured lying down. This was done during computer data editing. The term "height" is used in this report to refer to both standing height and recumbent length.

2.3 NUTRITIONAL STATUS INDICES AND INDICATORS OF UNDERNUTRITION

Because children's height and weight change with age, the World Health Organization (WHO) recommends that height and weight be related to age and that weight be related to height, taking the sex of the child into consideration (WHO Working Group, 1986). The weight-for-age, height-for-age, and weight-for-height indices are expressed as Z-scores from the median of the International Reference Population[2] as recommended by WHO. The data

[2]The International Reference Population recommended by the World Health Organization (WHO) was developed by the U.S. Centers for Disease Control (CDC), based on data from the National Center for Health Statistics (NCHS).

Table 2.1 Anthromponetry in DHS surveys

Summary of anthropometry in DHS surveys, Demographic and Health Surveys, 1985-1990

Country	Year of survey	Anthro-pometry included	Age group (in months)	Sample of children	Number of eligible children	Percent of eligible children with unknown month and year of birth
SUB-SAHARAN AFRICA						
Botswana	1988	No	NA	NA	NA	NA
Burundi	1987	Yes	3-36	National	2102	2.1
Ghana	1988	Yes	3-36	National	2205	6.9
Kenya	1988/89	No	NA	NA	NA	NA
Liberia	1986	No	NA	NA	NA	NA
Mali	1987	Yes	3-36	National	1687	40.2
Ondo State, Nigeria	1986/87	Yes	6-36	State	1504	0.0
Senegal[1]	1986	Yes	6-36	1/3	640	2.0
Sudan	1989/90	No	NA	NA	NA	NA
Togo	1988	Yes	0-36	National	1782	16.3
Uganda	1988/89	Yes	0-60	National	4442	0.0
Zimbabwe	1988/89	Yes	3-60	National	3098	0.1
NEAR EAST/ NORTH AFRICA						
Egypt	1988/89	Yes	3-36	1/2	2290	7.6
Morocco	1987	Yes	0-60	National	5693	19.9
Tunisia	1988	Yes	3-36	National	2405	1.2
ASIA						
Indonesia	1987	No	NA	NA	NA	NA
Sri Lanka	1987	Yes	3-36	National	2188	0.2
Thailand	1987	Yes	3-36	National	2013	1.6
LATIN AMERICA/ CARIBBEAN						
Bolivia	1989	Yes	3-36	National	3050	0.1
Brazil	1986	Yes	0-60	N.E. region	1215	0.4
Colombia	1986	Yes	3-36	National	1498	0.4
Dominican Republic	1986	Yes	6-36	National	2166	0.1
Ecudaor	1987	No	NA	NA	NA	NA
El Salvador	1985	No	NA	NA	NA	NA
Guatemala	1987	Yes	3-36	National	2437	0.2
Mexico	1987	No	NA	NA	NA	NA
Peru	1986	No	NA	NA	NA	NA
Trinidad and Tobago	1987	Yes	3-36	National	1072	0.0

NA = Not applicable
[1]Only children actually measured for height and weight are identified in the data file.

from the International Reference Population have been normalized to produce a distribution where the mean and the median coincide. A Z-score is the number of standard deviation units that the child's measurement deviates from the reference population median for that age. In the case of the weight-for-height index, the weight is related to the median weight for a given height. In the reference population, 2.3 percent of the children have a Z-score below minus two (-2) standard deviations (SD) from the median. Only 0.1 percent of children have a Z-score below -3 SD from the median. The use of the International Reference Population allows comparison of the nutritional status of children of different ages and makes it possible to monitor secular trends as well as differences within and among countries.

Each of the three indices, height-for-age, weight-for-age, and weight-for-height, represents a different aspect of a child's anthro-

pometric status. The height-for-age Z-score reflects a child's stature in relation to his or her age. A low score is evidence of chronic undernutrition, in which past insults and deficiencies have caused short stature. The weight-for-height Z-score indicates how thin or fat a child is, and a low score reflects acute problems. The weight-for-age Z-score reflects a child's total body mass. It is a composite of both the height-for-age and weight-for-height indices, and a low score may result if a child is either short or thin.

To describe the extent of undernutrition in a population, three indicators are used; each corresponds to one of the indices just described (Beaton et al., 1990). These indicators are expressed as the percentage of children whose Z-score falls below a defined cut-off point, -2 SD from the median of the reference population. Children whose height-for-age Z-scores are below this cut-off point are considered short for their age. The proportion of children who fall into this category reflects the degree of stunting in a population; sometimes these children are referred to as *stunted*. It should be kept in mind, however, that even a child whose Z-score is above this arbitrary cut-off point may not have reached his or her full potential for height and may be shorter than he or she would have been under optimal conditions. The proportion of children whose weight-for-height Z-score is below the cut-off point is an indication of the extent of wasting in a population of children. These children are too thin for their height and are sometimes called *wasted*. Children whose weight-for-age Z-score is below the cut-off point are termed *underweight*.

In most developing countries, these indicators underestimate the percentage of children who are undernourished, because many of the children whose Z-scores are above the cut-off point would have been better nourished if they had lived under better circumstances, that is, their Z-scores would have been higher. Hence, although a small fraction of children in the International Reference Population have Z-scores below the cut-off point, there is no need to subtract this percentage from the estimates. The expected 2.3 percent below the cut-off point in the International Reference Population should, however, be kept in mind when there is a very low percentage of Z-scores below the cut-off point among the surveyed children. This is often the case for the wasting indicator.

Since Z-scores are interval level variables, their mean values are summary measures that describe the nutritional status of a group of children. Take, for example, children's height-for-weight Z-scores. If the mean Z-score in Country X is -1.5, stunting is a major problem. The mean and median Z-scores for the International Reference Population are zero, so the mean score for Country X children corresponds to a height-for-age Z-score which is 1.5 standard deviation units below the International Reference Population median and mean. Only about 6 percent of children in the reference population score below -1.5, compared to half the children in Country X.

The child's age is a necessary component of two of the three anthropometric indices; only the weight-for-height Z-score can be calculated independently of the child's age. In DHS surveys, the child's age was derived from the mother's report of the child's month and year of birth and the date of the interview. If information about either the month or year was missing, a date of birth was imputed by a computer program, assigning a likely birth date to the child. Only children whose mothers reported a month and year of birth are included in the analyses in this report unless otherwise specified.

The middle, or median, value across the countries surveyed is shown in the tables as an aid in examining the findings. These median figures should not be viewed as representative of global values. The terms *anthropometric* and *nutritional* status are used interchangeably in this report. Undernutrition refers to all three indicators: stunting, wasting, and underweight. The term *any undernutrition* refers to a child who, based on one or more of the three anthropometric indices, is classified as stunted, wasted, and/or underweight.

3 Data Quality

There are several issues regarding data quality that might affect the interpretation of anthropometric findings. It is important to know whether the children who were measured are representative of the larger population, whether the height and weight measurements are accurate, and whether the age information is reliable. A more extensive analysis of the quality of the DHS-I anthropometric data can be found in Sommerfelt and Boerma (1993). Their main findings will be summarized briefly here.

The proportion of eligible children whose height and weight were actually measured ranges from 79 percent in Trinidad and Tobago to 98 percent in Morocco. Over 90 percent of eligible children were measured in 11 of the surveys. Both measurements were obtained for almost all of these children. Children reported as not living with their mother or "fostered out" are unlikely to have been measured. Children whose mother was a visitor are somewhat less likely to have been measured than children who lived with their mother and whose mother was a regular household resident. Missing values are also more common among older children, in part because of fostering practices. In about two-thirds of the countries, there is also a trend toward more missing data for the next-to-youngest living child than for the youngest living child. Finally, the percentage of children not measured is almost always higher in urban than in rural areas.

Several possible biases in reporting the child's birth date (from which age is calculated) may affect the anthropometry results. These include incomplete reporting of the birth date, field imputation by the interviewer, inaccurate reporting of the birth date (e.g., heaping on preferred digits such as 12 or 24 months), and systematic over- and underreporting. Heaping on preferred digits was not a major problem. An evaluation of the reporting of the child's month and year of birth by Bicego and Boerma (1993a) discusses some of the misreporting of birth dates seen in countries where birth dates are often unknown, primarily in Africa.

Table 2.1 shows the proportion of children eligible for anthropometric measurement for whom the interviewer did *not* record a month and year of birth. Almost identical percentages were found for children whose measurements were actually obtained (data not shown). Birth date information is missing for a large proportion of children in only three countries: Mali (40 percent), Morocco (20 percent), and Togo (16 percent). In these three countries, information on the date of birth is more likely to be missing for children from rural areas and for children whose mothers had no formal education. In Ghana and Egypt, the month and year of birth is not reported for 5 to 10 percent of the children, and in the remaining 14 countries, birth date information is missing for no more than 2 percent of children. These low figures may be deceptive, however, since the mother's reporting may not have been accurate or the interviewer may have imputed a date.

A systematic bias in reading or recording the height and weight measurements is also possible. While it is difficult to assess the accuracy of the recorded measurements, height and weight data can be examined to determine the extent of digit preference, e.g, heaping on the commonly preferred decimals .0 and .5. In most surveys, heaping is not a problem. If no heaping occurs, about 20 percent of measurements should end in .0 or .5. Little, or no, heaping is seen for the weight readings; the median across all countries is 25 percent. Heaping is most evident in Tunisia and Morocco, where about 38 percent of weight readings end with .0 or .5. Height measurements show somewhat more evidence of heaping, with a median of 31 percent of the readings ending in .0 or .5. The problem is worst in the Dominican Republic, where more than four times as many as the expected number of readings end in .0 or .5 (85 percent).

Improbably high or low Z-scores were flagged, following the guidelines provided by the CDC. These extremely improbable Z-scores could have resulted either from mistakes in measurement, in recording, or in determining age. The percentage of scores flagged is similar for all three indices in each country. Less than 1 percent of the indices were flagged in about half the countries. Guatemala shows the highest percentage of flagged scores (4 percent). Children with a flagged Z-score for any of the indices are excluded from the analyses in this report.

4 Findings

4.1 OVERALL LEVELS OF UNDERNUTRITION

The surveys found high levels of undernutrition in all the countries, with the exception of Trinidad and Tobago (see Table 4.1). In 17 of the 19 countries, more than 20 percent of the children are stunted (in other words, too short), and the median level of stunting across all countries is 29 percent. The prevalence of stunting in sub-Saharan Africa ranges from 23 percent in Senegal to 47 percent in Burundi. In the North African and Asian countries surveyed, the prevalence ranges from 20 to 30 percent, with the exception of Tunisia where only 18 percent of the children are classified as stunted. Aside from Trinidad and Tobago, where only 5 percent of children are stunted, stunting levels in Latin America and the Caribbean range from 21 percent in the Dominican Republic to 58 percent in Guatemala.

The level of wasting, that is, the percentage of children classified as being too thin, is 5 percent or higher in eight of the countries surveyed, with the highest levels of wasting (12 percent) observed in Sri Lanka and Mali. In another eight countries, 2.3 percent or fewer of the children are wasted. This proportion is comparable to that in the reference population where, by definition, 2.3 percent of the children fall below the cut-off point of -2 SD units. As already noted, information on month and year of birth is missing for many children in Mali. The younger the child, the more likely the mother is to know the month and year of birth. Since wasting levels generally decrease in the third year of life, the proportion classified as wasted in Mali is somewhat higher than would be expected if age reporting was better.

Underweight reflects both stunting and wasting. In most countries, somewhat fewer children are classified as underweight than as stunted. Where the prevalence of wasting is low, the difference between the levels of stunting and underweight is greater. However, in countries where wasting is common, notably Sri Lanka and Mali, the percentage of children classified as underweight exceeds the percentage classified as stunted.

Waterlow and colleagues (1977) have suggested that height-for-age and weight-for-height Z-scores be cross-tabulated in order to further characterize children's nutritional status. Table 4.2 represents a modification of this approach. Column 3 shows the proportion of children who are both stunted and wasted, that is, who show evidence of both chronic and acute undernutrition. This level ranges from less than 1 percent to highs of 4 to 5 percent in Sri Lanka and Mali. In these two countries, an additional 7 to 8 percent of children are wasted but not stunted. With the exception of Trinidad and Tobago, the proportion of children who are stunted but not wasted ranges from 18 to 57 percent. The proportion of children who are underweight, but neither stunted nor wasted, ranges from 1 to 9 percent.

Table 4.1 Undernutrition among young children

Percentage of children age 3-35 months who are stunted, wasted, or underweight, Demographic and Health Surveys, 1986-1989

Country	Percentage of children classified as: Stunted	Wasted	Underweight	Number of children
SUB-SAHARAN AFRICA				
Burundi	47.4	5.7	37.5	1889
Ghana	29.4	8.0	30.3	1795
Mali	23.8	11.5	30.6	909
Ondo State, Nigeria[1]	32.2	6.2	27.4	1346
Senegal[1]	23.0	5.8	22.0	618
Togo	31.0	5.7	26.1	1281
Uganda	43.8	2.2	25.1	2327
Zimbabwe	29.8	1.2	12.6	1496
NEAR EAST/ NORTH AFRICA				
Egypt	30.9	1.1	13.4	1885
Morocco	23.7	3.7	14.0	2523
Tunisia	17.9	3.0	10.3	1970
ASIA				
Sri Lanka	27.2	11.6	37.3	1962
Thailand	21.5	5.3	25.3	1808
LATIN AMERICA/ CARIBBEAN				
Bolivia	37.7	1.6	13.2	2512
Brazil (NE)	29.3	1.1	14.1	571
Colombia	25.3	1.3	12.0	1301
Dominican Republic[1]	20.6	2.3	12.4	1768
Guatemala	57.7	1.3	33.2	2207
Trinidad and Tobago	4.8	3.8	6.5	817
Median	29.3	3.7	22.0	

Note: Children are classified as stunted, wasted, or underweight if their height for-age, weight-for-height, or weight-for-age Z-score is below -2 SD from the median of the International Reference Population (WHO/CDC/NCHS).
[1]6-35 months

4.2 PATTERNS OF UNDERNUTRITION

Figure 4.1 illustrates three patterns of undernutrition. While these patterns clearly represent a continuum, countries can be classified without much difficulty as falling into one of the three patterns. Global differences in the pattern of undernutrition have also been described (Victora, 1992).

Table 4.2 Combinations of indicators of undernutrition among young children

Percentage of children age 3-35 months with different combinations of undernutrition (stunted, wasted, or underweight), Demographic and Health Surveys 1986-1989

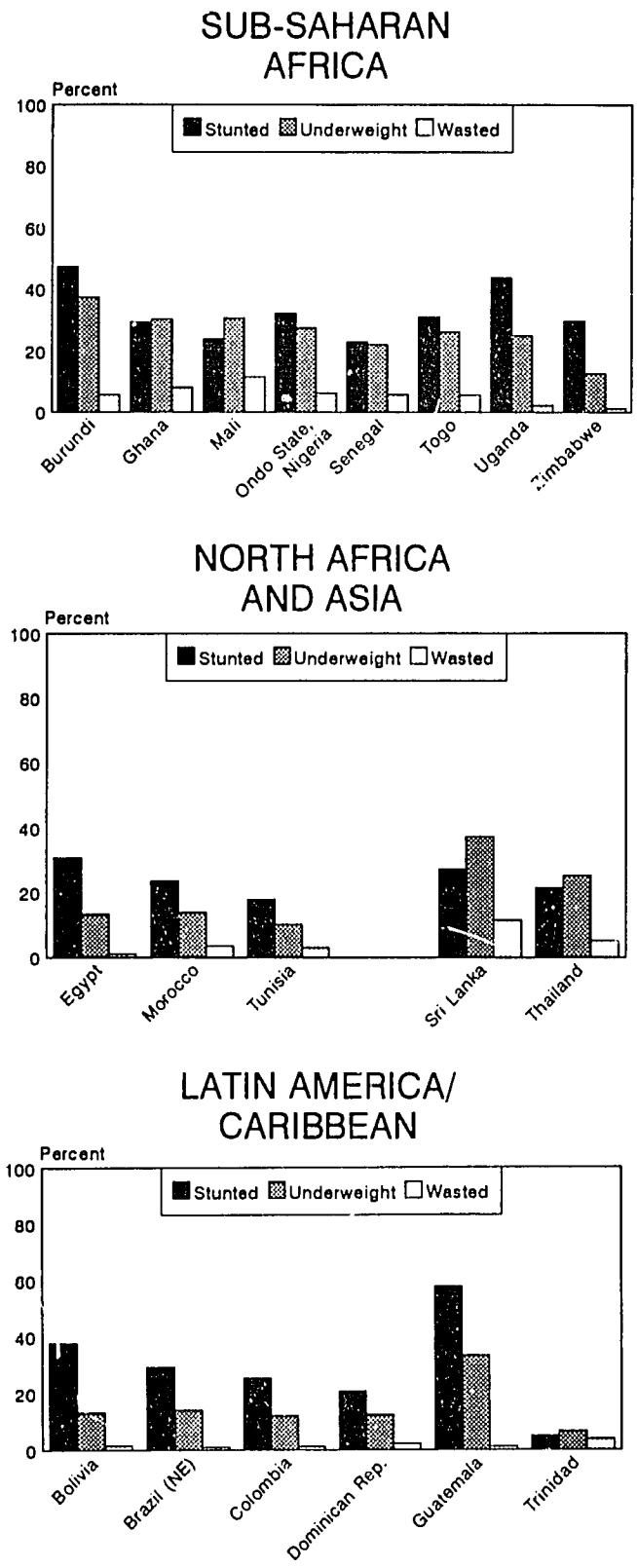
	Percentage of children classified as:						
Country	Stunted[1]	Wasted[1]	Stunted and wasted[1]	Underweight (not stunted or wasted)	Not stunted wasted, or underweight	Total	Number of children
SUB-SAHARAN AFRICA							
Burundi	44.8	3.1	2.6	4.8	44.7	100.0	1889
Ghana	26.1	4.7	3.3	6.1	59.8	100.0	1795
Mali	19.4	7.0	4.5	7.1	62.1	100.0	909
Ondo State, Nigeria[2]	30.8	4.7	1.5	4.5	58.5	100.0	1346
Senegal[2]	20.7	3.6	2.3	3.6	69.9	100.0	618
Togo	28.2	2.9	2.8	3.8	62.3	100.0	1281
Uganda	42.2	0.7	1.6	2.2	53.4	100.0	2327
Zimbabwe	29.3	0.7	0.5	1.9	67.6	100.0	1496
NEAR EAST/NORTH AFRICA							
Egypt	30.7	0.9	0.2	1.3	66.8	100.0	1885
Morocco	22.6	2.6	1.1	1.9	71.8	100.0	2523
Tunisia	17.5	2.6	0.4	2.2	77.3	100.0	1970
ASIA							
Sri Lanka	23.4	7.7	3.9	9.2	55.9	100.0	1962
Thailand	19.7	3.6	1.7	7.7	67.3	100.0	1808
LATIN AMERICA/CARIBBEAN							
Bolivia	37.2	1.1	0.5	1.2	60.0	100.0	2512
Brazil (NE)	28.3	0.2	0.9	0.9	69.7	100.0	571
Colombia	24.9	0.9	0.4	1.2	72.6	100.0	1301
Dominican Republic[2]	19.8	1.5	0.8	1.6	76.2	100.0	1768
Guatemala	57.0	0.6	0.7	1.4	40.3	100.0	2207
Trinidad and Tobago	4.4	3.4	0.4	2.3	89.5	100.0	817
Median	26.1	2.6	1.1	2.2	66.8		

Note: Children are classified as stunted, wasted, or underweight if their height-for-age, weight-for-height, or weight-for-age Z-score is below -2 SD from the median of the International Reference Population (WHO/CDC/NCHS).

[1]May include children who are also underweight

[2]6-35 months

Figure 4.1 Levels of stunting, underweight, and wasting among children age 3-35 months, Demographic and Health Surveys, 1986-1989



Countries in North Africa, Latin America, and the Caribbean generally have substantial levels of stunting, but no wasting—that is, the percentage of children who fall below the cut-off point for wasting is the same as, or even lower than, that seen in the reference population. Underweight is about half as common as stunting. The exception is Trinidad and Tobago where there is little evidence of stunting. There, since the level of wasting exceeds that in the reference population, more children are classified as underweight than as stunted.

At the other extreme are countries like Mali and Sri Lanka, where levels of both wasting and stunting are high. In these countries, underweight is a more common problem than stunting because of the existence of children who are very thin but not, by international standards, too short.

The third pattern, seen in most sub-Saharan countries surveyed, is an intermediate one with substantial levels of both stunting and wasting. The prevalence of stunting is similar to, or slightly higher than, the prevalence of underweight. In two sub-Saharan countries, Uganda and Zimbabwe, however, the pattern of undernutrition resembles that found in Latin America.

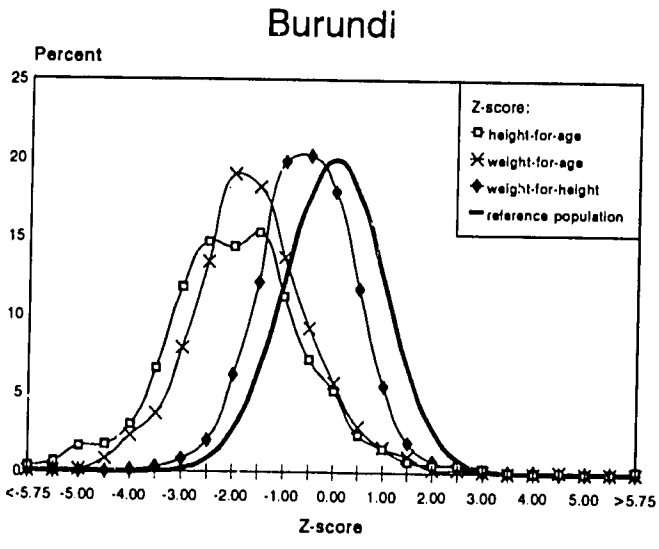
4.3 SUMMARY MEASURES OF NUTRITIONAL STATUS

Graphing the distribution of all three Z-scores, as shown in Figure 4.2, provides another picture of children's nutritional status in each of the countries surveyed. In Togo, for example, the weight-for-height curve is shifted to the left of the reference curve: Togolese children are thinner than those in the reference population, but not as thin as children in Ghana. In contrast, Moroccan children are not thin: the weight-for-height curve here is almost identical to that for the reference population. In Togo, the height-for-age curve also is shifted to the left of the reference curve, indicating that the children are shorter than they would have been under better circumstances. The children also weigh less than they should: the weight-for-age curve is shifted to the left, too.

Tables 4.3-4.5 show the Z-score distributions for each of the three indices of nutritional status in all countries surveyed, while Table 4.6 presents the means and standard deviations of the Z-scores. The standard deviation is largest for the height-for-age index. This may, in part, reflect a lesser degree of accuracy in this measurement. Alternatively, height at a given age may actually vary more among children than the other indices. The standard deviation for weight-for-height is closest to 1 Z-score unit, which is equivalent to the standard deviation of the International Reference Population.

Figure 4.2 Distributon of height-for-age, weight-for-age, and weight-for-height Z-scores among children age 3-35 months, Demographic and Health Surveys, 1986-1989

SUB-SAHARAN AFRICA



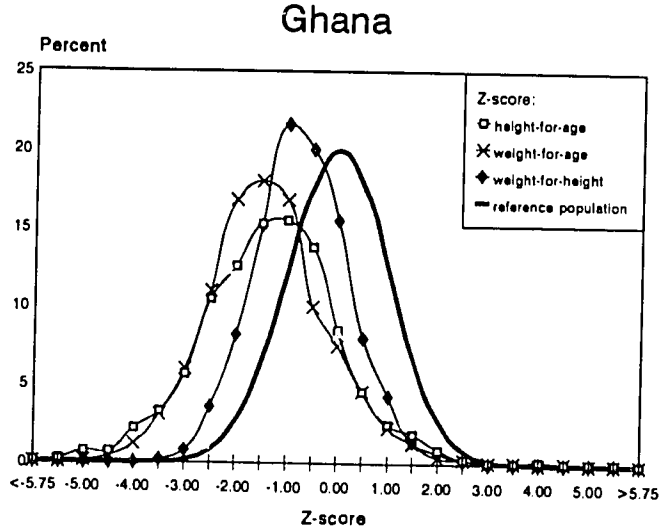
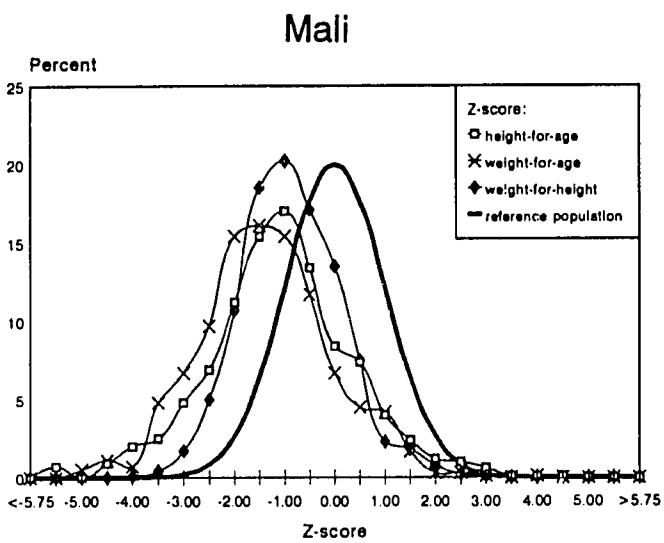
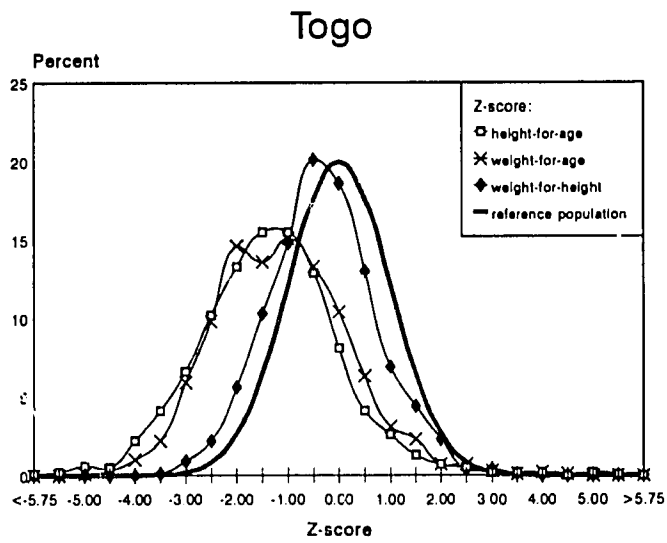
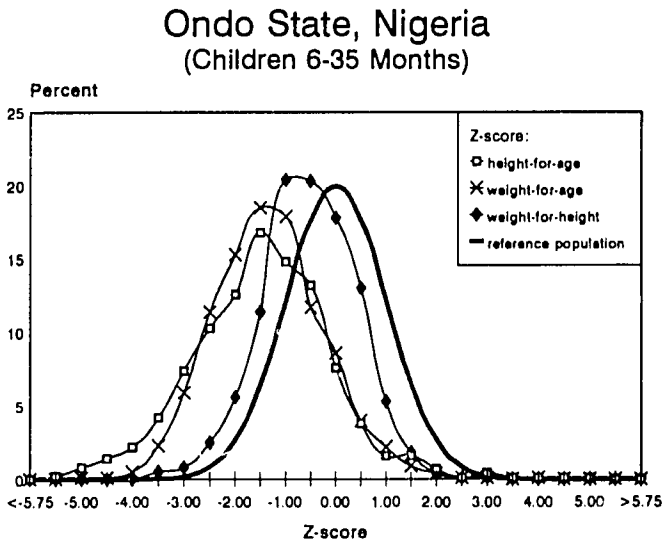
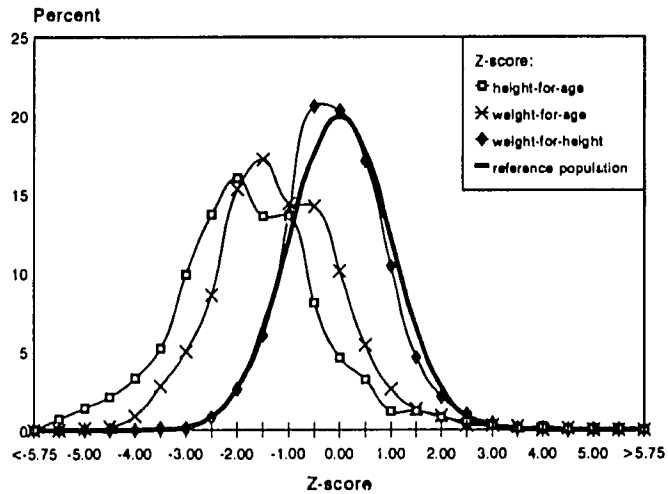


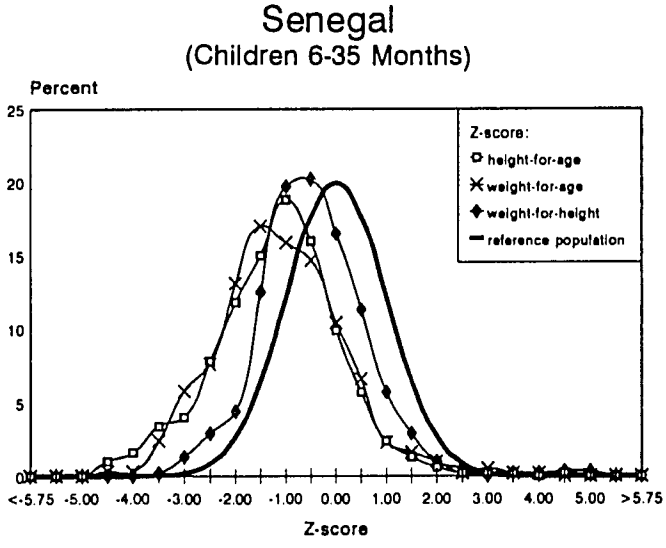
Figure 4.2—*Continued*











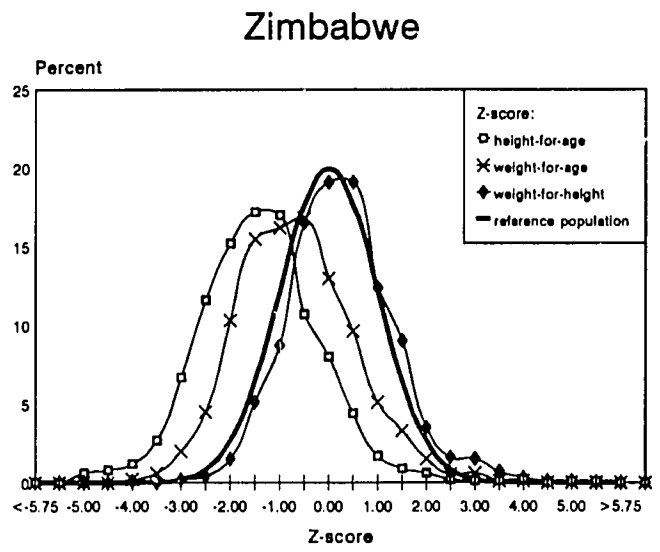
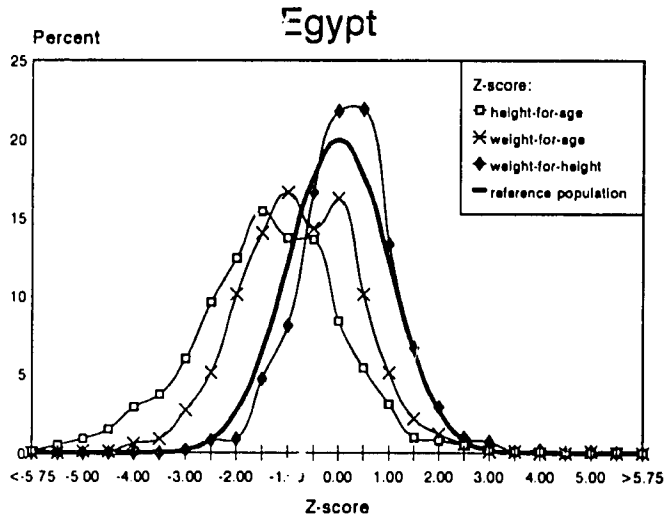
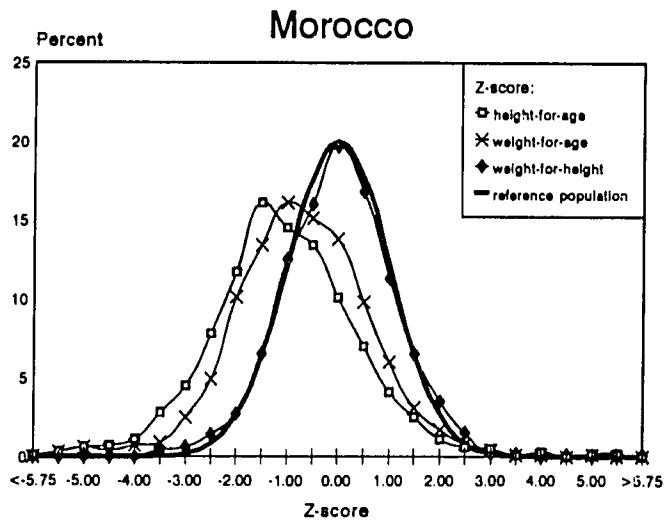
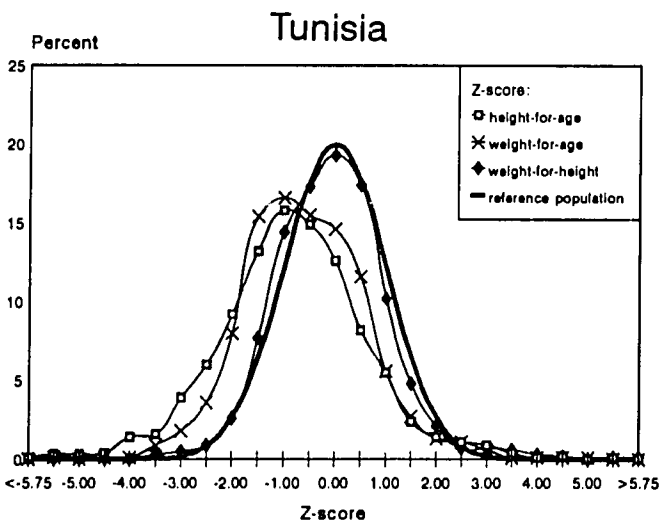


Figure 4.2—*Continued*

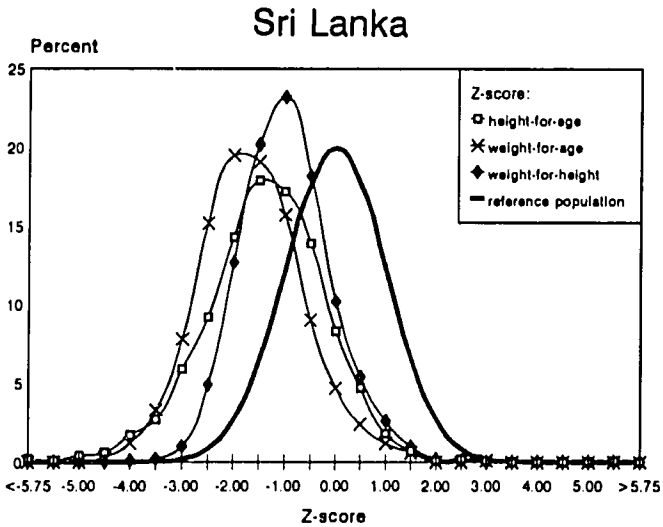
NEAR EAST/NORTH AFRICA







ASIA



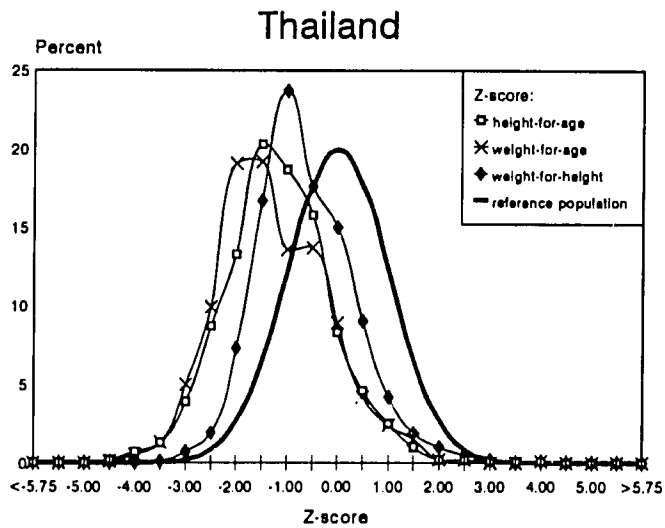
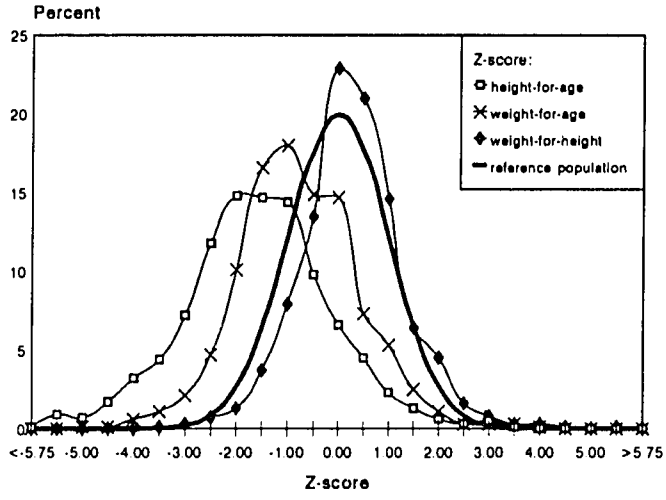


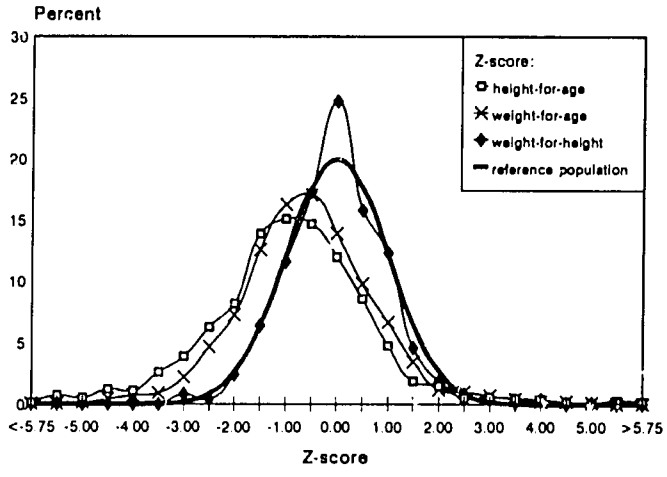
Figure 4.2—*Continued*

LATIN AMERICA/CARIBBEAN

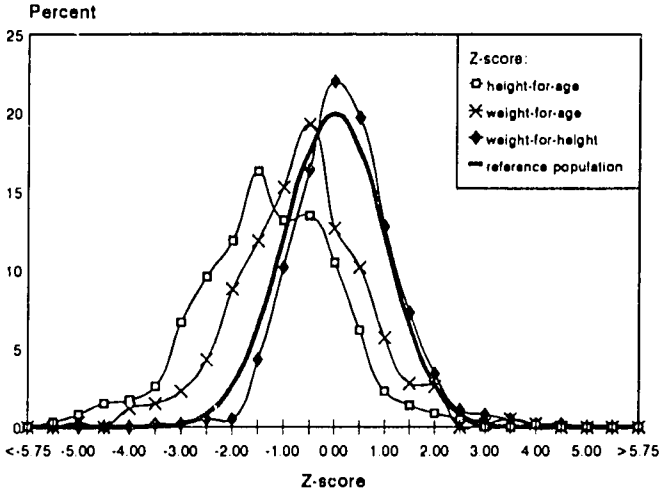
Bolivia



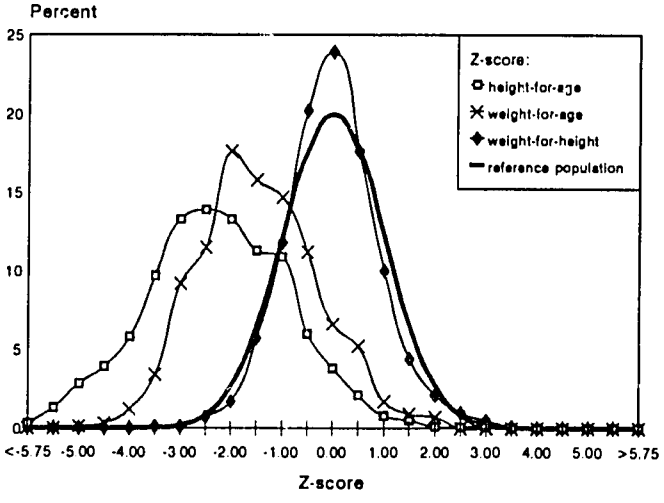
Dominican Republic
(Children 6-35 Months)



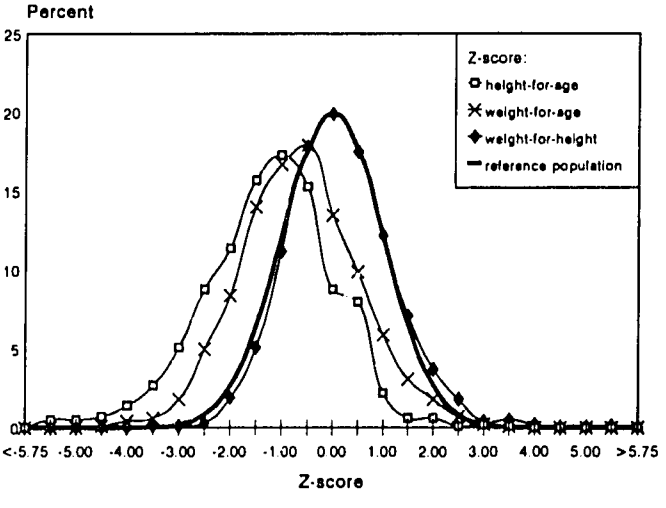
Brazil (NE)



Guatemala



Colombia



Trinidad and Tobago

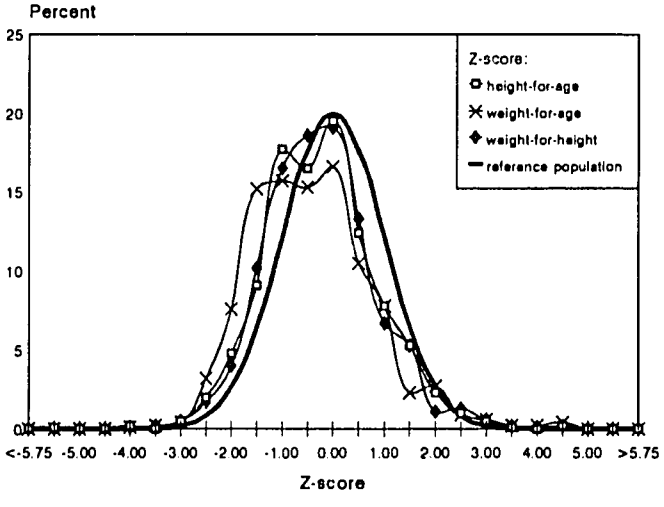


Table 4.3 Height-for-age Z-scores among young children

Percent distribution of height-for-age Z-scores among children age 3-35 months based on the standard deviation (SD) categories of the International Reference Population, Demographic and Health Surveys, 1986-1989

Country	Below -3.00 SD	-3.00 to -2.01 SD	-2.00 to -1.01 SD	-1.00 to -0.01 SD	0.00 to 1.00 SD	1.01 to 2.00 SD	Above 2.00 SD	Number of children
SUB-SAHARAN AFRICA								
Burundi	18.8	28.5	29.1	14.7	5.8	1.8	1.3	1889
Ghana	9.7	19.7	30.4	25.3	10.2	3.3	1.3	1795
Mali	8.2	15.7	29.1	25.5	14.6	4.8	2.1	909
Ondo State, Nigeria[1]	12.6	19.7	30.1	25.3	8.8	2.2	1.3	1346
Senegal[1]	7.6	15.4	31.6	29.8	12.3	2.4	1.0	618
Togo	10.2	20.8	29.4	26.2	9.4	2.4	1.6	1281
Uganda	17.3	26.5	29.4	17.2	5.7	2.3	1.7	2327
Zimbabwe	8.0	21.8	35.2	22.3	9.7	1.9	1.1	1496
NEAR EAST/NORTH AFRICA								
Egypt	12.0	19.0	28.8	24.7	11.6	2.6	1.3	1885
Morocco	7.6	16.1	29.8	25.3	14.2	5.1	1.9	2523
Tunisia	5.4	12.5	26.3	28.7	18.6	5.2	3.2	1970
ASIA								
Sri Lanka	7.9	19.4	34.6	27.0	9.2	1.5	0.5	1962
Thailand	4.1	17.4	35.8	30.7	9.2	2.4	0.5	1808
LATIN AMERICA/CARIBBEAN								
Bolivia	14.5	23.2	29.3	20.4	8.6	2.7	1.2	2512
Brazil (NE)	10.8	18.4	28.5	26.6	11.6	3.1	0.9	571
Colombia	8.2	17.1	29.4	29.5	13.8	1.5	0.5	1301
Dominican Republic[1]	7.6	13.0	24.3	29.8	16.7	5.2	3.3	1768
Guatemala	30.1	27.6	23.5	13.1	4.6	0.8	0.2	2207
Trinidad and Tobago	0.4	4.4	21.2	35.3	26.6	9.2	3.1	817
Expected[2]	0.1	2.2	13.6	34.1	34.1	13.6	2.3	

[1]6-35 months
[2]Expected percentages are those from the International Reference Population (WHO/CDC/NCHS)

Table 4.4 Weight-for-height Z-scores among young children

Percent distribution of weight-for-height Z-scores among children age 3-35 months based on the standard deviation (SD) categories of the International Reference Population, Demographic and Health Surveys, 1986-1989

Country	Below -3.00 SD	-3.00 to -2.01 SD	-2.00 to -1.01 SD	-1.00 to -0.01 SD	0.00 to 1.00 SD	1.01 to 2.00 SD	Above 2.00 SD	Number of children
SUB-SAHARAN AFRICA								
Burundi	0.8	4.8	25.2	39.2	24.3	4.5	1.1	1889
Ghana	0.4	7.6	31.0	39.2	18.0	3.3	0.5	1795
Mali	1.3	10.2	33.5	36.0	15.2	3.1	0.7	909
Ondo State, Nigeria[1]	0.7	5.5	24.4	39.7	25.3	4.0	0.4	1346
Senegal[1]	0.3	5.5	25.1	39.0	21.8	6.5	1.8	618
Togo	0.5	5.2	21.1	36.7	26.0	9.0	1.6	1281
Uganda	0.2	2.1	13.8	37.6	33.3	10.5	2.5	2327
Zimbabwe	0.3	0.9	9.5	29.8	57.0	16.4	6.0	1496
NEAR EAST/NORTH AFRICA								
Egypt	0.1	1.0	8.7	32.1	41.1	13.9	3.1	1885
Morocco	0.7	3.0	13.3	32.1	34.1	13.4	3.3	2523
Tunisia	0.6	2.4	15.0	34.9	33.8	9.8	3.5	1970
ASIA								
Sri Lanka	0.6	11.0	38.9	36.0	11.2	2.2	0.1	1962
Thailand	0.4	4.9	33.6	36.7	19.0	4.2	1.2	1808
LATIN AMERICA/CARIBBEAN								
Bolivia	0.3	1.3	7.6	29.8	40.4	16.1	4.5	2512
Brazil (NE)	0.2	0.9	9.1	31.6	39.3	14.9	4.0	571
Colombia	0.2	1.1	11.4	32.8	35.3	14.6	4.6	1301
Dominican Republic[1]	0.2	2.2	12.7	35.5	35.9	10.8	2.8	1768
Guatemala	0.1	1.2	11.8	39.0	35.4	9.9	2.7	2207
Trinidad and Tobago	0.7	3.1	19.6	38.1	27.2	8.3	3.1	817
Expected[2]	0.1	2.2	13.6	34.1	34.1	13.6	2.3	

[1]6-35 months

[2]Expected percentages are those from the International Reference Population (WHO/CDC/NCHS)

Table 4.5 Weight-for-age Z-scores among young children

Percent distribution of weight-for-age Z-scores among children age 3-35 months based on the standard deviation (SD) categories of the International Reference Population, Demographic and Health Surveys, 1986-1989

Country	Below -3.00 SD	-3.00 to -2.01 SD	-2.00 to -1.01 SD	-1.00 to -0.01 SD	0.00 to 1.00 SD	1.01 to 2.00 SD	Above 2.00 SD	Number of children
SUB-SAHARAN AFRICA								
Burundi	10.0	27.5	35.3	18.9	6.2	1.7	0.4	1889
Ghana	7.1	23.2	34.9	22.6	9.3	2.4	0.6	1795
Mali	9.2	21.3	32.8	21.7	11.2	3.2	0.6	909
Ondo State, Nigeria[1]	5.6	21.8	36.6	24.7	9.3	1.8	0.2	1346
Senegal[1]	5.3	16.7	35.0	27.3	11.3	3.4	1.0	618
Togo	6.5	19.8	29.2	26.6	12.2	4.1	1.8	1281
Uganda	6.1	19.0	32.3	26.7	11.9	2.7	1.2	2327
Zimbabwe	1.5	11.2	28.7	31.6	18.3	7.0	1.8	1496
NEAR EAST/NORTH AFRICA								
Egypt	2.5	10.8	28.6	31.3	20.8	4.9	1.1	1885
Morocco	3.2	10.8	26.3	30.9	19.7	6.7	2.3	2523
Tunisia	1.7	8.6	27.7	31.9	21.6	6.1	2.4	1970
ASIA								
Sri Lanka	8.3	29.0	37.5	19.2	4.8	1.1	0.1	1962
Thailand	4.0	21.3	37.2	24.7	10.0	2.3	0.5	1808
LATIN AMERICA/CARIBBEAN								
Bolivia	2.6	10.7	31.3	31.5	16.6	5.9	1.4	2512
Brazil (NE)	4.3	9.8	25.2	31.6	20.4	6.7	2.0	571
Colombia	1.9	10.1	26.3	33.5	21.0	5.6	1.7	1301
Dominican Republic[1]	2.8	9.6	24.8	32.3	20.4	6.9	3.1	1768
Guatemala	8.5	24.6	33.8	21.3	9.4	1.9	0.4	2207
Trinidad and Tobago	0.4	6.1	28.4	30.8	24.0	6.4	3.9	817
Expected[2]	0.1	2.2	13.6	34.1	34.1	13.6	2.3	

[1]6-35 months

[2]Expected percentages are those from the International Reference Population (WHO/CDC/NCHS)

Table 4.6 Nutritional status of young children

Mean Z-scores and standard deviations for height-for-age, weight-for-height, and weight-for age among children age 3-35 months, Demographic and Health Surveys, 1986-1989

Country	Height-for-age Z-score		Weight-for-height Z-score		Weight-for-age Z-score		Number of children
	Mean	Standard deviation	Mean	Standard deviation	Mean	Standard deviation	
SUB-SAHARAN AFRICA							
Burundi	-1.86	1.45	-0.52	0.98	-1.61	1.16	1889
Ghana	-1.30	1.39	-0.71	0.94	-1.37	1.18	1795
Mali	-1.07	1.44	-0.86	1.00	-1.37	1.28	909
Ondo State, Nigeria[1]	-1.44	1.38	-0.54	0.94	-1.33	1.10	1346
Senegal[1]	-1.17	1.24	-0.46	1.09	-1.11	1.23	618
Togo	-1.35	1.39	-0.33	1.06	-1.12	1.31	1281
Uganda	-1.75	1.49	-0.06	0.99	-1.18	1.24	2327
Zimbabwe	-1.39	1.26	0.26	1.09	-0.68	1.19	1496
NEAR EAST/NORTH AFRICA							
Egypt	-1.38	1.44	0.19	0.96	-0.73	1.18	1885
Morocco	-1.05	1.44	-0.00	1.12	-0.68	1.29	2523
Tunisia	-0.81	1.43	-0.06	1.10	-0.58	1.21	1970
ASIA							
Sri Lanka	-1.36	1.20	-0.98	0.90	-1.64	1.03	1962
Thailand	-1.18	1.08	-0.64	0.98	-1.27	1.09	1808
LATIN AMERICA/CARIBBEAN							
Bolivia	-1.57	1.45	0.27	1.03	-0.77	1.18	2512
Brazil (NE)	-1.30	1.37	0.20	1.01	-0.67	1.29	571
Colombia	-1.22	1.26	0.14	1.05	-0.64	1.16	1301
Dominican Republic[1]	-0.87	1.59	-0.01	1.02	-0.58	1.31	1768
Guatemala	-2.27	1.41	-0.02	0.93	-1.47	1.18	2207
Trinidad and Tobago	-0.26	1.13	-0.25	1.11	-0.43	1.21	817
Median	-1.30	1.39	-0.06	1.01	-1.11	1.19	

[1]6-35 months

5 Differentials in Levels of Undernutrition

5.1 BIO-DEMOGRAPHIC CHARACTERISTICS

The Deterioration of Nutritional Status During the First Year of Life

Analyzing the magnitude of undernutrition at different ages reveals how nutritional status changes during a child's first three years of life. Results show that nutritional status deteriorates markedly during the first year of life. The decline is discernable even during the first few months of life and is pronounced by the first birthday. The rate of deterioration generally is greatest in countries that reach the highest levels of undernutrition. In those countries where children under age 3 months were measured (Northeast Brazil, Morocco, Togo, and Uganda), findings show that the decline begins early: levels of undernutrition during the first few months of life are even lower than those seen among 3-5 month olds.

Figure 5.1 tracks the mean Z-scores for each of the three indices through each month of life. Since the number of cases at each age is small, a three-point moving average was calculated. The graphs show that the prevalence of wasting peaks during the second year of life and then decreases. In contrast, the prevalence of stunting usually plateaus at about 24 months, and there is no evidence of improvement as the child grows older. In a few countries, there is no indication that the problem of stunting is stabilized even by the end of the third year of life. However, in those countries where children up to age 5 were measured (Northeast Brazil, Morocco, Uganda, and Zimbabwe), stunting levels plateau during the third year of life. While there is no further deterioration, these four surveys also found no improvement during the fourth and fifth years.

Figure 5.1 Mean height-for-age, weight-for-height, and weight-for-age Z-scores by child's age in months, Demographic and Health Surveys, 1986-1989

SUB-SAHARAN AFRICA

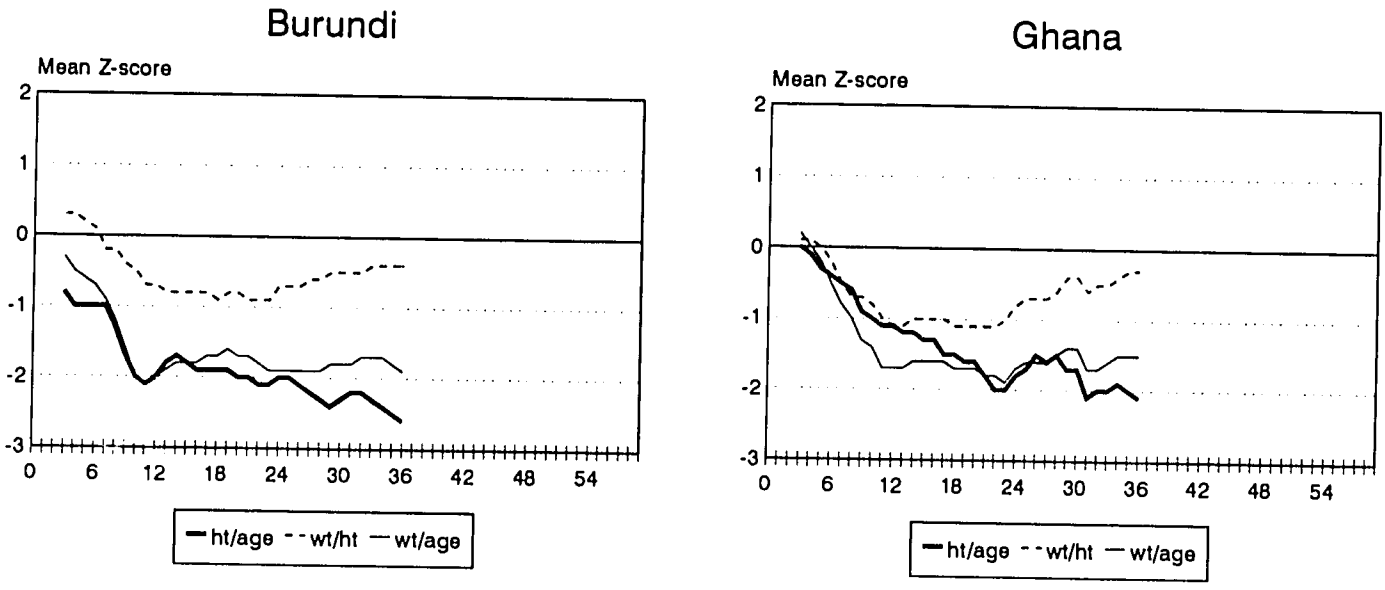


Figure 5.1—*Continued*

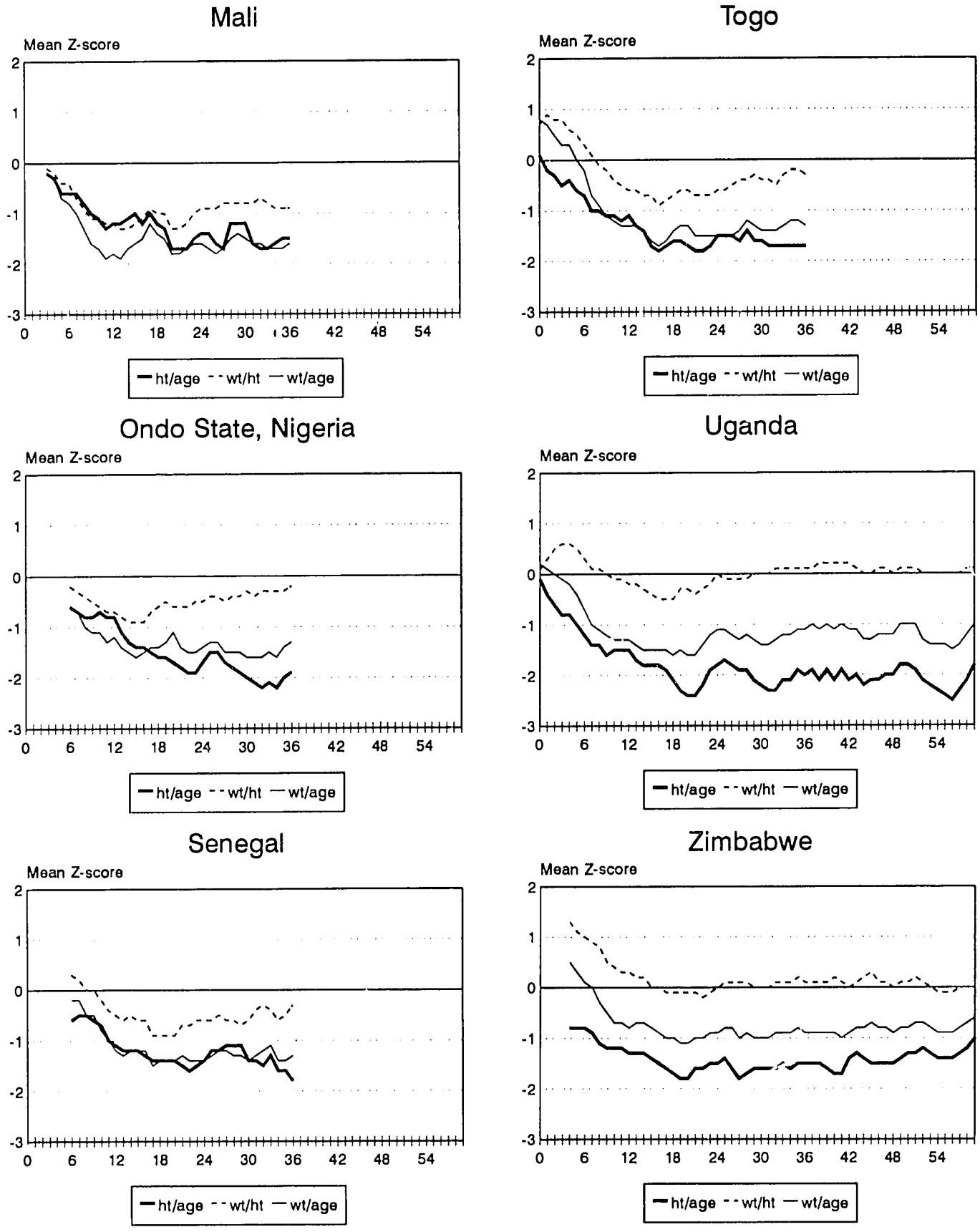
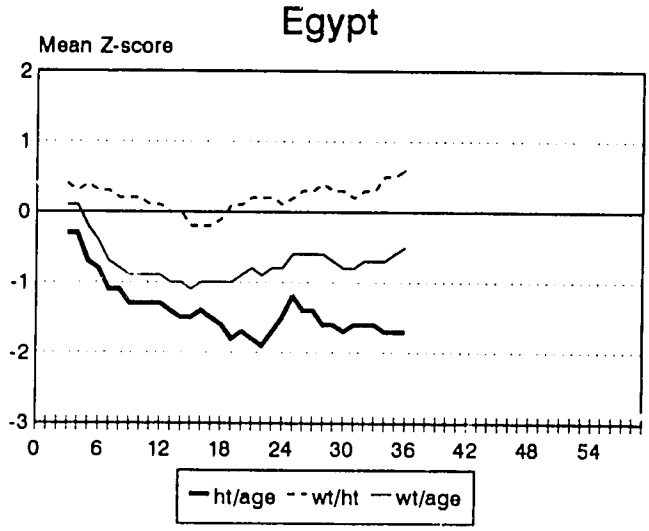
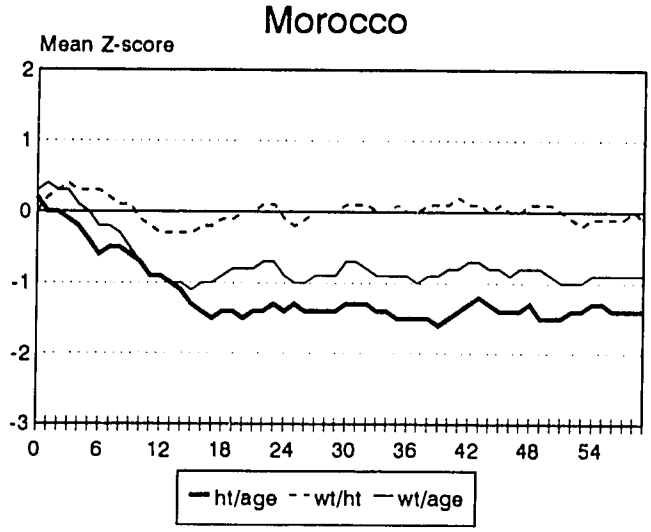
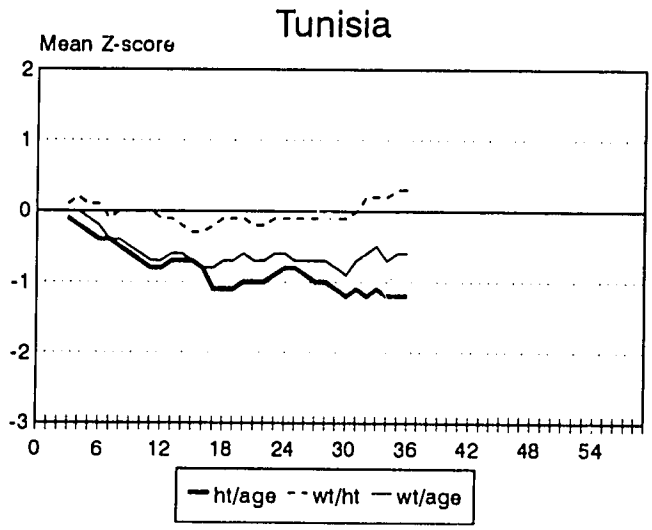


Figure 5.1—*Continued*

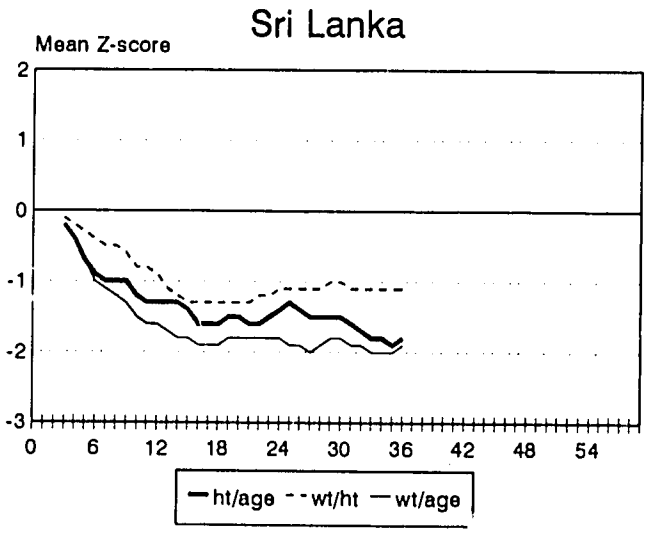
NEAR EAST/NORTH AFRICA







ASIA



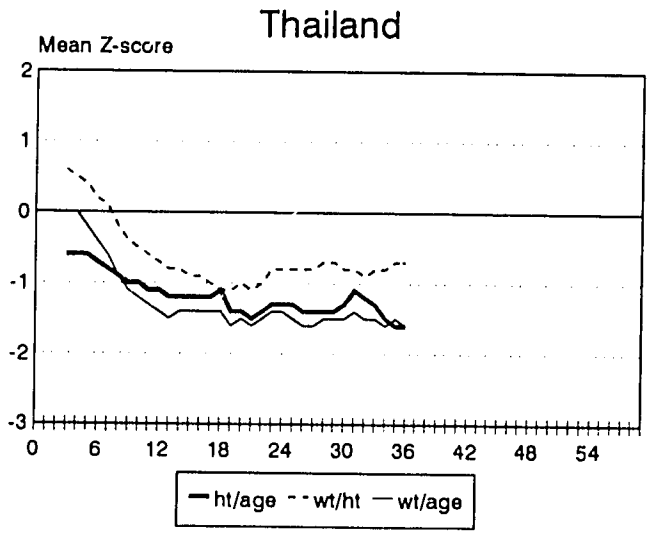
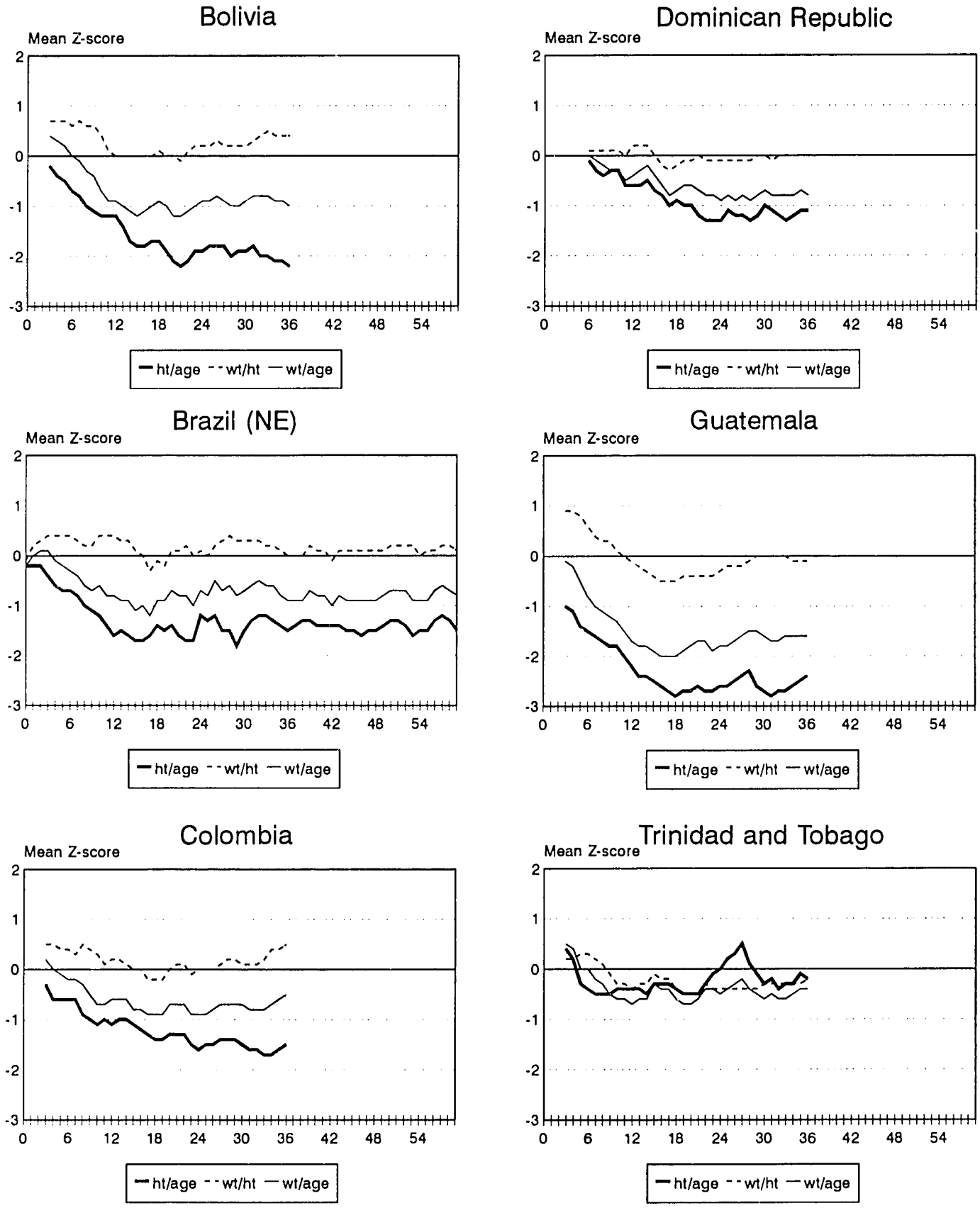


Figure 5.1—*Continued*

LATIN AMERICA/CARIBBEAN



Levels of stunting among children 3-5 months of age range from 5 to about 15 percent in most countries (see Table 5.1). The exceptions are Trinidad and Tobago, with a low level of 2 percent, and Burundi and Guatemala, with the highest level of 20 percent. Wasting is not a problem in this age group. The proportion classified as underweight is also remarkably low, ranging from 1 to 7 percent. Since the prevalence of underweight in Burundi and Guatemala is similar to that in other countries, the higher levels of stunting among the youngest infants in these two countries may reflect a different growth pattern among young infants or, possibly, a measurement problem. Measurement does not appear to be an issue for older infants in these two countries: in the next age group, levels of both underweight and stunting are considerably higher than in other countries in the same region.

In almost all countries where wasting is a problem, the prevalence is greatest in the 12-23 month age group, Trinidad and Tobago being the exception. Typically, wasting is least common among children 3-5 months old and somewhat more common in the 6-11 month age group. After prevalence peaks during the second year of life, wasting declines. Levels at age 24-35 months are similar to those at age 6-11 months.

The prevalence of stunting rises more slowly with age. Among children under three years of age, stunting peaks during the third year of life in two-thirds of the countries and during the second year of life in the remaining countries. Over half of all children age 24-35 months are classified as stunted in Bolivia, Burundi, Guatemala, and Uganda.

Table 5.1 Undernutrition by age group

Percentage of children age 3-35 months who are stunted, wasted, or underweight by age group, Demographic and Health Surveys, 1986-1989

Country	Percent stunted				Percent wasted				Percent underweight				Number of children			
	3-5 months	6-11 months	12-23 months	24-35 months	3-5 months	6-11 months	12-23 months	24-35 months	3-5 months	6-11 months	12-23 months	34-35 months	3-5 months	6-11 months	12-23 months	24-35 months
SUB-SAHARAN AFRICA																
Burundi	20.1	35.5	49.3	59.4	2.4	3.8	10.4	3.4	4.2	31.8	43.3	43.9	172	403	622	691
Ghana	4.7	13.1	33.2	42.4	1.8	7.6	14.7	2.4	3.0	21.3	38.4	34.4	169	367	672	587
Mali	6.9	16.7	31.0	33.2	2.2	11.7	18.5	6.9	6.1	29.8	40.5	33.4	146	242	319	203
Ondo State, Nigeria	U	10.9	32.2	47.1	U	4.0	8.6	4.7	U	16.5	28.6	33.5	U	322	559	465
Senegal	U	8.6	27.2	28.4	U	2.0	8.8	4.6	U	4.6	28.7	26.3	U	152	272	194
Togo	9.9	23.4	37.4	36.6	0.0	4.9	9.8	3.8	4.9	24.2	33.5	27.3	162	244	457	418
Uganda	13.6	30.1	52.9	52.2	0.0	1.1	4.2	1.4	4.2	21.8	31.5	26.2	227	519	872	708
Zimbabwe	9.9	20.9	32.6	36.4	0.0	0.8	1.9	1.1	0.0	6.5	15.1	16.4	141	263	537	555
NEAR EAST/ NORTH AFRICA																
Egypt	8.0	29.3	36.2	32.3	1.4	1.7	1.6	0.2	5.6	15.3	16.8	10.6	176	363	703	643
Morocco	8.9	12.8	30.0	29.4	2.9	3.7	5.8	1.5	4.8	10.1	17.7	15.9	314	517	914	778
Tunisia	7.5	12.0	19.6	22.2	1.6	5.9	3.5	1.3	3.2	10.1	11.9	10.5	187	375	713	695
ASIA																
Sri Lanka	7.8	15.2	30.8	33.8	1.2	3.5	19.4	9.9	3.7	21.9	42.2	47.2	158	353	734	717
Thailand	5.1	13.8	23.1	27.1	0.8	1.4	10.5	2.6	0.8	17.1	29.4	30.4	138	328	710	633
LATIN AMERICA/ CARIBBEAN																
Bolivia	7.6	20.3	41.8	50.1	2.8	1.2	2.1	1.0	1.5	8.6	18.9	12.1	194	498	985	834
Brazil (NE)	13.3	18.9	37.6	30.9	0.0	1.6	2.2	0.0	6.7	11.0	18.6	13.3	53	112	200	206
Colombia	11.6	15.2	24.8	34.0	1.1	2.0	1.2	1.1	2.9	8.5	13.6	13.8	87	247	510	457
Dominican Republic	U	10.0	21.6	25.5	U	3.2	2.8	1.3	U	6.9	12.6	15.4	U	367	754	647
Guatemala	20.1	38.7	69.4	67.5	0.4	0.7	2.8	0.4	4.0	19.5	44.2	38.3	224	437	779	767
Trinidad and Tobago	(2.1)	5.8	5.3	4.0	(8.5)	2.9	4.3	3.0	(0.0)	7.0	9.3	4.4	47	172	301	297
Median	7.8	15.2	32.2	33.8	1.1	2.9	4.3	1.5	3.2	15.3	28.6	26.2				

Note: Children are classified as stunted, wasted, or underweight if their height-for-age, weight-for-height, or weight-for-age Z-score is below -2 SD from the median of the International Reference Population (WHO/CDC/NCHS).
U = Unknown (not available)
( ) Figures in parentheses are based on 25 to 49 unweighted cases

Underweight, a composite measure reflecting both stunting and wasting, is most common during the second year of life in over half the countries surveyed.

The deterioration in young children's nutritional status corresponds to the ages when they are first exposed to contaminants in their food and environment and when an inadequate food intake has a profound effect on growth. Wasting, which reflects recent and acute problems, is seen more commonly among younger children. Stunting, which results from chronic undernutrition in response to a child's adverse environment, follows. Viral diarrhea is common among infants and young children in all countries; children living in developing countries where drinking water is often unsafe and excreta may not be properly disposed of are also at risk of developing more severe bacterial and parasitic illnesses. Inadequate food intake, either because of improper feeding practices or food shortages, also contributes to the development of undernutrition. Children should be breastfed for the first 4 to 6 months of life, after which appropriate and adequate complementary foods should be given in addition to breast milk (WHO/UNICEF, 1990). Children require complementary foods in order to follow normal growth patterns. When children do not receive adequate complementary foods by the middle of the first year and when they also experience frequent bouts of infectious illnesses, such as diarrhea, the result is wasting, peaking during the first year of life. As dietary inadequacies and continued exposure to pathogens continue, the child becomes chronically undernourished; this is manifested in high levels of stunting by the third year of life.

Sex

With the exception of the Dominican Republic, there is little difference in the prevalence of undernutrition between boys and girls (see Table 5.2). In the Dominican Republic, 25 percent of the boys are classified as stunted compared to 17 percent of the girls.

Table 5.2 Undernutrition by child's sex

Percentage of children age 3-35 months who are stunted, wasted, or underweight by sex, Demographic and Health Surveys, 1986-1989

Country	Percent stunted		Percent wasted		Percent underweight		Number of children	
	Male	Female	Male	Female	Male	Female	Male	Female
SUB-SAHARAN AFRICA								
Burundi	47.7	47.1	6.2	5.1	37.1	38.0	958	931
Ghana	30.0	28.8	9.2	6.8	30.1	30.4	900	895
Mali	23.8	23.9	13.8	8.9	29.8	31.4	476	434
Ondo State, Nigeria[1]	32.8	31.6	6.5	5.8	27.6	27.3	704	642
Senegal[1]	25.3	20.6	8.1	3.5	24.0	20.0	308	310
Togo	33.6	28.2	6.7	4.6	26.9	25.2	654	627
Uganda	46.3	41.4	2.2	2.3	25.6	24.6	1121	1206
Zimbabwe	31.0	28.7	1.5	0.9	13.6	11.7	729	767
NEAR EAST/ NORTH AFRICA								
Egypt	30.9	31.0	1.4	0.8	13.8	12.9	986	899
Morocco	24.2	23.1	4.0	3.3	14.5	13.5	1264	1259
Tunisia	17.2	18.7	3.8	2.2	10.5	10.0	1000	970
ASIA								
Sri Lanka	26.0	28.7	11.6	11.5	37.0	37.7	1045	917
Thailand	21.9	21.1	5.3	5.3	25.3	25.4	912	896
LATIN AMERICA/ CARIBBEAN								
Bolivia	39.4	36.0	1.7	1.5	15.1	11.4	1247	1265
Brazil (NE)	31.8	26.7	1.5	0.6	14.8	13.4	287	285
Colombia	26.4	24.3	1.4	1.2	11.1	12.9	660	641
Dominican Republic[1]	24.7	16.8	3.5	1.2	14.4	10.6	852	915
Guatemala	58.7	56.7	1.1	1.5	32.4	33.9	1091	1116
Trinidad and Tobago	5.0	4.5	3.8	3.8	6.0	6.9	397	420
Median	30.0	28.2	3.8	3.3	24.0	20.0		

Note: Children are classified as stunted, wasted, or underweight if their height-for-age, weight-for-height, or weight-for-age Z-score is below -2 SD from the median of the International Reference Population (WHO/CDC/NCHS).
[1]6-35 months

These differences are consistent across all age groups (data not shown). In the remaining 18 countries, the differences in prevalence of stunting between boys and girls range from 0.1 to 5 percentage points. Although the differences are small, the overall trend is for girls to suffer less than boys from undernutrition. In 15 countries, stunting is less prevalent among girls than boys. Wasting is also somewhat more common among boys than girls, with the greatest difference (4-5 percent) found in Mali and Senegal. There was no consistent pattern in the prevalence of underweight by sex, reflecting the small overall differences observed for stunting and wasting.

Birth Order

The child's birth order was based on the birth history given by the mother. Birth order was recoded into four categories (first births, second or third, fourth or fifth, and sixth or higher). Data on undernutrition and birth order are presented in Table 5.3.

Table 5.3 Undernutrition by birth order

Percentage of children age 3-35 months who are stunted, wasted, or underweight by birth order, Demographic and Health Surveys, 1986-1989

	Percent stunted				Percent wasted				Percent underweight				Number of children			
Country	Birth 1	Birth 2-3	Birth 4-5	Birth 6+	Birth 1	Birth 2-3	Births 4-5	Birth 6+	Birth 1	Birth 2-3	Birth 4-5	Birth 6+	Birth 1	Birth 2-3	birth 4-5	Birth 6+
SUB-SAHARAN AFRICA																
Burundi	54.1	48.4	44.2	45.5	5.6	4.7	6.0	6.5	41.7	35.3	35.6	39.6	311	556	548	475
Ghana	29.4	27.7	32.2	29.0	7.5	6.6	8.1	10.5	31.3	27.4	31.3	32.4	361	591	432	411
Mali	26.4	23.6	25.6	21.6	10.0	10.9	13.0	11.4	27.0	31.2	34.0	29.0	133	255	227	294
Ondo State, Nigeria[1]	35.7	28.4	34.8	30.4	7.6	5.4	6.2	6.0	33.3	20.8	29.2	28.1	210	331	356	449
Senegal[1]	19.5	25.3	15.7	29.0	6.2	6.0	6.5	4.8	23.9	19.9	17.6	26.3	113	166	153	186
Togo	36.3	25.5	29.8	35.0	6.0	5.5	6.8	4.6	27.3	20.2	25.8	33.3	267	416	295	303
Uganda	44.3	43.6	44.8	43.0	1.2	2.7	2.3	2.3	24.6	22.8	25.5	27.2	382	713	502	730
Zimbabwe	26.2	25.8	30.6	36.9	0.6	0.9	1.6	1.6	12.3	8.4	13.9	16.7	317	431	382	366
NEAR EAST/ NORTH AFRICA																
Egypt	28.7	29.2	32.4	34.8	1.4	0.3	1.2	2.2	8.7	13.6	13.6	17.6	399	677	433	376
Morocco	21.6	22.1	23.7	26.5	2.7	2.8	4.0	4.9	9.3	13.2	14.6	17.2	450	752	569	752
Tunisia	15.1	15.5	18.3	24.4	3.0	2.9	2.5	3.7	8.1	9.6	11.7	11.9	372	722	471	405
ASIA																
Sri Lanka	21.4	26.1	38.9	37.8	10.8	11.6	13.6	10.7	34.7	35.2	44.5	50.0	592	969	282	119
Thailand	17.3	18.9	34.6	44.8	3.5	6.9	5.6	3.5	21.0	24.4	37.4	36.3	677	816	240	76
LATIN AMERICA/ CARIBBEAN																
Bolivia	30.7	34.7	41.5	44.3	1.8	1.7	1.2	1.7	12.0	10.2	13.3	18.4	526	816	589	581
Brazil (NE)	15.8	23.9	33.3	45.8	0.0	1.0	0.9	2.4	5.1	11.0	17.1	24.4	140	185	98	149
Colombia	19.9	21.9	30.3	40.0	1.5	1.4	0.8	1.2	9.6	12.4	12.9	14.6	381	507	230	184
Dominican Republic[1]	13.0	20.1	26.3	30.3	1.5	2.8	1.6	3.6	8.0	11.7	17.4	17.0	506	708	300	254
Guatemala	45.9	56.4	61.6	64.6	1.2	0.8	0.8	2.5	26.7	30.7	35.2	39.4	412	739	505	551
Trinidad and Tobago	5.0	4.1	5.3	6.1	3.2	4.7	4.0	1.2	5.4	5.8	9.3	7.3	222	363	150	82
Median	26.2	25.5	32.2	35.0	3.0	2.9	4.0	3.6	21.0	19.9	17.6	26.3				

Note: Children are classified as stunted, wasted, or underweight if their height-for-age, weight-for-height, or weight-for-age Z-score is below -2 SD from the median of the International Reference Population (WHO/CDC/NCHS).
[1]6-35 months

In the sub-Saharan countries, there is no consistent pattern of stunting by birth order, although stunting is never most common in birth order 2-3. The highest levels of wasting are generally seen among children whose birth order is 4 or higher. The largest proportion of underweight children is usually seen among children whose birth order is 6 or higher.

In the remaining regions, stunting is most common among children whose birth order is 6 or higher with one exception (Sri Lanka). There is no consistent pattern of wasting, and underweight occurs most frequently in the two highest birth order categories.

When all countries and all three indicators of undernutrition are considered, there is more undernutrition among children of higher birth order (4 and up). In part, this may stem from the more limited resources available in larger families; women who bear more children are likely to be of lower socioeconomic status than women with fewer children.

Preceding Birth Interval

The length of the interval preceding each child's birth is derived from the birth history provided by the mother. The length of the birth interval was divided into three categories: shorter than 24 months, 24-47 months, and 48 months or longer. The length of the succeeding birth interval is not considered here because, in many countries, few of the children who were measured had a younger sibling.

Almost all countries show a consistent pattern linking undernutrition with shorter birth intervals (see Table 5.4). In three-quarters of the countries, stunting is most prevalent among children born after short intervals of less than 24 months. The median level of stunting across all countries is 33 percent among children born less than 24 months after their sibling, compared to 24 percent for children born 4 years or more after the last birth. First-born children also have lower levels of stunting than children born after a

Table 5.4 Undernutrition by length of preceding birth interval

Percentage of children age 3-35 months who are stunted, wasted, or underweight by length of the preceding birth interval, Demographic and Health Surveys, 1986-1989

Country	Percent stunted			Percent wasted			Percent underweight			Number of children		
	<24 months	24-47 months	48+ months	<24 months	24-47 months	48+ months	<24 months	24-47 months	48+ months	<24 months	24-47 months	48+ months
SUB-SAHARAN AFRICA												
Burundi	50.1	46.7	38.1	5.0	5.4	7.9	43.5	35.9	32.8	274	1065	238
Ghana	34.7	29.5	25.8	9.0	8.1	7.5	34.2	30.0	26.7	222	889	318
Mali	32.5	21.6	19.7	10.8	12.0	11.7	33.2	32.3	25.5	154	472	150
Ondo State, Nigeria[1]	32.4	32.1	30.3	5.8	5.8	6.4	27.2	27.1	23.1	173	723	234
Senegal[1]	23.7	23.3	25.9	8.6	4.3	8.2	25.8	21.2	18.8	93	326	85
Togo	29.6	31.1	24.1	7.2	5.9	4.1	28.8	26.3	21.4	125	665	220
Uganda	46.7	45.1	39.6	1.3	3.2	1.2	28.6	24.0	23.4	513	1202	227
Zimbabwe	37.3	31.0	24.1	1.0	1.2	2.3	14.5	13.5	8.2	193	765	220
NEAR EAST/ NORTH AFRICA												
Egypt	33.9	32.5	25.5	1.3	1.0	0.7	15.8	15.2	11.4	458	718	307
Morocco	29.0	24.1	17.8	3.3	4.2	3.6	18.2	15.6	9.3	538	1131	399
Tunisia	21.0	19.3	10.6	2.9	3.1	3.0	12.9	11.1	4.7	544	818	235
ASIA												
Sri Lanka	32.2	31.0	25.0	9.9	13.6	11.3	40.8	40.0	33.4	382	619	365
Thailand	27.3	26.5	19.5	10.5	6.0	4.4	37.1	25.7	25.4	231	457	441
LATIN AMERICA/ CARIBBEAN												
Bolivia	43.6	42.2	28.2	1.2	1.7	1.7	16.6	13.8	9.2	520	1038	425
Brazil (NE)	38.8	31.3	23.0	2.2	0.5	1.4	20.3	15.9	9.5	205	161	65
Colombia	33.3	31.4	14.1	1.9	0.5	1.4	16.6	13.2	7.9	332	344	238
Dominican Republic[1]	25.1	27.3	13.3	2.8	3.2	1.2	15.6	15.9	7.9	484	526	252
Guatemala	62.1	61.6	53.0	1.4	1.2	1.8	38.3	34.3	29.5	515	991	285
Trinidad and Tobago	6.1	3.8	4.0	3.3	4.8	4.0	7.0	7.7	5.7	213	208	174
Median	32.5	31.0	24.1	3.3	4.2	3.6	25.8	21.2	18.8			

Note: Children are classified as stunted, wasted, or underweight if their height-for-age, weight-for-height, or weight-for-age Z-score is below -2 SD from the median of the International Reference Population (WHO/CDC/NCHS).
[1]6-35 months

short birth interval (less than 24 months) in 16 of 19 countries. There is no consistent pattern in the level of wasting and the length of the preceding birth interval. As expected, the proportion of children who are underweight is highest among children born after a short interval in all but two surveys (Dominican Republic and Trinidad and Tobago).

Mother's Age

The mother's age at delivery was calculated from the reported dates of birth for the mother and child. Three categories were used: under 20 years, 20-34 years, and 35 years or older.

There is no consistent pattern of undernutrition by mother's age at the time of the child's birth (see Table 5.5). However, in 7 of 11 surveys in sub-Saharan and North African countries, stunting is most common among children of very young mothers (under age 20). In 7 of 8 countries in Asia and Latin America and the Caribbean, stunting is most prevalent among children of older mothers (age 35 or older). Wasting shows no consistent pattern, while underweight tends to be most common among children of older mothers.

5.2 SOCIOECONOMIC CHARACTERISTICS

Urban-Rural Residence

The classification of urban and rural places of residence is based on the definitions used by the national statistical office in each country. Therefore, the size of towns and cities defined as urban may differ from one country to another.

Table 5.5 Undernutrition by mother's age

Percentage of children age 3-35 months who are stunted, wasted, or underweight by mother's age at child's birth, Demographic and Health Surveys, 1986-1989

	Percent stunted			Percent wasted			Percent underweight			Number of children		
	Mother's age:			Mother's age:			Mother's age:			Mother's age:		
Country	<20 years	20-34 years	35+ years	<20 years	20-34 years	35+ years	<20 years	20-34 years	35+ years	<20 years	20-34 years	35+ years
SUB-SAHARAN AFRICA												
Burundi	50.4	47.5	46.1	6.0	5.3	7.0	35.8	37.3	39.1	95	1452	342
Ghana	30.4	29.2	29.6	7.0	7.7	10.5	30.7	29.7	32.4	270	1278	247
Mali	28.2	23.0	22.1	8.9	12.9	7.9	30.5	31.4	26.8	166	611	132
Ondo State, Nigeria[1]	39.7	30.8	33.5	10.3	5.6	6.1	39.0	24.2	32.4	136	932	278
Senegal[1]	15.7	24.1	27.3	4.3	6.5	4.5	20.0	21.9	25.0	115	415	88
Togo	38.8	28.5	32.8	7.2	5.7	3.4	29.5	24.9	27.0	237	870	174
Uganda	40.5	45.5	39.7	0.9	2.7	2.1	20.4	26.6	24.9	502	1558	267
Zimbabwe	29.3	28.9	35.5	0.4	1.2	2.2	13.6	12.0	15.3	242	1071	183
NEAR EAST/ NORTH AFRICA												
Egypt	15.3	12.8	14.8	1.3	1.1	1.1	34.4	30.4	29.9	262	1419	204
Morocco	28.3	23.5	21.9	2.7	3.4	5.4	14.6	13.4	16.3	226	1849	448
Tunisia	14.2	18.0	18.9	1.8	2.9	3.9	8.0	10.5	9.7	113	1598	259
ASIA												
Sri Lanka	30.5	26.4	30.6	11.5	11.9	9.5	42.7	36.6	36.9	200	1550	212
Thailand	21.6	20.7	29.0	6.9	4.9	5.8	28.5	23.7	33.4	341	1335	133
LATIN AMERICA/ CARIBBEAN												
Bolivia	31.5	38.0	42.8	2.3	1.5	1.5	14.9	11.3	20.5	397	1735	379
Brazil (NE)[1]	18.1	29.9	39.3	1.0	0.4	4.5	6.7	14.6	20.2	93	400	79
Colombia	30.2	23.4	31.1	2.8	0.8	2.6	14.8	10.6	17.5	236	941	122
Dominican Republic[2]	20.5	20.1	25.7	3.1	2.1	1.8	12.0	12.2	15.5	402	1237	129
Guatemala[1]	56.8	57.4	61.2	0.5	1.2	3.6	29.5	32.9	40.8	407	1550	250
Trinidad and Tobago	2.8	5.3	4.5	4.2	3.8	3.0	4.2	7.1	6.1	143	608	66
Median	29.3	26.4	30.6	3.1	3.4	3.9	20.4	23.7	25.0			

Note: Children are classified as stunted, wasted, or underweight if their height-for-age, weight-for-height, or weight-for-age Z-score is below -2 SD from the median of the International Reference Population (WHO/CDC/NCHS).
[1]Women 15-44
[2]6-35 months

There are marked and consistent differences in the levels of undernutrition in rural compared with urban areas: stunting is considerably more common in rural areas in all countries but one (see Table 5.6 and Figure 5.2). In Trinidad and Tobago, where few children are undernourished, there is no difference between rural and urban areas. The median level of stunting across all countries in urban areas is 21 percent, compared to 31 percent in rural areas. In only 2 countries does the level of stunting exceed 30 percent in urban areas (Bolivia and Guatemala), in contrast to rural areas where 11 countries have levels that high. Over 40 percent of urban children are stunted in just one country, Guatemala, while more than 40 percent of rural children are stunted in Bolivia, Burundi, Guatemala, and Uganda.

Wasting is also more prevalent in rural than urban areas in 9 of the 11 countries where the overall levels of wasting exceed those of the reference population (i.e., more than 2.3 percent). The only exceptions are Burundi and Tunisia, where there is slightly more wasting in urban than rural areas.

The urban-rural pattern for underweight is similar to that for stunting. Rural levels of underweight are higher than urban levels in all 19 countries. Median levels of underweight across all countries are 12 percent in urban areas and 26 percent in rural areas.

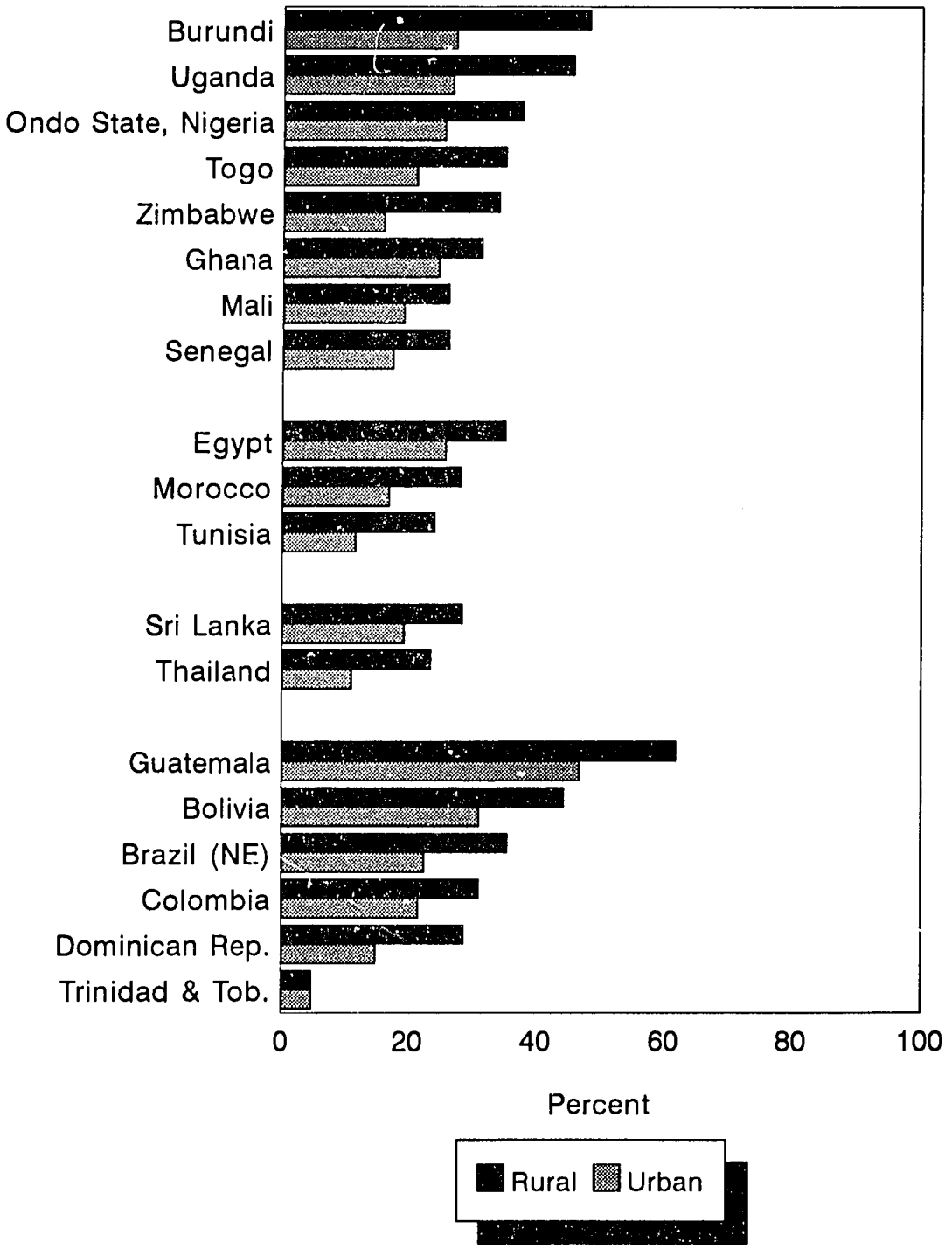
Table 5.6 Undernutrition by urban-rural residence

Percentage of children age 3-35 months who are stunted, wasted, or underweight by urban-rural residence, Demographic and Health Surveys, 1986-1989

Country	Percent stunted		Percent wasted		Percent underweight		Number of children	
	Urban	Rural	Urban	Rural	Urban	Rural	Urban	Rural
SUB-SAHARAN AFRICA								
Burundi	27.2	48.0	6.5	5.6	19.9	38.1	59	1830
Ghana	24.6	31.3	7.1	8.4	24.6	32.5	505	1290
Mali	19.2	26.2	9.9	12.2	25.1	33.3	307	603
Ondo State, Nigeria[1]	25.5	37.6	4.5	7.5	21.0	32.5	596	750
Senegal[1]	17.5	26.2	3.5	7.2	14.9	26.2	228	390
Togo	21.2	35.0	4.0	6.4	16.7	29.9	372	909
Uganda	26.7	45.5	1.3	2.3	15.6	26.0	213	2114
Zimbabwe	16.0	34.0	1.4	1.1	6.9	14.4	350	1146
NEAR EAST/ NORTH AFRICA								
Egypt	25.7	35.1	1.4	1.0	8.9	16.9	834	1051
Morocco	16.9	28.1	1.9	4.9	8.2	17.8	1003	1520
Tunisia	11.7	24.1	3.4	2.6	6.8	13.7	983	987
ASIA								
Sri Lanka	19.4	28.4	10.8	11.7	27.0	38.9	260	1702
Thailand	11.1	23.5	4.4	5.5	11.5	28.1	302	1507
LATIN AMERICA/ CARIBBEAN								
Bolivia	31.1	44.3	1.2	2.0	10.6	15.9	1260	1252
Brazil (NE)	22.6	35.5	1.6	0.6	11.1	16.9	278	294
Colombia	21.6	31.1	1.5	1.0	10.1	14.9	786	516
Dominican Republic[1]	14.9	28.7	2.2	2.5	9.2	16.9	1034	734
Guatemala	46.8	61.9	1.3	1.3	25.2	36.2	615	1592
Trinidad and Tobago	4.8	4.8	2.4	4.8	4.2	8.1	333	484
Median	21.2	31.3	2.4	4.8	11.5	26.0		

Note: Children are classified as stunted, wasted, or underweight if their height-for-age, weight-for-height, or weight-for-age Z-score is below -2 SD from the median of the International Reference Population (WHO/CDC/NCHS).
[1]6-35 months

Figure 5.2 Stunting among children age 3-35 months by urban-rural residence, Demographic and Health Surveys, 1986-1989



Note: Children are classified as stunted if their height-for-age Z-score is below -2SD from the median of the International Reference Population (WHO/CDC/NCHS)

Mother's Education

Mother's education is defined here as the highest level of schooling attended, regardless of whether the woman completed that level. Thus, women identified as having primary education have attended, but not necessarily completed, primary school. Secondary and higher education have been combined into one category since few women have achieved higher levels of education in most countries.

There is a negative association between the mother's education and the likelihood that her children are undernourished: the higher the level of education, the lower the percentage classified as undernourished (see Table 5.7). Stunting consistently is most prevalent among children whose mothers received no formal schooling and least prevalent among children of mothers with secondary or higher education. Children whose mothers attended primary school show intermediate levels of undernutrition. The decline in the levels of stunting with increasing maternal education is not always gradual. In some countries stunting levels are fairly similar for children whose mothers attended primary or secondary school, while elsewhere there is a greater similarity between children whose mothers attended primary school or had no formal schooling. Median levels of stunting across all countries range from 36 percent for children of mothers with no education, to 29 percent for children whose mothers had some primary education, to 16 percent for children of mothers with secondary or higher education.

Table 5.7 Undernutrition by mother's education

Percentage of children age 3-35 months who are stunted, wasted, or underweight by mother's level of education, Demographic and Health Surveys, 1986-1989

Country	Percent stunted			Percent wasted			Percent underweight			Number of children		
	Mother's education:			Mother's education:			Mother's education:			Mother's education:		
	No education	Primary	Secondary or higher	No education	Primary	Secondary or higher	No education	Primary	Secondary or higher	No education	Primary	Secondary or higher
SUB-SAHARAN AFRICA												
Burundi	48.5	45.4	24.6	5.7	5.4	5.7	38.9	34.0	19.5	1518	322	50
Ghana	32.1	28.7	15.2	7.8	8.7	2.2	32.0	29.7	21.7	731	972	92
Mali	24.8	19.5	*	12.0	9.6	*	31.6	25.9	*	734	164	12
Ondo State, Nigeria[1]	33.4	33.7	27.7	6.9	6.2	4.6	29.6	27.9	22.4	592	451	303
Senegal[1]	25.3	12.0	14.7	7.0	1.2	0.0	24.8	12.0	5.9	501	83	34
Togo	33.2	29.2	23.1	7.4	3.5	2.2	31.5	19.3	13.4	774	373	134
Uganda	46.1	44.3	27.4	2.9	1.9	1.0	28.5	23.7	15.8	953	1197	177
Zimbabwe	37.7	31.5	17.5	2.3	1.2	0.3	20.8	12.4	6.3	265	929	302
NEAR EAST/ NORTH AFRICA												
Egypt	35.6	28.9	23.7	1.3	1.2	0.6	16.2	13.9	5.9	878	622	386
Morocco	26.0	16.1	8.7	4.2	1.5	1.6	15.9	5.9	4.4	2065	273	183
Tunisia	22.1	14.9	5.0	2.9	2.9	3.9	12.2	9.3	2.2	1072	718	180
ASIA												
Sri Lanka	49.7	33.9	20.9	10.0	12.5	11.4	51.6	43.5	32.3	176	569	1217
Thailand	25.5	23.2	9.6	8.6	5.5	2.4	35.7	26.9	10.7	139	1416	254
LATIN AMERICA/ CARIBBEAN												
Bolivia	55.7	40.4	22.3	2.8	1.2	1.5	22.9	13.6	6.9	450	1304	758
Brazil (NE)	44.2	28.3	11.0	2.5	0.9	0.0	22.5	13.8	2.4	106	390	73
Colombia	39.6	30.0	14.6	1.0	1.4	1.3	16.1	14.2	7.4	98	748	456
Dominican Republic[1]	35.6	25.0	8.0	2.3	3.1	0.6	19.2	14.8	5.7	100	1149	519
Guatemala	68.4	51.7	25.0	1.6	1.2	0.0	42.0	27.4	11.0	1064	971	172
Trinidad and Tobago	*	5.3	4.1	*	4.0	3.4	*	6.8	5.6	6	399	411
Median	35.6	28.9	16.4	3.6	2.9	1.6	26.7	14.8	7.2			

Note: Children are classified as stunted, wasted, or underweight if their height-for-age, weight-for-height, or weight-for-age Z-score is below -2 SD from the median of the International Reference Population (WHO/CDC/NCHS).

* Less than 25 unweighted cases

[1]6-35 months

In 7 of the 11 countries where overall wasting levels exceed 2.3 percent (Table 4.1), the prevalence of wasting is highest for children of mothers without any formal education.

The pattern of underweight by mother's education is similar to that seen for stunting. In all countries, children of mothers without formal education are most likely to be underweight, while children of mothers with secondary or higher education are least likely to be underweight. Median levels of underweight across all countries are 27 percent for children of mothers lacking formal education, 15 percent for children whose mothers had some primary education, and 7 percent for children whose mothers had attended secondary school.

Mother's Work Status

All the surveys discussed in this report questioned women about their work, although the format differed somewhat from country to country. This analysis focuses on whether the mother was working at the time of the survey, which most of the questionnaires defined as working for cash wages. In two-thirds of the surveys, stunting is more prevalent among children whose mothers did not work (see Table 5.8). Wasting and underweight also tend to be more common among the children of non-working mothers.

Table 5.8 Undernutrition by mother's work status

Percentage of children age 3-35 months who are stunted, wasted, or underweight by mother's work status, Demographic and Health Surveys, 1986-1989

Country	Percent stunted		Percent wasted		Percent underweight		Number of children	
	Mother working	Mother not working	Mother working	Mother not working	Mother working	Mother not working	Mother working	Mother not working
SUB-SAHARAN AFRICA								
Burundi	34.4	48.0	6.9	5.6	22.3	38.2	78	1810
Ghana	30.7	27.9	8.3	7.7	30.0	30.6	977	818
Mali	16.6	26.0	8.6	12.3	24.5	32.4	207	701
Ondo State, Nigeria[1]	33.7	29.6	6.1	6.4	27.6	27.0	876	470
Senegal[1]	25.3	22.2	4.8	6.2	20.5	22.6	166	451
Togo	31.1	30.6	6.7	3.3	27.7	22.0	916	363
Uganda	35.5	44.5	1.3	2.3	25.1	25.1	189	2138
Zimbabwe	27.5	31.0	1.6	1.0	11.2	13.4	510	986
NEAR EAST/ NORTH AFRICA								
Egypt	28.9	31.2	0.4	1.2	8.8	14.0	231	1654
Morocco	14.4	24.1	0.0	3.9	4.8	14.5	125	2398
Tunisia	12.9	18.3	0.6	3.2	7.7	10.5	155	1815
ASIA								
Sri Lanka	38.9	25.4	8.7	12.1	39.4	36.9	272	1691
Thailand	21.5	21.5	5.8	4.7	27.1	23.4	938	870
LATIN AMERICA/ CARIBBEAN								
Bolivia	34.7	38.4	1.4	1.7	11.2	13.7	463	2049
Brazil (NE)	30.2	28.9	0.5	1.3	14.6	13.9	170	402
Colombia	23.8	25.6	0.0	1.5	10.1	12.3	187	1114
Dominican Republic[1]	12.6	22.4	1.0	2.6	9.3	13.1	320	1448
Guatemala	52.2	58.5	2.4	1.1	31.3	33.5	291	1916
Trinidad and Tobago	3.8	5.0	2.5	4.1	3.1	7.3	160	654
Median	28.9	27.9	2.4	3.3	20.5	22.0		

Note: Children are classified as stunted, wasted, or underweight if their height-for-age, weight-for-height, or weight-for-age Z-score is below -2 SD from the median of the International Reference Population (WHO/CDC/NCHS).
[1]6-35 months

Radio Ownership

Surveys asked whether a radio was present in the household in all countries except Egypt and Bolivia. Ownership of a radio is used as a simple indicator of socioeconomic status: families who own a radio are likely to be better off than families who do not. They may also have greater exposure to health education messages about the management of common childhood illnesses, infant feeding practices, and the importance of vaccinating young children.

Undernutrition is associated with lack of a radio in the household in all countries (see Table 5.9). Stunting is more common in households that lack a radio: the median figures for stunting across all countries are 32 percent among children without a radio in the household and 23 percent where a radio is present. Levels of wasting also tend to be higher when a child's family does not own a radio. Underweight follows the same pattern as does stunting, with every country showing a higher prevalence among children living in households without a radio. The median level of underweight is 27 percent when there is no radio, compared to 20 percent when a radio is present.

Table 5.9 Undernutrition by radio ownership

Percentage of children age 3 35 months who are stunted, wasted, or underweight by presence of radio in the household, Demographic and Health Surveys, 1986-1989

Country	Percent stunted		Percent wasted		Percent underweight		Number of children	
	Radio	No radio	Radio	no radio	Radio	No radio	Radio	No radio
SUB-SAHARAN AFRICA								
Burundi	37.6	49.7	3.2	6.3	26.5	40.1	359	1530
Ghana	25.9	31.6	8.6	7.7	26.6	32.5	687	1108
Mali	19.0	29.6	10.7	12.4	25.6	36.5	493	416
Ondo State, Nigeria[1]	29.2	37.3	5.4	7.5	22.9	34.9	839	507
Senegal[1]	21.5	28.8	5.3	8.0	20.7	27.2	493	125
Togo	27.1	34.8	3.9	7.5	21.2	30.9	641	640
Uganda	37.5	46.3	0.3	3.0	20.2	27.0	668	1659
Zimbabwe	22.8	34.4	0.8	1.4	9.0	15.0	591	905
NEAR EAST/ NORTH AFRICA								
Egypt	U	U	U	U	U	U	U	U
Morocco	22.6	28.7	3.5	4.7	13.6	15.8	2080	443
Tunisia	15.8	22.6	2.9	3.3	8.7	13.7	1364	606
ASIA								
Sri Lanka	24.9	33.2	10.9	13.5	35.3	42.5	1409	553
Thailand	18.1	29.3	5.6	4.6	23.3	30.2	1262	544
LATIN AMERICA/ CARIBBEAN								
Bolivia	U	U	U	U	U	U	U	U
Brazil (NE)	28.0	31.7	0.9	1.3	13.5	15.2	373	198
Colombia	22.5	37.0	1.1	2.2	10.6	17.3	1044	256
Dominican Republic[1]	18.3	24.1	2.0	2.8	9.5	16.8	1065	702
Guatemala	53.0	64.8	1.1	1.7	29.9	38.0	1329	878
Trinidad and Tobago	4.6	6.1	3.8	3.7	6.3	8.5	733	82
Median	22.6	31.6	3.2	3.7	20.2	27.0		

Note: Children are classified as stunted, wasted, or underweight if their height-for-age, weight-for-height, or weight-for-age Z-score is below -2 SD from the median of the International Reference Population (WHO/CDC/NCHS).
U = Unknown (not available)
[1]6-35 months

Source of Drinking Water

Drinking water was divided into three categories based on its source. The best source is water piped onto the premises, either into the house or the yard. Intermediate sources include public taps and all wells. Surface water (rivers, lakes, streams, canals, etc.) is the least desirable source of drinking water. Since not all questionnaires differentiated between protected and unprotected wells, this coding scheme provides the most consistent categories across countries.

Children from households with piped drinking water are less likely to be stunted than other children with two exceptions (see Table 5.10). In the Dominican Republic, stunting is least common among children in households which obtain drinking water from a well or public tap. In Egypt, the lowest levels are seen for those using surface water. Stunting is most prevalent when the source of drinking water is surface water or a well or public tap. The median level of stunting across all countries for children whose drinking water supply was piped into their house or yard is 19 percent, while the corresponding figures are 30 and 31 percent, respectively, for children drinking well or public tap water and children drinking surface water.

The proportion of children who are classified as wasted tends to be highest when surface water is the main source of drinking water, but this pattern is not entirely consistent. In 11 of the 19 countries, wasting is least common among children with piped drinking water.

Table 5.10 Undernutrition by source of drinking water

Percentage of children age 3-35 months who are stunted, wasted, or underweight by source of hoursehold drinking water, Demographic and Health Surveys, 1986-1989

	Percent stunted			Percent wasted			Percent underweight			Number of children		
Country	Piped water (house or yard)	Public tap or well	Surface water[1]	Piped water (house or yard)	Public tap or well	Surface water[1]	Piped water (house or yard)	Public tap or well	Surface water[1]	Piped water (house or yard)	Public tap or well	Surface water[1]
SUB-SAHARAN AFRICA												
Burundi	13.4	45.5	48.2	2.7	5.2	5.8	9.9	31.8	38.7	26	209	1654
Ghana	23.2	34.6	30.5	6.6	9.8	8.0	24.3	34.6	31.5	470	367	958
Mali	14.8	24.1	24.6	9.9	10.7	15.3	24.6	30.3	33.3	35	721	154
Ondo State, Nigeria[2]	25.3	29.6	35.2	5.1	5.9	6.5	19.0	25.3	30.2	79	574	693
Senegal[2]	17.5	25.9	19.7	6.3	6.2	4.9	16.2	25.1	18.6	80	355	183
Togo	(22.0)	31.3	31.3	(2.4)	5.3	6.8	(12.2)	25.2	29.5	41	860	380
Uganda	18.6	40.7	48.7	2.0	1.9	2.7	12.8	23.6	27.3	57	1213	1056
Zimbabwe	20.0	32.1	47.5	1.3	1.0	2.2	8.5	14.7	12.9	461	896	139
NEAR EAST/ NORTH AFRICA												
Egypt	30.2	33.7	29.7	1.0	1.4	1.6	11.4	18.1	18.3	1341	409	136
Morocco	14.5	26.1	31.3	1.8	5.3	3.3	7.2	16.7	17.9	795	1120	608
Tunisia	11.4	23.4	24.6	3.0	2.8	3.3	6.8	12.7	14.5	940	636	394
ASIA												
Sri Lanka	16.8	27.6	33.1	5.5	12.1	11.6	21.1	38.4	40.8	149	1643	171
Thailand	12.7	26.1	18.3	3.4	5.6	6.2	14.3	30.0	23.8	345	980	484
LATIN AMERICA/ CARIBBEAN												
Bolivia	33.0	45.3	35.4	0.8	1.6	2.7	9.7	16.7	14.2	996	822	694
Brazil (NE)	19.4	33.0	36.5	0.4	0.9	1.8	10.7	16.5	16.1	223	96	252
Colombia	21.0	29.4	32.4	1.4	0.6	1.7	9.7	13.3	16.5	745	238	318
Dominican Republic[2]	19.0	14.5	28.2	2.4	1.8	2.2	11.7	11.0	15.3	1224	155	389
Guatemala	46.9	65.1	62.3	1.2	1.5	1.1	24.8	38.9	36.8	816	853	538
Trinidad and Tobago	3.5	8.4	7.0	3.9	2.3	5.2	5.6	6.1	11.3	571	131	115
Median	19.0	29.6	31.3	2.4	2.8	3.3	11.7	23.6	18.6			

Note: Children are classified as stunted, wasted, or underweight if their height-for-age, weight-for-height, or weight-for-age Z-score is below -2 SD from the median of the International Reference Population (WHO/CDC/NCHS).
( ) Figures in parentheses are based on 25 to 49 unweighted cases
[1]Surface water includes river, lake, stream, canal, etc.
[2]6-35 months

The proportion of children classified as underweight is lowest when drinking water is piped onto the premises except in the Dominican Republic. Median levels of underweight across all countries are 12, 24, and 19 percent, respectively, for children drinking piped water, water from a well or public tap, and surface water.

Sanitation Facilities

Sanitation facilities were also classified into three groups: flush toilets, latrines of any type, and no toilet. The "other" category was classified as "no toilet" in these analyses. "Other" accounted for a substantial proportion of responses only in Bolivia, where the questionnaire did not include a code for no toilet facility. In the remaining countries only a small fraction of the responses fell into the "other" category.

There are consistent differences in the prevalence of stunting and underweight by the type of toilet facility used by the child's family (Table 5.11). In all countries except Egypt, stunting is least common when the child's family had a flush toilet; the median level of stunting in these circumstances is 17 percent. Stunting is

Table 5.11 Undernutrition by type of sanitation facilities

Percentage of children age 3-35 months who are stunted, wasted, or underweight by type of household sanitation facilities, Demographic and Health Surveys, 1986-1989

Country	Percent stunted			Percent wasted			Percent underweight			Number of children		
	Flush toilet	Latrine	No toilet	Flush toilet	Latrine	No toilet	Flush toilet	Latrine	No toilet	Flush toilet	Latrine	No toilet
SUB-SAHARAN AFRICA												
Burundi	*	47.6	50.2	*	5.7	4.4	*	37.7	41.1	20	1791	78
Ghana	10.7	28.2	34.7	3.6	7.7	9.2	16.1	29.1	34.9	56	1252	487
Mali	*	21.0	30.8	*	10.4	14.0	*	27.1	39.2	3	631	273
Ondo State, Nigeria[1]	20.9	30.9	36.0	4.5	5.6	7.1	14.9	24.8	32.6	134	589	623
Senegal[1]	(13.6)	20.1	27.5	(2.3)	7.4	4.7	(9.1)	22.5	23.6	44	298	276
Togo	(16.7)	19.1	34.0	(2.4)	3.8	6.2	(7.1)	15.3	29.1	42	209	1028
Uganda	16.8	43.5	49.7	1.7	2.3	2.3	11.9	24.9	28.0	68	1860	398
Zimbabwe	15.9	29.5	38.9	1.3	0.8	1.5	5.8	13.9	15.8	395	488	612
NEAR EAST/NORTH AFRICA												
Egypt	29.3	40.5	22.6	0.9	1.3	3.6	11.1	22.1	17.2	1452	331	103
Morocco	17.5	24.0	30.4	2.1	2.5	5.6	9.7	13.2	18.8	1261	121	1141
Tunisia	12.8	20.8	25.5	3.4	0.9	3.1	7.4	12.8	14.2	1094	226	650
ASIA												
Sri Lanka	19.7	28.7	37.5	9.6	12.2	13.8	29.2	38.6	48.8	749	775	439
Thailand	17.6	21.7	26.9	4.3	6.2	6.6	20.0	25.9	32.8	1028	50	730
LATIN AMERICA/CARIBBEAN												
Bolivia	18.9	30.8	48.6	1.7	1.4	1.6	6.3	12.0	16.8	642	458	1409
Brazil (NE)	11.0	25.5	40.1	0.0	2.1	1.0	6.2	13.0	18.4	128	170	273
Colombia	19.9	35.8	35.0	1.4	0.0	1.5	9.3	15.4	17.1	832	97	367
Dominican Republic[1]	6.9	23.4	30.9	0.8	2.3	4.2	4.6	13.1	20.4	475	905	388
Guatemala	35.4	61.8	65.0	1.8	1.0	1.4	16.7	35.4	39.4	449	889	869
Trinidad and Tobago	2.1	7.2	*	3.1	4.4	*	3.9	8.6	*	386	428	1
Median	16.8	28.2	34.9	2.1	3.8	4.3	9.3	22.1	25.8			

Note: Children are classified as stunted, wasted, or underweight if their height-for-age, weight-for-height, or weight-for-age Z-score is below -2 SD from the median of the International Reference Population (WHO/CDC/NCHS).
* Less than 25 unweighted cases
( ) Figures in parentheses are based on 25 to 49 unweighted cases
[1]6-35 months

most common when the child's mother reported no toilet facility, except in Egypt and Colombia, where stunting is greatest among children whose family used a latrine. Median levels of stunting across all countries are 35 percent for children from families with no toilet facilities and 28 percent for children from households with a latrine.

The proportion of children classified as wasted tends to be highest among children whose family reported no toilet facility, although this pattern is not observed in all countries.

Everywhere except Egypt, underweight is most prevalent among children from families who have no toilet facility. The median level of underweight across all countries for these children is 26 percent, compared to 22 and 9 percent, respectively, for children from households with a latrine or flush toilet.

5.3 RECENT ILLNESS

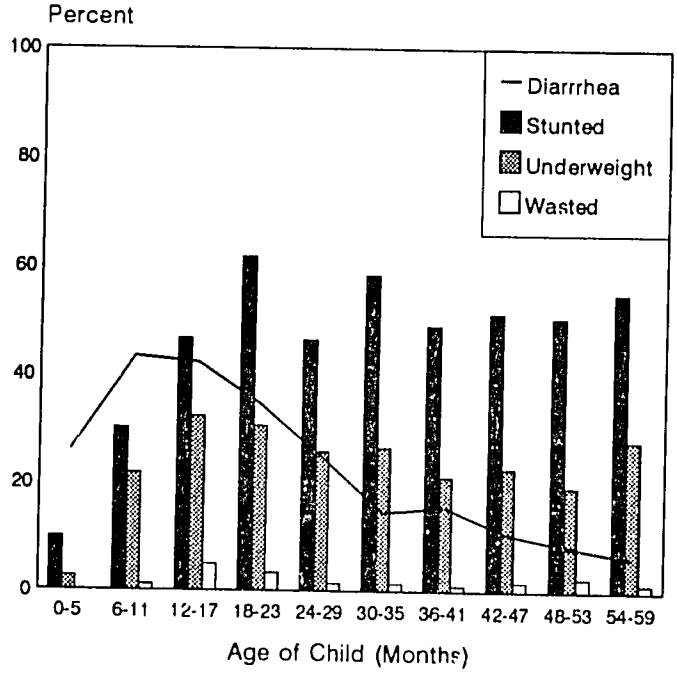
Diarrhea

Most DHS-I surveys asked about diarrheal illness during the preceding 24 hours and the preceding two weeks. The questionnaires in Senegal and Ondo State, Nigeria did not ask about the 24-hour period, and the questionnaire in Egypt substituted one week for the standard two-week period. Childhood morbidity and treatment patterns in DHS-I countries have been described by Boerma et al. (1991).

DHS surveys do not collect information about chronic or recurrent illness, which would be expected to show an even higher degree of correlation with poor nutritional status than is seen for recent illness. Children who suffer from chronic diarrhea, however, are likely to be included among the children with diarrhea during the two weeks preceding the survey.

Diarrhea is an important contributory cause of undernutrition in young children. The striking deterioration in nutritional status during the first and second years of life parallels diarrhea prevalence levels (see Table 5.1, Figure 5.3). Using Uganda as an example, Figure 5.3 illustrates this temporal relationship between the prevalence of diarrhea and increasing levels of undernutrition for children under five years of age. The graph shows the percentage of children in each age group reported to have had diarrhea in the two weeks before the interview. Only children whose nutritional status is analyzed here are included. Stunting, wasting and underweight levels are also shown. The prevalence of diarrhea peaks among children age 6-17 months and declines steadily with increasing age. The percentage classified as underweight is highest among children age 12-23 months, at about 30 percent, and then decreases to about 20 percent. High levels of stunting (about 50 percent) are seen by the end of the second year with no evidence of improvement thereafter.

Figure 5.3 Diarrhea and undernutrition among children under five by age group, Uganda, 1988-89



Note: Children are classified as stunted, underweight, or wasted if their height-for-age, weight-for-age, or weight-for-height Z-score is below -2SD from the median of the International Reference Population (WHO/CDC/NCHS).

Table 5.12 shows the association between undernutrition and recent diarrhea for children 12-35 months of age. The prevalence of stunting is higher among children who experienced diarrhea during the two weeks preceding the survey in all but two countries (Bolivia and Trinidad and Tobago). Median levels of stunting across all countries are 38 percent among children who had diarrhea and 32 percent for children who did not. The proportion classified as wasted is also higher among children with recent diarrhea in all countries except Colombia and Zimbabwe. The difference in the prevalence of wasting between children with and without recent diarrhea reaches 16 percentage points in Ondo State, Nigeria and is 4 percentage points or more in Burundi, Senegal, Sri Lanka, and Thailand. Children with recent diarrhea are also more likely to be underweight than children without diarrhea in all countries except Trinidad and Tobago: the median levels for the two groups across all countries are 31 and 24 percent, respectively.

A further analysis of the children who had diarrhea in the past two weeks compared levels of undernutrition among children who were still sick at the time of the interview (i.e., had diarrhea in the last 24 hours) and children whose episode of diarrhea had terminated. There is no consistent pattern in the levels of stunting and underweight according to whether the diarrhea episode had terminated or was still ongoing (data not shown). In most countries, however, wasting levels are higher among children reporting diarrhea in the last 24 hours than among those whose episode ended during the previous two weeks.

Other Childhood Illnesses

Nine surveys also asked questions about other childhood illnesses, including fever and cough during the four weeks preceding the interview. These questions were asked in all the sub-Saharan countries as well as in Colombia. In Mali and Togo the question on respiratory illness referred to "difficult or rapid breathing" but did not mention cough.

Table 5.12 Undernutrition by occurrence of recent diarrhea

Percentage of children age 12-35 months who are stunted, wasted, or underweight by occurrence of diarrhea in the last two weeks, Demographic and Health Surveys, 1986-1989

Country	Percent stunted		Percent wasted		Percent underweight		Number of children	
	Diarrhea[1]	No Diarrhea	Diarrhea[1]	No diarrhea	Diarrhea[1]	No diarrhea	Diarrhea[1]	No diarrhea
SUB-SAHARAN AFRICA								
Burundi	57.2	53.9	11.0	5.6	48.0	42.6	263	1052
Ghana	38.8	36.8	11.1	7.9	41.8	33.8	433	826
Mali	34.7	29.7	15.3	12.9	43.9	33.0	227	295
Ondo State, Nigeria	39.7	38.9	22.1	5.8	47.1	29.7	68	956
Senegal	28.2	27.2	9.1	5.3	31.4	24.4	220	246
Togo	38.4	36.2	8.4	6.2	34.4	28.3	323	552
Uganda	58.4	49.9	4.3	2.3	36.0	25.9	500	1080
Zimbabwe	40.5	32.3	0.7	1.7	21.0	13.9	291	801
NEAR EAST/NORTH AFRICA								
Egypt	40.2	32.8	1.2	0.9	17.9	12.8	287	1059
Morocco	31.1	29.0	5.2	3.1	22.2	13.9	618	1074
Tunisia	23.1	20.1	3.0	2.2	15.9	9.6	372	1036
ASIA								
Sri Lanka	35.9	32.0	19.4	14.3	53.2	44.0	111	1340
Thailand	31.4	23.5	10.2	5.9	37.9	27.9	260	1082
LATIN AMERICA/CARIBBEAN								
Bolivia	45.2	45.9	2.0	1.4	19.0	14.1	670	1150
Northeast Brazil	38.8	32.3	3.0	0.3	23.1	12.9	119	287
Colombia	38.2	26.5	0.8	1.3	18.2	12.3	223	745
Dominican Republic	29.9	20.5	2.6	1.9	18.7	11.7	432	969
Guatemala	70.5	68.0	2.7	1.3	44.9	40.3	332	1214
Trinidad and Tobago	3.9	4.8	3.9	3.7	5.9	6.9	51	547
Median	38.4	32.3	4.3	3.1	31.4	24.4		

Note: Children are classified as stunted, wasted, or underweight if their height-for-age, weight-for-height, or weight-for-age Z-score is below -2 SD from the median of the International Reference Population (WHO/CDC/NCHS).
U = Unknown (not available)
[1]Includes children who had diarrhea in the last 24 hours

Table 5.13 looks at undernutrition according to the recent illnesses reported by the mother. Children 12-35 months old were classified into three groups: those with recent diarrhea (regardless of whether or not they also had fever and/or cough), those with fever and/or cough in the last four weeks but no diarrhea, and those with no illness. The levels of stunting are highest among children with recent diarrhea in six countries. Stunting is least common among children who had fever and/or cough but no diarrhea and those without any recent illness. Wasting also tends to be most common among children who have had recent episodes of diarrhea. Levels of underweight are similar to those seen for stunting: in all countries, underweight is highest among children who have recently had diarrhea.

Table 5.13 Undernutrition by occurrence of recent illnesses

Percentage of children age 12-35 months who are stunted, wasted, or underweight by occurrence of recent illness (diarrhea and fever or cough) in the last two to four weeks, Demographic and Health Surveys, 1986-1989

Country	Percent stunted			Percent wasted			Percent underweight			Number of children		
	Diarrhea[1]	Fever or cough (no diarrhea)	No illness	Diarrhea[1]	Fever or cough (no diarrhea)	No illness	Diarrhea[1]	Fever or cough (no diarrhea)	No illness	Diarrhea[1]	Fever or cough (no diarrhea)	No illness
Burundi	57.2	55.8	52.5	11.0	5.3	5.8	48.0	41.7	43.2	263	453	599
Ghana	38.8	37.3	36.3	11.1	7.7	8.1	41.8	33.3	34.2	433	405	421
Mali	34.7	28.9	30.1	15.3	19.1	0.2	43.9	37.9	30.8	227	90	205
Ondo State, Nigeria	39.7	34.9	40.5	22.1	4.7	6.2	47.1	28.7	30.1	68	275	681
Senegal	28.2	23.4	32.7	9.1	5.5	5.0	31.4	24.8	23.8	220	145	101
Togo	38.4	44.9	35.4	8.4	0.0	6.8	34.4	28.6	28.2	323	49	503
Uganda	58.4	51.0	48.7	4.3	3.3	1.2	36.0	30.2	21.2	500	569	511
Zimbabwe	40.5	35.8	31.8	0.7	0.9	1.9	21.0	13.8	13.9	291	109	692
Colombia	38.2	27.4	26.3	0.8	2.2	0.9	18.2	13.1	12.0	223	217	528
Median	38.8	35.8	35.4	9.1	4.7	5.8	36.0	28.7	28.2			

Note: Children are classified as stunted, wasted, or underweight if their height-for-age, weight-for-height, or weight-for-age Z-score is below -2 SD from the median of the International Reference Population (WHO/CDC/NCHS).
[1]Children who had diarrhea in the last two weeks (including the last 24 hours) whether or not they also had fever or cough.

5.4 VACCINATION HISTORY

Health Card

Possessing a health card indicates some contact with health services as well as a greater chance of being vaccinated. Respondents were asked whether they had a written vaccination record (or health card) for each child born during the five years preceding the survey. If so, they were asked to show it to the interviewer. It is recommended that the first vaccination be given to an infant soon after birth, and mothers should receive a child's vaccination record at this time. DHS surveys have found, however, that mothers are less likely to show a health card to the interviewer for children under 6 months of age than for older children (Boerma et al., 1990). Therefore, levels of undernutrition by health card status are examined only for children 12-35 months of age.

In all but two surveys (Burundi and Ondo State, Nigeria), stunting is substantially more common among children without a card (see Table 5.14). The median level of stunting across all countries is 41 percent for children whose mothers did not have a vaccination card, compared to 32 percent for children whose mothers reportedly received one. This latter category includes children whose card was not seen by the interviewer. Wasting levels are highest for children without a card in all but two of those countries where wasting levels exceed those in the reference population. Underweight follows a pattern similar to that described for stunting. The median level of underweight across all countries is 34 percent for children without a vaccination card, compared with 22 percent for children with a card.

A separate analysis looked at the differences in nutritional levels for two groups of children who both reportedly had vaccination cards: those whose mother actually showed the card to the interviewer and those whose mother reported having a card but did not show it. There are only small differences in the level of stunting between these two groups (data not shown). Stunting tended to be slightly less common among children whose mothers actually showed a health card to the interviewer than the others.

Table 5.14 Undernutrition by vaccination card status

Percentage of children age 12-35 months who are stunted, wasted, or underweight by whether mother reported having a vaccination card for the child, Demographic and Health Surveys, 1986-1989

Country	Percent stunted		Percent wasted		Percent underweight		Number of children	
	Vaccination card[1]	No vaccination card	Vaccination card[1]	No vaccination card	Vaccination card[1]	No vaccination card	Vaccination card[1]	No vaccination card
SUB-SAHARAN AFRICA								
Burundi	55.1	53.1	7.1	5.6	43.9	43.1	981	333
Ghana	34.5	43.5	8.8	9.3	33.5	42.6	841	418
Mali	23.7	37.9	11.2	16.0	31.5	42.3	221	301
Ondo State, Nigeria	37.4	33.7	6.1	9.1	28.6	37.7	772	252
Senegal	22.1	33.6	5.4	8.8	22.1	33.6	240	226
Togo	36.9	39.3	6.8	8.9	30.2	35.7	819	56
Uganda	51.0	56.7	2.9	3.1	27.0	34.6	1137	443
Zimbabwe	33.6	51.9	1.2	7.4	15.4	22.2	1038	54
NEAR EAST/NORTH AFRICA								
Egypt	34.4	*	1.0	*	13.7	*	1332	14
Morocco	27.8	34.1	3.0	5.8	14.1	23.3	1176	516
Tunisia	19.9	36.7	2.6	0.0	11.0	15.2	1329	79
ASIA								
Sri Lanka	32.0	40.5	14.6	17.3	44.4	51.7	1399	53
Thailand	19.1	30.7	6.1	7.3	25.2	34.3	658	684
LATIN AMERICA/CARIBBEAN								
Bolivia	43.4	53.9	1.5	1.8	14.9	19.0	1427	392
Brazil (NE)	31.1	41.6	0.6	2.2	14.6	19.0	285	121
Colombia	27.5	42.9	1.2	1.0	12.6	23.1	864	104
Dominican Republic	18.5	28.0	2.1	2.1	11.5	16.0	678	723
Guatemala	66.3	75.1	1.8	1.0	38.5	49.4	1153	393
Trinidad and Tobago	4.7	*	3.5	*	6.6	*	573	25
Median	32.0	40.5	3.0	5.8	22.1	34.3		

Note: Children are classified as stunted, wasted, or underweight if their height-for-age, weight-for-height, or weight-for-age Z-score is below -2 SD from the median of the International Reference Population (WHO/CDC/NCHS).
* Less than 25 unweighted cases
[1]Includes children whose mothers reported having a card, whether or not they showed the card to the interviewer

Measles Vaccination Status among Children with a Vaccination Card

The interviewer copied the child's vaccination record from the health card in all surveys except Togo. Therefore, in most countries, information about specific vaccinations is available only for those children whose health card was seen by the interviewer. Practically all children with a health card had received at least some vaccinations.

Of all the immunizations given to children, measles vaccine has the greatest impact on childhood morbidity, nutritional status, and mortality. In those children who survive the infection, measles is likely to result in undernutrition. Most countries recommend that measles vaccine be given to children at nine months of age. Therefore, nutritional status by measles vaccination status was analyzed only for those children age 12-35 months. The analysis included only children whose vaccination card was seen by the interviewer.

In most countries, stunting levels are highest among children who were not vaccinated against measles; Mali and Senegal are the exceptions (see Table 5.15). The median prevalence of stunting across all countries was 27 percent for children with a measles vaccination recorded on their health cards as compared to 35 percent for children whose card did not show measles vaccination. The proportion classified as wasted does not follow a consistent pattern by measles vaccination status. In all but two surveys, underweight was more common among children without a measles vaccination recorded on their health cards.

Table 5.15 Undernutrition by measles vaccination status

Among children age 12-35 months whose mother showed a vaccination card to the interviewer, the percentage who are stunted, wasted, or underweight by measles vaccination status, Demographic and Health Surveys, 1986-1989

Country	Percent stunted		Percent wasted		Percent underweight		Number of children	
	Measles vaccination	No measles vaccination	Measles vaccination	No measles vaccination	Measles vaccination	No measles vaccination	Measles vaccination	No measles vaccination
SUB-SAHARAN AFRICA								
Burundi	55.4	61.1	8.0	7.7	44.4	46.5	604	162
Ghana	30.4	36.4	11.0	7.8	30.9	37.0	382	154
Mali	21.9	(19.6)	8.8	(19.4)	29.3	(29.5)	77	23
Ondo State, Nigeria	33.8	38.5	4.9	4.6	26.3	30.8	266	65
Senegal	19.6	(17.8)	3.3	(8.9)	17.4	(22.2)	92	45
Togo	U	U	U	U	U	U	U	U
Uganda	50.9	52.9	3.3	1.6	26.8	34.2	616	208
Zimbabwe	33.5	41.0	1.2	1.6	15.4	19.7	832	61
NEAR EAST/NORTH AFRICA								
Egypt	26.5	40.4	0.9	1.1	10.4	17.6	512	384
Morocco	26.8	34.9	2.9	4.7	12.7	18.0	699	172
Tunisia	18.9	27.7	2.6	2.4	10.4	18.1	997	83
ASIA								
Sri Lanka	30.5	33.5	14.3	16.5	44.7	44.3	808	374
Thailand	13.9	22.9	6.4	4.8	23.1	26.4	250	215
LATIN AMERICA/CARIBBEAN								
Bolivia	40.9	50.7	0.8	2.9	14.2	17.9	351	103
Northeast Brazil	30.2	33.3	0.0	2.2	13.4	17.8	205	80
Colombia	25.9	32.0	1.2	0.7	11.9	11.0	423	111
Dominican Republic	(7.1)	16.9	(0.0)	3.5	(8.8)	9.5	55	195
Guatemala	66.5	73.3	1.4	3.7	38.5	39.3	704	191
Trinidad and Tobago	4.0	5.2	3.1	2.6	5.4	5.9	224	270
Median	26.8	34.9	2.9	3.7	15.4	22.2		

Note: Children are classified as stunted, wasted, or underweight if their height-for-age, weight-for-height, or weight-for-age Z-score is below -2 SD from the median of the International Reference Population (WHO/CDC/NCHS).
U = Unknown (not available)
( ) Figures in parentheses are based on 25-49 unweighted cases

Vaccination Status among All Children

In eight surveys (Bolivia, Brazil, Egypt, Guatemala, Morocco, Sri Lanka, Trinidad and Tobago, and Tunisia), when mothers could not show a child's health card, the interviewer asked supplemental questions about which vaccinations the child had received. In these countries, it is possible to analyze the vaccination status of all children, not just those for whom a health card was shown. Children are divided into three groups, based on information about their vaccination status either from a written record or from the mother's report. Children in the first group had received measles vaccine; those in the second group had received some vaccinations, but not against measles; and the remaining group had received no vaccinations at all. Almost all the children who were vaccinated against measles had also received other vaccines.

Table 5.16 presents levels of undernutrition according to vaccination status for the eight DHS-I countries where immunization information was based on the mother's recall if a written record was not available. The results for the group with measles vaccinations are remarkably similar in most countries to those reported in Table 5.15 for children with a measles vaccination recorded on their health card.

Levels of undernutrition vary widely by vaccination status. Stunting is least common among children with measles vaccinations in all countries except Trinidad and Tobago, where the overall level of stunting is extremely low. In all eight countries, stunting is most prevalent either among children with no vaccinations or among children with some vaccinations, but not against measles. Wasting shows no consistent pattern, but underweight varies substantially with vaccination status. Underweight is most common among children with no immunizations, except in Egypt, and least common among children who were vaccinated against measles, except in Sri Lanka. In Egypt, underweight is most prevalent among children who had received some vaccinations, but not measles vaccine.

Table 5.16 Undernutrition by vaccination status

Among all children age 12-35 months, the percentage who are stunted, wasted, or underweight by vaccination status (according to vaccination card or mother's report), Demographic and Health Surveys, 1986-1989

Country	Percent stunted			Percent wasted			Percent underweight			Number of children		
	Measles vaccination[1]	Other vaccinations only[2]	No vaccinations	Measles vaccination[1]	Other vaccinations only[2]	No vaccinations	Measles vaccination[1]	Other vaccinations only[2]	No vaccinations	Measles vaccination[1]	Other vaccinations only[2]	No vaccinations
Egypt	28.3	48.2	38.9	0.9	2.7	0.7	10.6	25.9	15.4	675	116	556
Morocco	26.8	32.6	40.2	3.1	3.0	10.6	14.3	16.7	33.0	1075	438	179
Tunisia	19.8	28.4	(28.2)	2.5	2.1	(0.0)	10.5	14.9	(20.5)	1228	141	39
Sri Lanka	30.5	35.5	*	14.1	15.6	*	44.7	44.1	*	978	458	15
Bolivia	42.6	50.8	53.9	0.8	3.6	2.3	13.4	20.1	21.4	1213	405	202
Brazil (NE)	30.3	36.9	*	0.0	2.7	*	12.8	18.9	*	283	98	25
Guatemala	65.6	71.5	79.9	1.2	3.1	1.5	38.1	41.0	58.8	1057	295	194
Trinidad and Tobago	3.6	5.7	(3.3)	3.2	3.5	(10.0)	5.1	7.6	(13.3)	253	315	30
Median	29.3	36.2	40.0	1.9	3.1	1.9	13.1	19.5	27.2			

Note: Children are classified as stunted, wasted, or underweight if their height-for-age, weight-for-height, or weight-for-age Z-score is below -2 SD from the median of the International Reference Population (WHO/CDC/NCHS).

* Less than 25 unweighted cases

( ) Figures in parentheses are based on 25 to 49 unweighted cases

[1]Children who received measles vaccine, regardless of whether they were given other vaccinations

[2]Children who received some vaccinations, but not measles vaccine

6 Survival and Undernutrition by the Fifth Birthday

Child survival is measured by mortality rates. Many different factors contribute to high mortality rates among children in developing countries. These include repeated and improperly treated infectious illnesses, diseases caused by waterborne organisms (due to inadequate water supplies and sanitation facilities), undernutrition resulting from inadequate food intake and illness, and short spacing between births. While mortality rates do not provide information about the cause of death, they are important in assessing overall child health in a country or in a population subgroup.

Similarly, nutritional, or anthropometric, status is the end result of a number of factors. Undernutrition is generally caused by the same risk factors that lead to high mortality rates. Assessing the nutritional status of children complements mortality information. As child survival improves, periodic nutritional assessments of children can serve as a barometer of the health of those children who survive.

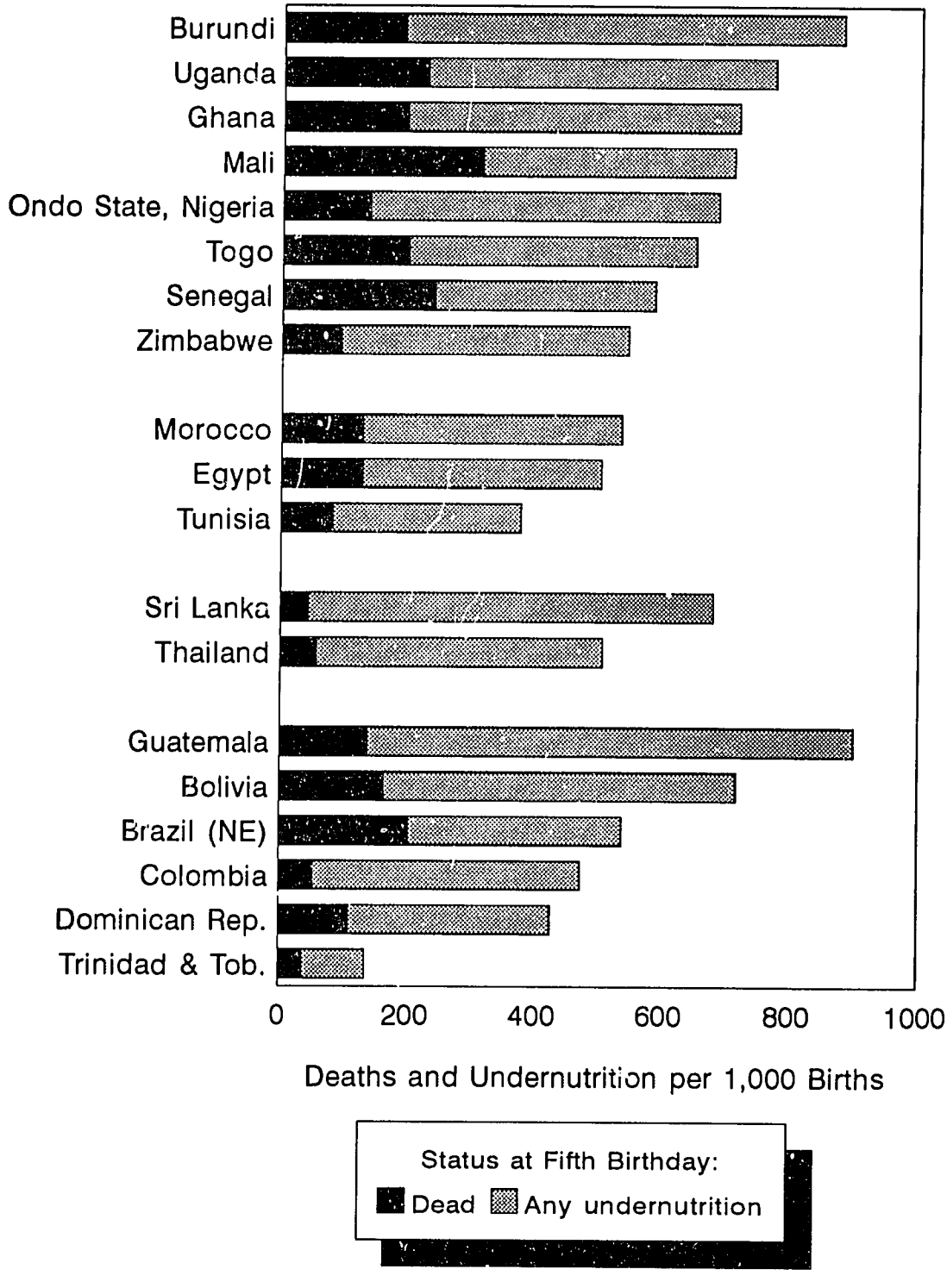
Figure 6.1 summarizes children's survival and nutritional status by the fifth birthday using DHS data.[3] The under-five mortality rate, taken from the DHS First Country report for each survey, is the probability of dying before reaching the fifth birthday and can be expressed as the number of deaths per 1,000 live births. The estimates of undernutrition by the fifth birthday are based on the figures for children age 24-35 months, because height and weight were measured only up to age three years in most DHS-I surveys. This is acceptable since surveys that do include measurements up to five years of age (four DHS-I and all DHS-II surveys) show little or no improvement in nutritional status among children during the fourth and fifth years of life. All three indicators of undernutrition are considered in Figure 6.1, so that a child classified as stunted, wasted, or underweight falls into the *any undernutrition* category.

The estimates of undernutrition apply to surviving children. Take, for example, a country with an under-five mortality rate of 200 and a 25 percent of level of undernutrition by the fifth birthday. Out of an original birth cohort of 1,000, 200 children would have died before their fifth birthday and 200 of the surviving children would be undernourished. It should be kept in mind when examining Figure 6.1 that the nutritional status of many, if not most, of the remaining children is also far from optimal.

In about two-thirds of the countries surveyed, at least 1 in 10 children die before reaching their fifth birthday. In Mali, where under-five mortality is highest, almost 1 in 4 children never reach their fifth birthday. In most countries, about 400 to 600 of the original 1,000 children are either dead or undernourished by the fifth anniversary of their birth.

[3]A discussion of the effects of high mortality rates on estimates of undernutrition can be found in Boerma and Sommerfelt (1992).

Figure 6.1 Survival and nutritional status at the fifth birthday, Demographic and Health Surveys, 1986-1989



Note: Children are classified as undernourished if their height-for-age, weight-for-height, or weight-for-age Z-score is below -2SD from the median of the Internation Reference Population (WHO/CDC/NCHS).

7 Summary and Conclusions

Children's nutritional status is a reflection of their health. Undernutrition results from exposure to a number of risk factors, including preventable and inadequately treated infectious illnesses, food scarcity, improper feeding and weaning practices, and being born too soon after a sibling. Nutritional, or anthropometric status based on the measurement of children's height and weight is one of the important outcome measures of the Demographic and Health Surveys. Since nationally representative samples are used, DHS data permit a comparison of children within and across countries. Other outcome measures from DHS surveys include infant and under-five mortality rates, fertility rates, and contraceptive prevalence rates.

The pattern of undernutrition—i.e., the proportions classified as too short (or stunted), too thin (or wasted), and/or underweight—differs from country to country. Three main patterns were identified, roughly corresponding to different regions of the world:

1. In some countries, children are shorter than expected but not thin. The data show levels of stunting that are much higher than levels of underweight, but the proportion classified as wasted is similar to that seen for the International Reference Population. This pattern of undernutrition is typically seen in Latin American and North African countries, as well as in Uganda and Zimbabwe.

2. At the other extreme are countries where children are both shorter and thinner than expected. The data show high levels of stunting accompanied by even higher levels of underweight, with wasting more common than in the other countries. The findings from Mali and Sri Lanka conform to this pattern.

3. Most of the remaining countries, including most sub-Saharan countries, display an intermediate pattern where children are shorter and somewhat thinner than expected. The data show high and roughly equal levels of stunting and underweight, and wasting is also more common than expected.

In three-quarters of the countries, from 20 to about 30 percent of children age 3-35 months are stunted; stunting affects around 40 to almost 60 percent of young children in Bolivia, Burundi, Guatemala, and Uganda. The prevalence of underweight is, on the whole, somewhat lower, ranging from 7 percent in Trinidad and Tobago to 38 percent in Burundi. Wasting does not appear to be a problem in 8 countries where the percentage of children classified as wasted is the same as or lower than that seen for the International Reference Population. In the remaining 11 countries, the prevalence of wasting ranges from 3 percent (Tunisia) to 12 percent (Mali and Sri Lanka).

A major finding in all countries is the pronounced deterioration in nutritional status during the first year of life. There is relatively little undernutrition in the youngest age group, age 3-5 months, but nutritional status deteriorates rapidly during the remainder of the first year of life and continues to worsen during the second and third years. There is no evidence of any significant improvement thereafter, so that "catch-up" growth does not take place. By age 24 to 35 months, levels of stunting range from 4 percent in Trinidad and Tobago, to 22 percent in Tunisia, to a high of 68 percent in Guatemala. Stunting affects at least a third of the children in this age group in half the countries surveyed.

Most countries show only small differences in levels of undernutrition between girls and boys, but both birth order and birth intervals are strongly associated with undernutrition. The Dominican Republic is the one country where sex differences are pronounced: there boys suffer from undernutrition more often than girls. In most countries, children of higher birth order tend to have higher levels of undernutrition, indicating that children from larger families have worse nutritional status. Children born less than 24 months after their last sibling are consistently more likely to be stunted and underweight than those born after an interval of 48 months or more. In half the countries surveyed, a third or more of the children born after short intervals (less than 24 months) are stunted. The comparable figure for children born after intervals of four years or more is just 24 percent. These findings point to the importance of birth spacing for children's health and nutritional status.

There are also marked differentials in levels of undernutrition by urban-rural residence, mother's education, source of drinking water, and type of toilet facility. Undernutrition is more prevalent in rural than urban areas in all the countries surveyed, with rural children in Bolivia, Burundi, Guatemala, and Uganda suffering from extremely high levels of stunting (44 percent). Undernutrition tends to be most common when mothers have no education and least common when mothers have secondary or higher education. In many countries, however, even children of the most educated mothers show significant levels of undernutrition. As for water sources, nutritional problems generally show up less among children that have a safe supply of drinking water: piped water in their house or yard. Undernutrition tends to be most common among children whose families drink surface water from lakes and rivers, which is frequently unsafe. There is an even stronger correlation between undernutrition and the type of toilet facility: undernutrition is more frequent when toilet facilities are lacking. The median level of stunting is 35 percent for children from households without any kind of toilet facilities, compared to just 17 percent when there is a flush toilet in the home.

Since case fatality rates following measles infection are high and survivors show significant morbidity and deterioration in nutritional status, it is not surprising to find that vaccination status is related to levels of undernutrition. Children who have been vaccinated against measles are less likely to be stunted than those who did not receive measles vaccine. Illness is also related to children's nutritional status: children who have recently suffered from diarrhea are more likely to be undernourished.

Many factors found to be related to poor nutritional status are, of course, also associated with one another. For instance, rural children are more likely than urban children to drink surface water, and children with educated mothers are more likely than others to live in households with a flush toilet or a latrine. Likewise, measles vaccination rates are generally higher for urban children and children of educated mothers. Other studies, however, have demonstrated that improvements in household water and sanitation do have beneficial effects on children's nutritional status (Mertens et al., 1990), as does appropriate treatment of acute infectious illnesses, including diarrhea (Lutter et al., 1989). Likewise, measles infection is a severe illness which clearly predisposes a child to other infections and leads to undernutrition. Thus, factors like drinking water, sanitation, vaccination status, reproductive practices, and illnesses do not merely reflect urban-rural residence or mother's educational level. Rather, they may explain, at least in part, why nutritional status varies with mother's education and place of residence. Multivariate analyses also show the importance of each of these factors (Bicego and Boerma, 1993b; Boerma and Bicego, 1992; Sommerfelt, 1991).

Improvements in nutritional status will only be seen when infants and young children are no longer exposed to the risk factors which lead to undernutrition. Actions that would reduce these risk factors include, but are not limited to, the following:

- Support of breastfeeding and proper infant feeding practices (infants should be exclusively breastfed for 4-6 months, when adequate and complementary foods should be added, with continued breastfeeding until the second birthday or beyond);
- Assuring food security for families with children and preventing micronutrient deficiencies;
- Successful immunization programs that maintain high coverage levels and deliver potent vaccines, including measles vaccine, to young children via an unbroken cold chain;
- Providing safe drinking water and sanitary disposal of excreta to prevent many serious diarrheal infections;
- Treatment of diarrheal illnesses with oral rehydration therapy, increased fluids, and continued feeding;
- Appropriate management of common childhood illnesses, such as acute respiratory illnesses and malaria; and
- Providing effective contraceptive methods to couples who want to limit the size of their family or increase the birth interval between children.

As the mortality rate among infants and children falls, this stark indicator of child health must be complemented by other indicators that measure the health of the children who survive. Nutritional, or anthropometric status is one such indicator. It allows children's health to be tracked over time and to be compared between populations.

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Appendix

Summary of DHS-I and DHS-II Surveys, 1985-1993

Region and Country	Date of Fieldwork	Implementing Organization	Respondents	Sample Size	Male/Husband Survey	Supplemental Studies, Modules, and Additional Questions
SUB-SAHARAN AFRICA						
DHS-I						
Botswana	Aug-Dec 1988	Central Statistics Office	AW 15-49	4,368		AIDS, PC, adolescent fertility
Burundi	Apr-Jul 1987	Département de la Population, Ministère de l'Intérieur	AW 15-49	3,970	542 Husbands	CA, SAI, adult mortality
Ghana	Feb-May 1988	Ghana Statistical Service	AW 15-49	4,488	943 Husbands	CA, SM, WE
Kenya	Dec-May 1988/89	National Council for Population and Development	AW 15-49	7,150	1,133 Husbands	
Liberia	Feb-Jul 1986	Bureau of Statistics, Ministry of Planning and Economic Affairs	AW 15-49	5,239		TBH, employment status
Mali	Mar-Aug 1987	Institut du Sahel, USED/CERPOD	AW 15-49	3,200	970 Men 20-55	CA, VC, childhood physical handicaps
Ondo State, Nigeria	Sep-Jan 1986/87	Ministry of Health, Ondo State	AW 15-49	4,213		CA, TBH
Senegal	Apr-Jul 1986	Direction de la Statistique, Ministère de l'Economie et des Finances	AW 15-49	4,415		CA, CD
Sudan	Nov-May 1989/90	Department of Statistics, Ministry of Economic and National Planning	EMW 15-49	5,860		M, MM, female circumcision, family planning services
Togo	Jun-Nov 1988	Unité de Recherche Démographique, Université du Benin	AW 15-49	3,360		CA, SAI, marriage history
Uganda	Sep-Feb 1988/89	Ministry of Health	AW 15-49	4,730		CA, SAI
Zimbabwe	Sep-Jan 1988/89	Central Statistical Office	AW 15-49	4,201		AIDS, CA, PC, SAI, WE
DHS-II						
Burkina Faso	Dec-Mar 1992/93	Institut National de la Statistique et de la Démographie	AW 15-49	6,000	1,845 Men 18+	AIDS, CA, MA, SAI
Cameroon	Apr-Sep 1991	Direction Nationale du Deuxième Recensement Général de la Population et de l'Habitat	AW 15-49	3,871	814 Husbands	CA, CD, SAI
Madagascar	May-Nov 1992	Centre National de Recherches sur l'Environnement	AW 15-49	6,260		CA, MM, SAI
Malawi	Sep-Nov 1992	National Statistical Office	AW 15-49	4,850	1,151 Men 20-54	AIDS, CA, MA, MM, SAI
Namibia	Jul-Nov 1992	Ministry of Health and Social Services, Central Statistical Office	AW 15-49	5,421		CA, CD, MA, MM
Niger	Mar-Jun 1992	Direction de la Statistique et des Comtes Nationaux	AW 15-49	6,503	1,570 Husbands	CA, MA, MM, SAI
Nigeria	Apr-Oct 1990	Federal Office of Statistics	AW 15-49	8,781		CA, SAI
Rwanda	Jun-Oct 1992	Office National de la Population	AW 15-49	6,551	598 Husbands	CA, SAI
Senegal	Nov-Aug 1992/93	Direction de la Prévision et de la Statistique	AW 15-49	6,310	1,436 Men 20+	AIDS, CA, MA, MM, SAI
Tanzania	Oct-Mar 1991/92	Bureau of Statistics, Planning Commission	AW 15-49	9,238	2,114 Men 15-60	AIDS, CA, MA, SAI
Zambia	Jan-May 1992	University of Zambia	AW 15-49	7,060		AIDS, CA, MA
NEAR EAST/NORTH AFRICA						
DHS-I						
Egypt	Oct-Jan 1988/89	National Population Council	EMW 15-49	8,911		CA, CD, MM, PC, SAI, WE, women's status
Morocco	May-Jul 1987	Ministère de la Santé Publique	EMW 15-49	5,982		CA, CD, S
Tunisia	Jun-Oct 1988	Office National de la Famille et de la Population	EMW 15-49	4,184		CA, CD, S, SAI
DHS-II						
Egypt	Nov-Dec 1992	National Population Council	EMW 15-49	9,864	2,406 Husbands	CA, MA, PC, SM
Jordan	Oct-Dec 1990	Department of Statistics, Ministry of Health	EMW 15-49	6,462		CA, SAI
Morocco	Jan-Apr 1992	Ministère de la Santé Publique	AW 15-49	9,256	1,336 Men 20-70	CA, MA, MM, SAI
Yemen	Nov-Jan 1991/92	Central Statistical Organization	EMW 15-49	5,687		CA, CD, SAI

Region and Country	Date of Fieldwork	Implementing Organization	Respondents	Sample Size	Male/Husband Survey	Supplemental Studies, Modules, and Additional Questions
ASIA						
DHS-I						
Indonesia	Sep-Dec 1987	Central Bureau of Statistics, National Family Planning Coordinating Board	EMW 15-49	11,844		PC, SM
Nepal (In-depth)	Feb-Apr 1987	New Era	CMW 15-49	1,623		KAP-gap survey
Sri Lanka	Jan-Mar 1987	Department. of Census and Statistics, Ministry of Plan Implementation	EMW 15-49	5,865		CA, NFP
Thailand	Mar-Jun 1987	Institute of Population Studies, Chulalongkorn University	EMW 15-49	6,775		CA, S, SAI
DHS-II						
Indonesia	May-Jul 1991	Central Bureau of Statistics, National Family Planning Coordinating Board, Ministry of Health	EMW 15-49	22,909		PC, SM
Pakistan	Dec-May 1990/91	National Institute of Population Studies	EMW 15-49	6,611	1,354 Husbands	CA
LATIN AMERICA & CARIBBEAN						
DHS-I						
Bolivia	Mar-Jun 1989	Instituto Nacional de Estadística	AW 15-49	7,923		CA, CD, MM, PC, S, WE
Bolivia (In-depth)	Mar-Jun 1989	Instituto Nacional de Estadística	AW 15-49	7,923		Health
Brazil	May-Aug 1986	Sociedade Civil Bem-Estar Familiar no Brasil	AW 15-44	5,892		CA, PC, SM, abortion, young adult use of contraception
Colombia	Oct-Dec 1986	Corporación Centro Regional de Población, Ministerio de Salud	15-49	5,329		CA, PC, SAI, SM
Dominican Republic	Sep-Dec 1986	Consejo Nacional de Población y Familia	AW 15-49	7,649		NFP, S, SAI, SM family planning communication
Dominican Rep. (Experimental)	Sep-Dec 1986	Consejo Nacional de Población y Familia	AW 15-49	3,885		
Ecuador	Jan-Mar 1987	Centro de Estudios de Población y Paternidad Responsable	AW 15-49	4,713		CD, SAI, employment
El Salvador	May-Jun 1985	Asociación Demográfica Salvadoreña	AW 15-49	5,207		S, TBH
Guatemala	Oct-Dec 1987	Instituto de Nutrición de Centro América y Panamá	AW 15-44	5,160		S, SAI
Mexico	Feb-May 1987	Dirección General de Planificación Familiar Secretaría de Salud	AW 15-49	9,310		NFP, S, employment
Peru	Sep-Dec 1986	Instituto Nacional de Estadística	AW 15-49	4,999		NFP, employment, cost of family planning
Peru (Experimental)	Sep-Dec 1986	Instituto Nacional de Estadística	AW 15-49	2,534		
Trinidad and Tobago	May-Aug 1987	Family Planning Association of Trinidad and Tobago	AW 15-49	3,806		CA, NFP, breastfeeding
DHS-II						
Brazil (NE)	Sep-Dec 1991	Sociedade Civil Bem-Estar Familiar no Brasil	AW 15-49	6,222	1,266 Husbands	AIDS, PC
Colombia	May-Aug 1990	PROFAMILIA	AW 15-49	8,644		AIDS
Dominican Republic	Jul-Nov 1991	Instituto de Estudios de Población y Desarrollo (PROFAMILIA), Oficina Nacional de Planificación	AW 15-49	7,320		CA, MA, S, SAI
Paraguay	May-Aug 1990	Centro Paraguayo de Estudios de Población	AW 15-49	5,827		CA, SAI
Peru	Oct-Mar 1991/92	Instituto Nacional de Estadística e Informática	AW 15-49	15,882		CA, MA, MM, SAI

AW all women
CMW currently married women
EMW ever-married women

AIDS acquired immune deficiency syndrome
CA child anthropometry
CD causes of death (verbal reports of symptoms)
M migration
MA maternal anthropometry
MM maternal mortality

NFP natural family planning
PC pill compliance
S sterilization
SAI service availability information
SM social marketing
TBH truncated birth history
VC value of children